August 23, 2006

Mr. David Hinds, Manager, ESBWR
General Electric Company
P.O. Box 780, M/C L60
Wilmington, NC 28402-0780

SUBJECT: REQUEST FOR ADDITIONAL INFORMATION LETTER NO. 54 RELATED TO ESBWR DESIGN CERTIFICATION APPLICATION

Dear Mr. Hinds:

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 Auxiliary Systems, Chapter 9, Radioactive Waste Management, Chapter 11, and Radiation Protection, Chapter 12, of Tier 2 of the ESBWR design control document (DCD). The RAI questions regarding Chapter 9, were sent to you via electronic mail on July 10, 2006, and were discussed with your staff during a telecon on July 24, 2006. On the telecon, when discussing question 9.1-18, GE identified the fuel and auxiliary pools cooling system (FAPCS) discharge to the liquid rad waste system on the DCD system diagram and provided a reference to DCD section 11.5.3.2.7 regarding the radioactivity monitoring of the reactor component cooling water system (RCCWS). The reviewer found that this information is adequate to resolve question 9.1-18, therefore, this question is not included in this letter. You agreed to respond to the remaining questions in the RAI by September 8, 2006.

The RAI questions regarding Chapter 12, were sent to you via electronic mail on July 9, 2006, and were discussed with your staff during a telecon on August 1, 2006. You agreed to respond to this RAI by September 1, 2006. The RAI questions regarding Chapter 11, were sent to you via electronic mail on July 9, 2006, and were discussed with your staff during a telecon on July 28, 2006. You agreed to respond to this RAI with the following schedule:

September 11, 2006:	Questions 11.2-4 through 11.2-10, 11.4-12, 11.4-14 through 11.4-15
October 2, 2006:	Questions 11.2-11, 11.2-14, 11.3-1, 11.3-3, 11.4-13
October 30, 2006:	Questions 11.2-12 through 11.2-13, 11.3-2

If you have any questions or comments concerning this matter, you may contact me at (301) 415-207 or lnq@nrc.gov, Amy Cubbage at (301) 415-42875 or aec@nrc.gov, Lawrence Rossbach at (301) 415-2863 or lwr@nrc.gov, or Martha Barillas at (301) 415-4115 or mcb@nrc.gov.

Sincerely,

/RA/

Lauren Quiñones, Project Manager
ESBWR/ABWR Projects Branch
Division of New Reactor Licensing
Office of Nuclear Reactor Regulation

Docket No. 52-0010

Enclosure: As stated

cc: See next page

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Requests for Additional Information (RAIs)
ESBWR Design Control Document DCD, Chapter 9

RAI Number	Reviewer	Question Summary	Full Text
9.1-1	Jones S	Discuss seismic qualification of fuel preparation machines and new fuel inspection stand.	DCD Tier 2, Section 9.1.4 states that two fuel preparation machines are mounted on the wall of the spent fuel pool and are used to assist in the loading of new fuel into the spent fuel storage pool racks and for channeling and rechanneling of new and spent fuel assemblies. Section 9.1.4 also states that the new fuel inspection stand supports two fuel bundles contained in a mechanically driven inspection carriage. DCD Tier 2, Tables 3.2-1 and 9.1.4-1 do not specifically describe the qualification of these structures. Describe the seismic qualification of the fuel preparation machines and the new fuel inspection stand and the basis for the qualification level. Define the basis for the seismic qualification with regard to maintenance of a subcritical array. For the fuel preparation machine, also address protection of stored spent fuel and protection of spent fuel pool (SFP) integrity.
9.1-2	Jones S	Describe administrative controls for moving heavy loads over the RB buffer pool.	DCD Tier 2, Section 9.1.5.5 states that the reactor building (RB) crane is interlocked to prevent movement of heavy loads over the fuel pools. However, Section 9.1.1 states that, should it become necessary to move major loads along or over the pools, administrative controls require that the load be moved over the empty portion of the buffer pool and avoid the area of the new fuel racks. Describe the administrative controls governing bypassing of the RB crane interlocks and handling of heavy loads over the buffer pool.

RAI Number	Reviewer	Question Summary	Full Text
9.1-3	Jones S	Describe how the fuel storage capacity was translated into storage pool size.	DCD Tier 2, Section 9.1.2.3 states that the fuel storage racks provided in the SFP in the fuel building (FB) provide for storage of irradiated fuel assemblies resulting from 10 calendar years of plant operation plus one full core off load. Section 9.1.2.3 also states that the fuel storage racks in the RB buffer pool deep pit can hold a total of 154 spent fuel assemblies. Standard Review Plan (SRP), Section 9.1.2, Revision 3, July 1981, Criterion III.1, provides guidance indicating high-density storage would be reviewed on a case-by-case basis. If high-density storage (i.e., storage configurations where solid neutron absorbers are necessary to satisfy reactivity limits) is necessary to achieve the indicated storage capacity in either the SFP or the buffer pool, provide justification for the reduced cooling effectiveness relative to low-density storage. Clarify whether any fuel rack storage locations will be used for storage of irradiated components other than fuel. Finally, describe how the size of the SFP and the buffer pool as defined in DCD Tier 1 drawings were verified to accommodate the specified storage capacities.
9.1-4	Jones S	Clarify how fuel assemblies are precluded from storage in unanalyzed locations within the fuel racks.	DCD Tier 2, Section 9.1.2.4 states that the racks include individual solid tube storage compartments, which provide lateral restraints over the entire length of the fuel assembly or bundle, and lead-in guides at the top of the storage spaces provide guidance of the fuel during insertion. The guidance of SRP 9.1.2, Revision 3, July 1981, Criterion III.2.b states that the storage racks should be designed such that a fuel assembly cannot be inserted anywhere other than in a design location. Clarify how the rack design precludes storage of fuel in unanalyzed locations.

RAI Number	Reviewer	Question Summary	Full Text
9.1-5	Jones S	Clarify how crane uplift forces from a stuck fuel assembly were considered in the rack design.	DCD Tier 2, Section 9.1.2.4 lists possible loads affecting the racks including a postulated stuck fuel assembly causing an upward force. However, the load combinations considered in the design of the racks as listed in Section 9.1.2.4 do not include such an upward force. Clarify how crane uplift forces from a stuck fuel assembly were considered in the rack design.
9.1-6		Clarify seismic design classification of buffer pool and SFP liners. Describe loading conditions and thermal stresses used to evaluate liner integrity.	DCD Tier 2, Section 9.1.2.4 states that the SFP is a reinforced concrete structure with a stainless steel liner, and the fuel storage racks and the pool liner embedments are designed to meet Seismic Category I requirements. DCD Tier 2, Table 3.2-1 lists the fuel racks, the reactor building, and the fuel building as structures designed to Seismic Category I. The guidance of SRP Section 9.1.2, Revision 3, July 1981, Criterion III.2.a states that the spent fuel storage facility including the storage pool, pool liner, and racks have been classified and designed to Seismic Category I requirements. Clarify whether the SFP and buffer pool liners are designed to Seismic Category I requirements. Describe the loading conditions and the thermal stresses used in evaluating liner integrity. If the pool liner structures are not designed to Seismic Category I requirements, address the potential for events listed in SRP Section 9.1.2, Revision 3, July 1981, Criterion III.2.b.
9.1-7	Jones S	Clarify capability of the RWCU/SDC system to provide backup cooling of the SFP.	DCD Tier 2, Sections 3.1.6.2 and 5.4.8.2.2 describe that cooling of the SFP can be backed up from one train of the reactor water cleanup (RWCU)/shutdown cooling (SDC) system. However, DCD Tier 1, Figures 2.6.1-1and 2.6.2-1 show only an interface with the RWCU/SDC system for the low pressure coolant injection mode of the fuel and auxilliary pool cooling system (FAPCS). Clarify the capability of the RWCU/SDC system to provide backup cooling of the SFP.

RAI Number	Reviewer	Question Summary	Full Text
9.1-8	Jones S	Describe how SFP decay heat is transferred to UHS under accident conditions (i.e., pool boiling) and how essential equipment is protected against environmental effects.	DCD Tier 2, Section 3.1.6.2 states that the safety-related method of cooling the spent fuel is to allow the SFP to boil. Sufficient pool water inventory is provided to permit pool boiling for several days without makeup. GDC 44 requires that a means be provided to transfer heat under accident conditions to an ultimate heat sink (UHS), and GDC 61 requires that fuel storage systems be designed with residual heat removal capability having reliability and testability consistent with its importance to safety. GDC 61 also specifies that the fuel storage systems be designed to prevent a significant reduction in fuel storage pool inventory under accident conditions. The guidelines of SRP Section 9.1.3, Revision 3, July 1981, Criterion II.1, describe that either a safety-related forced cooling system or a combination of safety-related makeup and ventilation systems may be used to satisfy the residual heat removal requirements under accident conditions. Describe how the SFP decay heat is transferred to a UHS under accident conditions (i.e., pool boiling) and how essential equipment is protected against the environmental effects of pool boiling. The response should address ventilation of water vapor to the environment, mitigation of offsite releases of radioactivity consistent with the guidelines of Regulatory Guide (RG) 1.52, and condensation of water vapor and the potential resultant flooding that could adversely affect safety-related systems in the fuel building and adjacent areas.

RAI Number	Reviewer	Question Summary	Full Text
9.1-9	Jones S	Describe how adequate cooling is provided for fuel stored in the reactor building buffer pool under accident conditions.	DCD Tier 2, Section 9.1.2 states that spent fuel storage racks in the buffer pool area provide storage in the reactor building spent fuel pool for spent fuel received from the reactor vessel during the refueling operation. DCD Tier 1, Figure 2.6.2-1 indicates that the emergency makeup water line does not extend to the reactor building buffer pool. For the reactor building buffer pool, explain how the requirements of GDC 61 are satisfied with respect to providing adequate residual heat removal and preventing a significant reduction in fuel storage coolant inventory during accident conditions, such as loss of the non-safety related forced cooling system.
9.1-10	Jones S	Specify how adequate decay heat removal capacity will be demonstrated for normal operating (i.e., non-accident) conditions.	DCD Tier 2, Section 9.1.3 states that each FAPCS cooling and cleanup (C/C) train has sufficient flow and cooling capacity to maintain the SFP bulk water temperature below 48.9EC (120EF) under normal heat load conditions and that, during the maximum SFP heat load conditions of a full core off-load plus irradiated fuel in the SFP resulting from 10 years of plant operations, both FAPCS C/C trains are needed to maintain the bulk temperature below 60EC (140EF). However, the DCD neither specifies the method of determining the associated heat load for each case nor the design heat removal capacity of each FAPCS C/C train. The above capabilities are consistent with the guidance of SRP Section 9.1.3, Revision 3, July 1981, Criterion III.1.d, but Criterion III.1.h specifies a method of calculating the necessary heat removal capacity. Describe an acceptable method of demonstrating adequate heat removal capacity or identify administrative controls to be established by the COL applicant that maintain the heat load of stored irradiated fuel within the FAPCS C/C system heat removal capacity for the specified pool temperature.

RAI Number	Reviewer	Question Summary	Full Text
9.1-11	Jones S	Clarify how the safety of stored spent fuel is assured following a piping failure in lines that extend below the surface of the SFP.	DCD Tier 1, Figure 2.6.2-1 indicates that the common emergency makeup header and the cooling system return lines extend below the normal water level in the SFP. DCD Tier 2, Section 9.1.3.2 states that anti-siphoning devices are used to prevent unintended drainage of the pools, but the minimum protected water level was not specified for the SFP. DCD Tier 2, Section 3.1.6.2 states that the spent fuel storage pool is designed with no penetrations below the water level necessary for adequate shielding at the operating floor, but the specific water level necessary for adequate shielding is not specified. Consistent with the guidelines of SRP Section 9.1.3, Revision 3, July 1981, Criterion III.1.e, identify the minimum level reached in the SFP assuming a piping failure outside the pool boundary in lines extending below the normal water level. GDC 61 requires the prevention of a significant reduction in storage pool coolant inventory under accident conditions. Because the emergency makeup function may be inoperable following a piping failure in the common makeup line and because even a small loss of inventory could result in a loss of forced circulation cooling, describe how adequate SFP cooling and adequate SFP water level for safe shutdown would be maintained for a piping failure in the common emergency makeup line.

RAI Number	Reviewer	Question Summary	Full Text
9.1-12	Jones S	Address quality classification and seismic qualification of makeup water supplies.	DCD Tier 2, 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 (FPS) to refill the isolation condenser (IC)/passive containment cooling system (PCCS) pools and SFP following a design basis loss of coolant accident. DCD Table 3.2-1 indicates this piping is safety-related, Seismic Category I, and Quality Group C. DCD Tier I, Section 1D.4 states that the COL applicant will identify other readily accessible and suitable volumes of water. However, the necessary characteristics of these water supplies are not specified. In addition, DCD Tier 2, Section 9.5.1 states that the FPS performs no safety-related function, and DCD Tier 2, Table 3.2-1 indicates that the fire protection piping is designed to Quality Group D or lower and the fire pump enclosure is non-seismic. The quality and seismic design guidelines of SRP Section 9.1.3, Revision 3, July 1981 and RG 1.13 specify that the primary SFP makeup system be permanently installed and designed to Seismic Category I, Quality Group C standards. As the identified permanently installed emergency makeup system, describe how the FPS satisfies the guidance of SRP 9.1.3 and RG 1.13. If not permanently installed, SRP Section 9.1.3 and RG 1.13 specify that the backup system be supplied from a seismic Category I source of water. Specify the design criteria for the water sources to be identified in resolving the COL action item.

RAI Number	Reviewer	Question Summary	Full Text
9.1-13	Jones S	Clarify how the redundancy requirements of the GDC are satisfied with respect to makeup water supplies to pools necessary for residual heat removal.	DCD Tier 2, 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 FPS to refill the IC/PCCS pools and SFP following a design basis loss of coolant accident. DCD Tier 1, Figure 2.6.2-1 indicates that the emergency makeup connections and the makeup water supply from the fire protection system each pass through a single isolation valve into a common header in the FAPCS for makeup to the SFP or to IC/PCCS pools. Clarify how the makeup water necessary for residual heat removal is assured, consistent with the requirements of GDC 34, GDC 38, and GDC 61, assuming a single active failure. Specify the characteristics of any pumps used with the COL applicant-specified water source necessary to satisfy the single failure criterion for the makeup water supply.
9.1-14	Jones S	Describe the necessary capacity of the emergency makeup lines and how the capacity of the makeup line will be confirmed.	DCD Tier 2, Sections 5.4.6, 6.2.2, and 9.1.3 state that makeup may be necessary after 72 hours for the IC/PCCS pools and SFP. However, neither the necessary makeup rate nor the capacity of the emergency makeup line are specified. Describe the capacity of the emergency makeup lines necessary to satisfy the requirements of GDC 34, 38, and 61 with respect to providing adequate heat removal from the reactor, containment, and SFP. Discuss how the necessary capacity was derived and how the safety-related function of the makeup lines to deliver the necessary makeup rate will be verified.

RAI Number	Reviewer	Question Summary	Full Text
9.1-15	Jones S	Describe how light load handling accidents would be mitigated.	DCD Tier 2, Section 9.1.2 states that the SFP is a reinforced concrete structure with a stainless steel liner. Operating experience indicates that damage to the liner from light load handling accidents, such as a fuel assembly drop, are credible and can allow leakage at high rates. Consistent with the guidance of SRP Section 9.1.3, Revision 3, July 1981, Criterion III.1.f, describe how the makeup capacities and the time required to make associated hookups are consistent with expected leakage from structural damage that causes leakage through the liner.
9.1-16	Jones S	Provide description of features providing protection from tornado effects to emergency makeup line connections and the fire protection system.	DCD Tier 2, Sections 3.3.2 and 3.5.2 state that safety-related structures, systems, and components listed in DCD Tier 2, Table 3.2-1 are protected within Seismic Category I structures from the effects of tornados. However, DCD Tier 1, Figure 2.6.2-1 indicates that the emergency makeup connections and isolation valves (F211 and F420) in the FAPCS for the SFP and IC/PCCS pools are located in the yard area of the plant outside of Seismic Category I structures. DCD Tier 2, Table 3.2-1 states that the piping and valves performing this function are safety-related. The FPS provides the alternate supply of water to these lines, but DCD Tier 2, Table 3.2-1 states that the FPS, including the water storage tanks and the fire pump house, are not safety-related, and therefore, not located where the components would be protected from the effects of tornados. The requirements of GDC 2 specify that the safety-related SFP makeup water supplies and the water supplies to the IC/PCC pools be protected from the effects of tornados and other natural phenomena. Provide a detailed description of the features to protect safety-related makeup water lines from the effects of tornados.

RAI Number	Reviewer	Question Summary	Full Text
9.1-17	Jones S	Describe how potentially radioactive leakage from the fuel storage pools and the FAPCS is collected and processed.	DCD Tier 2, Table 9.3-2 identifies that the fuel and reactor buildings have sumps to collect waste water from equipment and floor drains. Clarify how leakage from the storage pools and the FAPCS piping is detected and how the capacity of leakage collection devices and drains is assured to be adequate consistent with the guidance of SRP Section 9.1.3, Revision 3, July 1981, Criterion III.3.a.

RAI Number	Reviewer	Question Summary	Full Text
9.1-18	Jones S	Describe how SFP water level instrumentation satisfies the requirements of GDC 63.	DCD Tier 2, Section 7.5.5.5 states that the skimmer surge tanks have instruments for monitoring water level in the tanks. These instruments generate high, low and low-low water level signals when the water level reading exceeds their setpoints. These signals initiate high and low water level alarms in the main control room (MCR). DCD Tier 2, Section 9.1.3.5 states that the SFP has two wide-range safety-related level transmitters that transmit signals for water level indication and to initiate high/low-level alarms to the MCR and other pools (suppression pool, upper transfer pool, buffer pool, reactor well, dryer and separator storage pool) have local, non-safety related, panel-mounted level transmitters to provide signals for high/low-level alarms in the MCR. DCD Tier 1, Figure 2.6.2-1 does not indicate the location of the instrumentation, but DCD Tier 1, Table 2.6.2-1 states that level instruments are provided for monitoring and controlling the water levels in the skimmer surge tanks and IC/PCCS pool. GDC 63 states that appropriate systems shall be provided in fuel storage and associated handling areas to (1) detect conditions that may result in loss of residual heat removal capability and excessive radiation levels, and (2) initiate appropriate safety actions. Explain how the skimmer surge tank level instrumentation satisfies the requirements of GDC 63 when forced cooling flow is not available for the SFP. Also, explain how the buffer pool level instrumentation is adequate to satisfy the requirements of GDC 63 since DCD Tier 2, Section 9.1.3 states that fuel will be stored in that pool. Update DCD Tier 1, Figure 2.6.2-1 to indicate the location of instrumentation necessary to satisfy GDC 63 requirements.

RAI Number	Reviewer	Question Summary	Full Text
9.1-19	Jones S	Describe how adequate net positive suction head is assured.	DCD Tier 2, Section 9.1.3 states that the FAPCS is designed to provide post accident recovery (defense-in-depth) functions of suppression pool cooling, low pressure coolant injection drywell spray, and alternate shutdown cooling, which all take suction from the suppression pool. Section 9.1.3 also states that the SFP cooling mode of the FAPCS may be initiated following an accident to cool the SFP for accident recovery. Describe how adequate net positive suction head is assured for these functions, consistent with the guidance of SRP Section 6.2.2, Revision 4 October 1985, assuming the respective pool is at saturation temperature for the pressure at its surface.
9.1-20	Jones S	Define heat removal capacity of FAPCS for defense-in-depth functions of suppression pool cooling, drywell spray, and alternate shutdown cooling modes.	DCD Tier 2, Section 9.1.3 states that the FAPCS is designed to provide post accident recovery (defense-in-depth) functions of suppression pool cooling, low pressure coolant injection drywell spray, and alternate shutdown cooling, which all take suction from the suppression pool. Describe the water flow rate and heat removal capacity to perform these defense-in-depth functions, how those values are determined, and how the FAPCS will be designed and tested to provide those flow rates and heat removal capacities.

RAI Number	Reviewer	Question Summary	Full Text
9.1-21	Jones S	Clarify how the long-term cooling function of the PCCS is satisfied assuming a single active or passive failure affecting FAPCS makeup line.	DCD Tier 1, Figure 2.6.2-1 indicates that the emergency makeup header to the IC/PCCS pools is not redundant and that manual valve F426 separating the fire protection system from the makeup header is normally closed and located inside the reactor building. DCD Tier 2, Section 6.3.1.1.2 states that long-term cooling requirements call for the removal of decay heat from the drywell via the passive containment cooling system. DCD Tier 2, Section 6.2.2 describes that the passive containment cooling system removes heat beyond 72 hours with pool makeup. SRP 6.3, Revision 2, April 1884, Criterion III.20 states that an intermediate heat transport system used to provide long-term cooling capability should be capable of sustaining a single active or passive failure without loss of function. Describe how the long-term cooling function of the primary containment cooling system is satisfied assuming an active failure of valve F420 or a passive failure of the emergency makeup header pressure boundary.
9.1-22	Jones S	Clarify the configuration of the IC/PCC pool(s) and interconnections between subcompartments.	DCD Tier 1, Section 2.1.4 states that the IC/PCC pool subcompartments on each side of the reactor building communicate at their lower ends to enable full use of the collective water inventory, but that section also states that there is no cross connection between the IC/PCC pools. DCD Tier 1, Figure 2.6.2-1 indicates that a single emergency makeup line provides water to a single, interconnected IC/PCC pool. Clarify how the IC/PCC pools are configured and how subcompartments communicate to share inventory. Clarify how a single emergency makeup line provides water to an adequate number of IC and PCC heat exchangers to satisfy the accident analyses, assuming a single failure of any active valves.

RAI Number	Reviewer	Question Summary	Full Text
9.1-23	Jones S	Describe how the FAPCS is used to manage pool water inventory and how waste from the water treatment subsystem is handled.	DCD Tier 1, Figure 2.6.2-1 does not show any flow paths to reject excess water or radioactive waste (e.g., resin) to liquid and solid radioactive waste systems, respectively. Describe how the FAPCS is used to manage pool water inventory and how waste from the water treatment subsystem is handled. Update DCD Tier 1, Figure 2.6.2-1 to show these capabilities.
9.1-24	Jones S	Describe design of grapples used to handle fuel and how the design reduces the probability of a fuel assembly drop.	DCD Tier 2, Section 9.1.4.1 states that both the refueling machine and the fuel handling machine have telescoping masts with integral grapples mounted from a trolley structure. Section 9.1.4.1 also states that the machines are also equipped with auxiliary hoists and jib cranes to which other grapples are attached when required. Both have redundant safety features and indicators that ensure positive engagement with fuel bundles. Describe the design of grapples used to handle fuel and how the design reduces the probability of a fuel assembly drop. Identify any loads handled over stored fuel which could have greater kinetic energy that a fuel assembly dropped from its normal handling elevation.
9.1-25	Jones S	Describe scope of administrative controls to restrict loads handled over stored fuel and monitor light load handling system components for degradation.	DCD Tier 2, Section 9.1.6 states that the COL Holder shall develop fuel handling procedures and administrative controls. In order to address review guidance contained in paragraphs III.1 and II.6 of SRP Section 9.1.4, Revision 2, July 1981, describe the necessary scope of the administrative controls with regard to restrictions on loads handled over stored fuel and monitoring light load handling system components for degradation.

RAI Number	Reviewer	Question Summary	Full Text
9.1-26	Jones S	Describe how industry codes and standards Identified in Table 9.1-5 apply to specific components in the light and overhead heavy load handling systems.	DCD Tier 2, Section 9.1.4.1 states that, where applicable, DCD Tier 2, Table 9.1-5 provides the appropriate ASME, American National Standards Institute (ANSI), Industrial and Electrical Codes are identified. Describe how industry codes and standards Identified in DCD Tier 2, Table 9.1-5 apply to specific components in the light and overhead heavy load handling systems.

Requests for Additional Information (RAIs)
ESBWR Design Control Document DCD, Chapter 11

RAI Number	Reviewer	Question Summary	Full Text
11.2-4	Herrity T	Address deviation from RG 1.143 Rev. 2, Table 1 for atmospheric tanks.	DCD Tier 2, Table 11.2-1 specifies equipment codes for use in the liquid waste system. It states that the information is from Regulatory Guide (RG) 1.143, Table 1. The row for atmospheric tanks in Table 11.2-1 reflects RG 1.143, Rev. 1, which adds “ASME Code Section III, Class 3" as an acceptable Design and Fabrication code, and “AWWA D-100" as an acceptable Inspection and Testing code. Revision 2 of RG 1.143 specifies API-650 for these codes. (The currently released version of RG 1.143 contains a misprint for the Inspection & Testing code. Both columns should site API-650. A correction is being processed by the NRC.) Please revise Table 11.2-1 to reflect Revision 2 of the RG 1.143.
11.2-5	Herrity T	Address deviation from RG 1.143, Rev. 2, Table 1 for 0-15 psi tanks.	DCD Tier 2, Table 11.2-1 specifies equipment codes for use in the liquid waste system. It states that the information is from RG 1.143, Table 1. The row for 0-15 psi tanks in Table 11.2-1 reflects RG 1.143, Rev. 1, which adds “ASME Code Section III, Class 3" as an acceptable Design and Fabrication Code & Inspection and Testing code. Revision 2 of RG 1.143 specifies API-620 for these codes. (The currently released version of RG 1.143 contains a misprint for the Inspection & Testing code. Both columns should site API-620. A correction is being processed by the NRC.) Please revise Table 11.2-1 to reflect Revision 2 of RG 1.143.
11.2-6	Herrity T	Address deviation from RG 1.143, Rev. 2, Table 1 for pumps.	DCD Tier 2, Table 11.2-1 specifies equipment codes for use in the liquid waste system. It states that the information is from RG 1.143, Table 1. The row for pumps in Table 11.2-1 reflects both Rev. 1 & Rev. 2 of RG 1.143. Specifically, in the Design & Construction column and the Materials column, the DCD copies both Rev. 1 & Rev. 2, citations entirely. Rev. 1 & Rev. 2 cite different codes. In the Welding column and the Inspection & Testing column, Revision 1 is cited. Please revise Table 11.2-1 to reflect Revision 2 of RG 1.143.

RAI Number	Reviewer	Question Summary	Full Text
11.2-7	Herrity T	Address deviation from RG 1.143, Rev. 2, Table 1 for piping & valves.	DCD Tier 2, Table 11.2-1 specifies equipment codes for use in the liquid waste system. It states that the information is from RG 1.143, Table 1. The row for piping & valves in the DCD copies citations from both Rev. 1 & Rev. 2 of RG 1.143. Specifically, the DCD Table quotes Rev. 2 for Design & Fabrication and for Inspection & Testing. It quotes Rev. 1 for the Materials & the Welding. Please revise Table 11.2-1 to reflect Revision 2 of RG 1.143.
11.2-8	Herrity T	Explain the footnote to Table 11.2-1 stating that "per RG1.143, all materials are in accordance of ASME Section II."	DCD Tier 2, Table 11.2-1 specifies equipment codes for use in the liquid waste system. It states that the information is from RG 1.143, Table 1. However, the title block has an asterisk note which states that, per RG 1.143, all materials are ASME Section II. This conflicts with the rows for Piping & Valves (see question 11.2-4 above), Pumps (See 11.2-3 above) and Flexible Hoses. Please explain and justify these apparent conflicts.
11.2-9	Herrity T	Address conformance to RG 1.143 with respect to construction method for piping.	DCD Tier 2, Section 11.2.1 states that the system is designed to meet the guidance of RG1.143. However, there is no statement of the construction method for the piping other than in Table 11.2-1 which states ANSI B31.3. RG 1.143 states that the piping will be welded. ANSI/ASME B31.3 covers many fabrication methods in addition to welding (brazing/soldering, threaded joints, caulked, packed, straight thread, etc.). Please revise to reflect RG 1.143 guidance.
11.2-10	Herrity T	Address conformance to RG 1.143 with respect to material limitations.	DCD Tier 2, Section 11.2.1 states that the system is designed to meet the guidance of RG 1.143. However, there is no statement of the material specification conformance to RG 1.143 paragraph 1.1.2. Explain how conformance to RG 1.143 will be assured.

RAI Number	Reviewer	Question Summary	Full Text
11.2-11	Herrity T	Provide additional detail in Figure 11.2-1.	DCD Tier 2, Figure 11.2-1, "Liquid Waste Management System Process Diagram," does provide sufficient detail to assess the system's adequacy. Locations of components relative to other plant components and buildings are not shown. Update the diagram to include sufficient detail to identify all sources of liquid input volumes (e.g., condensate storage tank collection berm and individual building sumps), the points of collection of liquid waste, the flow paths of liquids through the system including all bypasses, and the specific points of release of liquid effluents to the environment (e.g., interface COL item with circulating water system), consistent with the guidance of Standard Review Plan (SRP) Section 11.2, Rev. 2, July 1981, Review Criterion III.1.
11.2-12	Jones S	Describe the basis for maximum input volumes for the liquid waste management system.	DCD Tier 2, Table 11.2-4 defines the probable maximum daily input volumes to the various subsystems of the liquid waste management system. Describe how the maximum daily volumes were derived from the potential input sources.
11.2-13	Jones S	Clarify safety classification and design attributes of liquid radioactive waste management system to protect against hazards.	DCD Tier 2, Table 3.2-1 lists the Liquid Waste Management System and Radioactive Waste Building as non-seismic and subject to an enhanced quality assurance program meeting the criteria described in RG 1.143. Fluid containing components are described as meeting Quality Group D and other requirements. RG 1.143, Section C.5 specifies guidance for subsystem design classifications and RG 1.143, Section C.6 specifies guidance for design criteria for protection against natural phenomena and man-induced hazards. Describe how the classifications and design criteria applied to the liquid radioactive waste management system, (including piping, tanks, and structures used to contain leakage), satisfies the requirements of general design criteria (GDC) 61 with respect to designing radioactive waste systems to assure adequate safety under accident conditions. Update DCD Tier 2, Section 3.1.6.2 and Chapter 11 to reflect this information.

RAI Number	Reviewer	Question Summary	Full Text
11.2-14	Jones S	Identify tanks in yard areas, other than the CST, that are likely to contain radioactivity.	DCD Tier 2, Table 3.2-1 identifies the condensate storage tank (CST) as a tank located outside DCD structures, and other yard tanks are identified as outside the scope of the DCD. Confirm that no tanks located in yard areas outside buildings, other than the CST, are likely to contain radioactivity. If any outside tanks are likely to contain radioactivity, describe their interface with the liquid waste management system.
11.3-1	Herrity T	Revise DCD Section 11.3.2.2 to cite appropriate regulatory guidance.	DCD Tier 2, Section 11.3.2.2, under the "Materials" heading states that the components satisfy regulatory position 1.2.2 for materials and restates the cited paragraph. The cited paragraph is intended for liquid waste systems. The DCD should be revised to cite regulatory position 2.2 which is intended for gaseous systems. The DCD should be reviewed to ensure compliance with the additional guidance of regulatory position 2.2, Rev. 2, which adds the following requirement: "If the potential for an explosive mixture of hydrogen and oxygen exists, adequate provisions should be made to preclude buildup of explosive mixtures, or the system should be designed to withstand the effects of an explosion." (Note: it is not limited to "...without the loss of integrity.")
11.3-2	Jones S	Clarify safety classification and design attributes to protect offgas system against hazards.	DCD Tier 2, Table 3.2-1 lists the offgas system as non-seismic and subject to an enhanced quality assurance program meeting the criteria described in RG 1.143. Fluid containing portions are described as meeting Quality Group D and other requirements. RG 1.143, Section C.5 specifies guidance for subsystem design classifications and RG 1.143, Section C.6 specifies guidance for design criteria for protection against natural phenomena and man-induced hazards. Describe how the classifications and design criteria applied to the offgas system piping and structures (used to delay the release of the offgas) satisfy the requirements of GDC 61 with respect to designing radioactive waste systems to assure adequate safety under accident conditions. Update DCD Tier 2, Section 3.1.6.2 and Chapter 11 to reflect this information.

RAI Number	Reviewer	Question Summary	Full Text
11.3-3	Jones S	Provide numerical performance criteria for resistance against hydrogen detonation.	DCD Tier 1, Table 2.10.3-1 states that the offgas system (OGS) is designed to withstand internal hydrogen explosions. Describe how the design pressure of the components was selected to provide this capability. Provide numerical performance criteria for the hydrostatic test demonstrating this capability.
11.4-12	Herrity T	Address conformance to RG 1.143 guidance for pumps.	DCD Tier 2, Section 11.4.2.3, "Detailed System Component Description," "Pumps" section, describes the types of pumps used but not the applicable Design & Construction Codes. Please revise DCD to address conformance to RG 1.143.
11.4-13	Herrity T	Address conformance to RG 1.143 guidance for tanks.	DCD Tier 2, Section 11.4.2.3, "Detailed System Component Description," "Tanks" section, lists several codes but does not link these codes to the tanks' type of service. Please revise DCD to address conformance to RG 1.143.
11.4-14	Herrity T	Address conformance to RG 1.143 guidance for piping.	DCD Tier 2, Section 11.4.2.3, "Detailed System Component Description," "Piping" section, refers to design velocities but is silent on construction or fabrication codes. Please revise DCD to address conformance to RG 1.143.
11.4-15	Jones S	Include ITAAC for resin transfer function.	DCD Tier 2, Section 11.4 describes the operation of the wet solid waste handling subsystem and provides a process flow diagram. Include Inspection, Test, Analysis, and Acceptance Criteria (ITAAC) to verify that the plant configuration is consistent with the described operations and process diagram.

Requests for Additional Information (RAIs)
ESBWR Design Control Document DCD, Chapter 12

RAI Number	Reviewer	Question Summary	Full Text
12.2-11	Dehmel JC	Provide basis for the estimated annual average doses from airborne effluents provided in Table 12.2-18b.	The estimated annual beta air dose and annual gamma air dose due to airborne releases presented in DCD Tier 2, Table 12.2-18b could not be duplicated using the information presented in DCD Tier 2, Tables 12.2-15, 12.2-17, and 12.2-18a and the GASPAR II Code (NUREG/CR-4653). Please address the following and update Table 12.2-18b accordingly: a. Review and update the listed beta and gamma air doses, or describe and provide any modifiers applied in adjusting code results and update Table 12.2-18a. b. Confirm the radiological unit used to report the beta and gamma air doses, either as mrad/year or mGy/year given that the rest of the data presented in the table are expressed in SI units.
12.2-12	Dehmel JC	Provide basis for the estimated annual average doses from airborne effluents in Table 12.2-18b for the milk pathway.	The estimated annual average doses from airborne effluents listed in DCD Tier 2, Table 12.2-18b for the milk pathway do not specify whether the results are for cow milk or goat milk consumption. Insert a qualifier to DCD Tier 2, Table 12.2-18a or 12.2-18b stating the basis for the milk exposure pathway. Update either table accordingly.
12.2-13	Dehmel JC	Provide basis for the estimated annual average doses from liquid effluents listed in Table 12.2-20b.	The estimated annual doses to the thyroid associated with the drinking pathway presented in DCD Tier 2, Table 12.2-20b could not be duplicated using the information presented in DCD Tier 2, Tables 12.2-19b and 12.2-20a and LADTAP II Code (NUREG/CR-4013). Review and update Table 12.2-20a to include any other assumptions used in the analysis but not listed in this table.

RAI Number	Reviewer	Question Summary	Full Text
12.2-14	Dehmel JC	Evaluate exposure pathway from irrigated foods and update Table 12.2-20b. Update Table 12.2-20a to provide associated model parameters and assumptions.	The exposure pathway associated with the consumption of irrigated foods is not included in DCD Tier 2, Table 12.2-20b. The omitted pathways are the consumption of vegetables, leafy vegetables, meat, and milk for the maximum exposed individual. Expand the analysis to include doses associated with the consumption of irrigated foods and update Table 12.2-20b in presenting all associated results. Update DCD Tier 2, Table 12.2-20a in describing all related model parameters and their assumed values used in the revised analysis.
12.2-15	Dehmel JC	Update Table 12.2-20a to include the transit time of effluents as a model parameter and provide the assumed value.	The dose model parameter describing the transit time of effluents from the point of discharge to the location of exposure (maximum exposed individual) is not listed in DCD Tier 2, Table 12.2-20a. Update Table 12.2-20a to include this model parameter and its assumed value used in the analysis.

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