

January 31, 2007

Mr. David H. Hinds, Manager, ESBWR
General Electric Company
P.O. Box 780, M/C J70
Wilmington, NC 28402-0780

SUBJECT: REQUEST FOR ADDITIONAL INFORMATION LETTER NO. 93 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 Tier 2, Revision 2, Chapter 3, Section 14.2, and Section 14.3, and Tier 1, Revision 2, of the ESBWR Design Control Document.

Chapter 3: 3.0-1
Section 14.2: 14.2-63
Section 14.3 and Tier 1: 14.3-130 through 14.3-145

To support the review schedule, you are requested to respond to these RAI questions by March 15, 2007.

If you have questions or comments concerning these RAIs please contact me at (301) 415-2863 or lwr@nrc.gov.

Sincerely,

/RA/

Lawrence Rossbach, 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

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ACCESSION NO. ML070310263

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Requests for Additional Information (RAIs)
ESBWR Design Control Document (DCD), Revision 2

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

RAI Number	Reviewer	Question Summary	Full Text
3.0-1	Patnaik P	Address threaded fasteners.	<p>For mechanical connections secured by threaded fasteners in ASME Code Class 1, 2, and 3 systems, the staff recently developed Standard Review Plan (SRP) Section 3.13, Revision 0, <u>Threaded Fasteners - ASME Code Class 1, 2, and 3</u>, as review guidance.</p> <p>A. Provide an outline of the criteria for design, material selection, mechanical testing, and inservice inspection for bolting to ensure compliance with GDCs 1, 4, 14, 30, and 10 CFR 50.55a.</p> <p>B. Identify any control of fabrication practices and/or special processes used to mitigate stress corrosion cracking or other forms of material degradation in the bolting during service.</p> <p>C. Provide a discussion, based on past industry operating experience, that demonstrates how the bolting practices for ESBWR systems/components effectively implements the lessons learned from the numerous failures in high strength bolting in the mid-1960s through 1980s.</p>

Section 14.2, Initial Plant Test Program

RAI Number	Reviewer	Question Summary	Full Text
14.2-63	Wagage H	Provide pressure suppression containment bypass leakage tests high and low pressure limits.	DCD, Tier 2, Revision 2, Section 14.2.8.1.32 states that an objective of the pressure suppression containment bypass leakage tests is to “verify that the suppression pool bypass leakage rate is within limits for high pressure and low pressure tests.” Please provide the values of the high and low pressures and their significance.

Section 14.3 and Tier 1

RAI Number	Reviewer	Question Summary	Full Text
14.3-130	Wagage H	Confirm relation between the IC/PCC pool and the dryer/separator storage pool.	DCD, Tier 1, Revision 2, Section 2.15.4 states that the isolation condenser(IC)/passive containment cooling (PCC) pools contain sufficient water to support operation of the PCC for at least 72 hours after a loss of coolant accident without need to make-up to the IC/PCC pool. However, DCD, Tier 2, Revision 2, Table 6.2-7 shows that accident analysis assumed that when the top 1/4 portion of the PCC tube length becomes uncovered, connection valves open to allow water from the dryer/separator storage pool to flow into the PCC pools. Please confirm whether you consider the dryer/separator storage pool as a part of the IC/PCC pool.
14.3-131	Davis R	Revise ITAACs for all systems that contain ASME Code Class 1, 2, 3 and safety significant pressure retaining piping and components in the ESBWR design.	The staff has identified inadequacies in Tier 1, Revision 2, ITAAC. Examples include: A. The NRC staff expects that any system that contains ASME Code Class 1, 2, and 3 components, has inspection, tests, analyses, and acceptance criteria (ITAAC) to ensure that the as-built systems meet the applicable ASME Code requirements. The ITACC should include a description of the type of documentation that is required to satisfy the ITAAC.

RAI Number	Reviewer	Question Summary	Full Text
			<p>The ITAAC for the Reactor Pressure Vessel (RPV) Listed in Table 2.1.1-2 includes the following Inspections, Tests, Analyses (ITA) :</p> <ol style="list-style-type: none"> 1. Inspections of the as built system will be performed. 2. Inspections of the ASME Code required documents will be conducted. 3. A hydrostatic test will be conducted on those components of the system required to be hydrostatically tested by ASME Code. 4. Inspections of the system fabrication records will be conducted. <p>The aforementioned ITA should be applicable to all ASME Code Class 1, 2, and 3 components. In Tier 1, Revision 2, ITA 1 and 3 are listed with ITAAC for ASME Code Class 1, 2, and 3 components. ITA 2 and 4 above are not currently listed.</p> <p>Although Section 1.2.2.1 (1) “Verification for Basic Configuration for Systems” discusses the ITA 1 above, it only applies to as-built pressure boundary welds. The staff considers the applicants ITAAC for several systems to be incomplete and vague. The staff’s expectation is that all metallic components and systems have clearly defined ITAAC to ensure that (a) the as-built system is inspected against the functional arrangement of the system and (b) inspections are conducted of the as-built ASME Code Section III piping, welds, and components against ASME Code Section III design, fabrication and testing requirements. The staff expects the ITAACs to reflect appropriate documentation for the inspections and satisfaction of the ASME Code Section III design, fabrication, and testing requirements. Below is a list of some but not all of the systems that contain ASME Code Class 1, 2 or 3 piping and components that should have very similar ITAAC.</p>

RAI Number	Reviewer	Question Summary	Full Text
			<p>2.1.2 Nuclear Boiler System (NBS)</p> <p>2.2.2 Control Rod Drive System</p> <p>2.2.4 Standby Liquid Control System</p> <p>2.4.1 Isolation Condenser System</p> <p>2.4.2 Emergency Core Cooling System - Gravity-Driven Cooling System</p> <p>2.6.1 Reactor Water Cleanup/Shutdown Cooling System</p> <p>2.6.2 Fuel And Auxiliary Pools Cooling System</p> <p>2.11.1 Turbine Main Steam System</p> <p>B. In Table 2.1.2-2 ITAAC for the NBS under the ITA for ITAAC number 2, the applicant states that ASME Code Data Reports will be reviewed and inspections of Code stamps will be conducted for ASME components in the NBS. The applicant should include a requirement to compare the data reports with the actual as-built system. The acceptance criteria for ITAAC 2 should include a report which concludes that the ITA has been performed and that the ITAAC 2 acceptance criteria has been met.</p> <p>C. The Design Commitment in ITAAC number 5 states “The ASME Code portions of the NBS retain their integrity under internal pressure that will be experienced during service.” The staff believes that this ITAAC should state “The ASME Code portions of the NBS retain their pressure boundary integrity at design pressure values.”</p> <p>The staff requests that the applicant develop ITAAC that address the issues identified above and apply those ITAAC to all systems that contain ASME Code Class 1, 2, 3 and safety significant pressure retaining piping and components in the ESBWR design.</p>

RAI Number	Reviewer	Question Summary	Full Text
14.3-132	Davis R	Address discrepancy in GDCS ITAAC regarding classification of components.	<p>The staff requests that the applicant revise the DCD to correct the following discrepancy:</p> <p>DCD Tier 1, Revision 2, Section 2.4.2 “Emergency Core Cooling System - Gravity Driven Cooling System [GDCS]” states that all piping and valves connecting the GDCS pools and S/P [suppression pool] to the biased-open check valve, and all piping and valves (including supports) connecting GDCS pool to lower Drywell shall be classified as Safety-Related and Quality Group B. DCD Tier 2, Revision 2 indicates that the aforementioned piping and components shall be classified as Safety-Related and Quality Group C. DCD Tier 1, Revision 2, Figure 2.4.2-1 “Gravity-Driven Cooling System” and DCD Tier 2, Revision 2, Figure 6.3-1 “GDCS Configuration” indicate that the piping and components in the GDCS, discussed above, are Quality Group C.</p>
14.3-133	Davis R	Verify the consistency of Code classification of systems, written text and figures, between DCD Tier 1 and Tier 2 for all Class 1, 2, and 3 piping and components.	Based on the inconsistencies discussed in RAI 14.3-132 above, the staff requests that the applicant verify the consistency of Code classification of systems, written text and figures, between DCD Tier 1 and Tier 2 for all Class 1, 2, and 3 piping and components.
14.3-134	Pedersen R	Provide radiation shielding ITAAC that verifies dose rates consistent with the planned access requirements.	Provide radiation shielding ITAAC that verifies, through inspection and/or calculation, that the as-built structures, systems and components, result in dose rates in rooms and areas of the plant that are consistent with the planned access requirements described in the table on page 12.3-7 in DCD Tier 2, Revision 2, Section 12.3.1.3, Radiation Zoning.

RAI Number	Reviewer	Question Summary	Full Text
14.3-135	Pedersen R	Provide ITAAC to verify access control to certain radiation areas.	<p>Provide ITAAC that verifies that the as-built plant layout, and components are such that:</p> <ul style="list-style-type: none"> a) areas likely to be High Radiation Areas [identify], greater than 1000 mrem/hr (10 mSv/hr) are provided with barriers so personnel access can be physically controlled; and b) an individual is not able to gain unauthorized access to dose rates in excess of 500 rem/hr (5.0 Sv/hr) [list these areas].
14.3-136	Pedersen R	Provide ITAAC that verify the design commitments of certain area radiation monitors.	Provide ITAAC that verify the design commitments (sensitivity, range, calibration, alarm function, and power supply) of area radiation monitors in areas of the plant [list] where plant evolutions, or anticipated operational occurrences, can result in accessible dose rate increases of 100 mrem/hr (1mSv/hr) or more. The list should include, but not be limited to, monitors in fuel handling areas, steam affected areas, and radwaste transfer affected areas.
14.3-137	Pedersen R	Add main condenser material design requirements to the Tier 1 design description.	Revise the Tier 1 Radiation Protection design description (Section 3.4 of DCD Tier 1) to reflect that the ESBWR main condenser will be fitted with corrosion resistant condenser tubes and tubesheets, in concert with the GE response to NRC RAI 12.5-5 (GE letter MFN 06-371, ADAMS Accession Number ML063060115).

RAI Number	Reviewer	Question Summary	Full Text
14.3-138	Dehmel J-C	Tier 2, Sections 14.3.2.1 and 14.3.7.3: the selection process criteria for Tier 1 and 2 information is inconsistent.	<p>A review of DCD Tier 2, Rev. 2, Sections 14.3.2.1, Design Descriptions, and 14.3.7.3, Criteria and Application Process, indicates that the selection process criteria for Tier 1 and 2 information is inconsistent whenever equipment is used to control and monitor radioactive releases within the requirements of NRC regulations in demonstrating compliance with dose limits for members of the public, and liquid and gaseous effluent concentration limits in unrestricted areas. The discussion addressing selection criteria defining inclusion in the certified design revealed an inconsistent approach when conditions involve “portable equipment and replaceable items” as to whether such type of equipment are Tier 1 or Tier 2 certification information. The discussion notes that Tier 1 design descriptions address fixed design features expected to be in place for the life of the plant. This approach, as described in Section 14.3.2.1, implies that portable or mobile equipment, such as that used to treat liquid and gaseous process and effluent streams, would be excluded as Tier 1 design systems, even though such equipment are necessary to demonstrate compliance with 10 CFR Part 20, Appendix B, Table 2 liquid and gaseous effluent concentration limits and doses to members of the public under 10 CFR Parts 20.1301 and 20.1302. On the other hand, the graded approach described in Section 14.3.7.3 states that for non-safety systems, classified as Tier 2 systems, that are included in plant systems used to monitor and control releases of radioactivity within the limits of 10 CFR Part 20 would be included as Tier 1 items.</p> <p>Accordingly, reconcile this inconsistency in excluding essential systems and equipment from Tier 1 because they are portable equipment and yet including them as Tier 1 because they are used to comply with 10 CFR Part 20 dose and effluent concentration limits.</p>
14.3-139	Dehmel J-C	Tier 1, Section 2.3.1 and Table 2.3.1-1: PRMS ITAACs do not describe prerequisite system conditions in preparation to the conduct of	<p>A review of DCD Tier 1, Rev. 2, Section 2.3.1 and Table 2.3.1-1 indicates that there are no ITAACs defining prerequisite system conditions in preparation to the conduct of necessary tests and inspections, and that they do not provide information about the types of tests and acceptance criteria that will be used to confirm that the Process Radiation Monitoring System (PRMS) will be built and will operate in accordance with all design</p>

RAI Number	Reviewer	Question Summary	Full Text
		<p>necessary tests and inspections, and do not provide information about tests and acceptance criteria.</p>	<p>commitments. As referred to in Table 2.3.1-1, the tests described in Section 2.3.1 are abbreviated functional descriptions of each PRMS subsystem and do not provide functional details on test objectives and requirements, and acceptance criteria that need to be used in complying with the intended purpose of ITAACs. Address the following as they relate to the PRMS used in monitoring and controlling radioactive liquid and gaseous process and effluent streams:</p> <p>A. Describe prerequisite system conditions in preparation for the conduct of tests and inspections, including as-built post-construction inspections and pre-operational testing, including:</p> <ul style="list-style-type: none"> i. confirmation of the proper installation of the types and number of radiation detector channels, interface with valves and dampers requiring isolation or diversion of effluent/process streams, checks of electrical wiring, location of control and alarm panels (main and remote), process and effluent streams sampling systems, etc. ii. cleaning, flushing, venting, filling, pressure testing, etc., following the installation of all mechanical components. iii. conduct of post-construction functional tests and pre-operational system calibration tests (electronic and radioactive standards) in confirming the operation of each subsystem, detection sensitivity, dynamic operational ranges, etc. <p>B. Describe tests, test objectives and requirements, and acceptance criteria in complying with all associated ITAACs.</p> <p>Accordingly, update the DCD as described above to include descriptions of post-construction and pre-operational testing, test objectives and requirements, and acceptance criteria.</p>

RAI Number	Reviewer	Question Summary	Full Text
14.3-140	Dehmel J-C	Tier 1, Section 2.7.2: define ITAACs for systems used to process liquid and solid radioactive wastes. The design descriptions exclude systems used to process radioactive gaseous wastes.	<p>A review of DCD Tier 1, Rev. 2, Section 2.7.2 indicates that there are no ITAACs defined for systems used to process liquid and solid radioactive wastes. Moreover, the design descriptions excludes, without explanation, systems used to process radioactive gaseous wastes. Address the following:</p> <ul style="list-style-type: none"> A. Given that the processing of radioactive wastes, as described in DCD Sections 11.2 to 11.4, relies on a combination of permanently installed plant systems and mobile waste treatment systems, it is not clear as to how the interface between plant systems and mobile waste treatment systems will confirm the placement and operational integration of radwaste system control panels. B. Provide definitions of inspections, tests and/or analyses, and all associated acceptance criteria as stand-alone ITAACs or integrate such ITAACs with their respective systems or placement in buildings. For example, ITAACs on radwaste system control panels could be included with those addressing the Solid Waste Management System (SWMS) (see Tier 1, 2.10.2), or with those identified for the Radwaste Building (see Tier 1, 2.16.9). A similar approach could be used for control panels associated with the Liquid Waste Management System (LWMS) or Gaseous Waste Management System (GWMS). <p>Accordingly, update the DCD as described above for radioactive waste management systems.</p>

RAI Number	Reviewer	Question Summary	Full Text
14.3-141	Dehmel J-C	Tier 1, Section 2.10.1 and Table 2.10.1-1: Provide ITAACs to confirm proper selection and performance characteristics of LWMS media used to treat process liquid and waste streams before discharge.	<p>A review of DCD Tier 1, Rev. 2, Section 2.10.1 and Table 2.10.1-1 indicates that there are no ITAACs defined to confirm the proper selection and performance characteristics of LWMS media used to treat liquid process, waste, and effluent streams. Address the following as they relate to the selection and installation of filtration and adsorbent media used to treat radioactive liquid process, waste, and effluent streams:</p> <ul style="list-style-type: none"> A. Given that the processing of radioactive wastes, as described in DCD Section 11.2, relies on a combination of permanently installed plant systems and mobile waste treatment systems, it is not clear as to how the operational interface between plant systems and mobile treatment systems will be confirmed via ITAACs. B. Describe each type and initial quantities of filtration and adsorbent media that will be used in LWMS components and mobile waste treatment systems described DCD Chapter 11.2. C. Describe the process that will be used to confirm that the performance characteristics of the selected filtration and adsorbent media will meet or exceed radioactivity or radionuclide decontamination factors or removal efficiencies described in DCD Section 11.2 in complying with Part 20 effluent concentration and dose limits and Part 50 Appendix I dose objectives. D. Refer to RAI 14.3-139 on DCD Section 2.3.1 as it applies to ITAACs for the Liquid Radwaste Discharge radiation monitor. <p>Accordingly, update the DCD as described above to include descriptions of tests, test objectives and requirements, and acceptance criteria addressing the selection and installation of filtration and adsorbent media in LWMS components and mobile waste processing systems.</p>

RAI Number	Reviewer	Question Summary	Full Text
14.3-142	Dehmel J-C	<p>Tier 1, Section 2.10.2: define ITAACs for systems used to process solid radioactive wastes through the SWMS. Include design descriptions for systems used to process wet radioactive wastes.</p>	<p>A review of DCD Tier 1, Rev. 2, Section 2.10.2 indicates that there are no ITAACs defined for systems used to process wet and solid radioactive wastes through the SWMS described in Section 11.4 of the DCD. Address the following as they relate to the processing of waste streams described in Section 11.4 of the DCD:</p> <ul style="list-style-type: none"> A. Given that the processing of radioactive wastes relies on a combination of permanently installed plant systems and mobile waste treatment systems, the ITAACs do not consider how operational interfaces between plant systems and mobile treatment systems and characteristics will be confirmed. B. Provide definitions of inspections, tests and/or analyses, and all associated acceptance criteria, as they relate to the SWMS and interface with the LWMS in controlling and monitoring liquid effluent releases described in DCD Sections 11.2 and 11.4. C. Describe types and initial quantities of filtration and adsorbent media placed in components of permanently installed and mobile waste treatment systems described DCD Chapters 11.2 and 11.4. D. Describe the process that will be used to confirm that the performance characteristics of the selected filtration and adsorbent media used for waste treatment will meet or exceed radioactivity or radionuclide decontamination factors or removal efficiencies described in DCD Sections 11.4 and 11.2 in complying with Part 20 effluent concentration and dose limits and Part 50 Appendix I dose objectives. E. Provide an equipment and process flow diagram for the SWMS. F. The citation to U.S. DOT shipping regulations is incorrect. <p>Accordingly, update the DCD as described above to include descriptions of tests, test objectives and requirements, and acceptance criteria as they relate to the operational integration and performance of the SWMS (as installed plant components and mobile treatment systems).</p>

RAI Number	Reviewer	Question Summary	Full Text
14.3-143	Dehmel J-C	Tier 1, Section 2.10.3 and Table 2.10.3-1: define ITAACs for confirming the proper selection and performance characteristics of media used to treat gaseous process streams and effluents before discharges through the GWMS.	<p>A review of DCD Tier 1, Rev. 2, Section 2.10.3 and Table 2.10.3-1 indicates that there are no ITAACs defined for confirming the proper selection and performance characteristics of the GWMS media used to treat gaseous process, waste, and effluent streams. Address the following as they relate to the selection and installation of adsorbent media used to treat radioactive gaseous, process, waste, and effluent streams:</p> <ul style="list-style-type: none"> A. Describe the type and initial quantities of adsorbent media that will be used in GWMS guard and main charcoal beds described DCD Chapter 11.3. B. Describe the process that will be used to confirm that the performance characteristics of the selected adsorbent media will meet or exceed radioactivity or radionuclide decontamination factors, removal efficiencies, or holding times described in DCD Section 11.3 in complying with Part 20 effluent concentration and dose limits and Part 50 Appendix I dose objectives. C. Refer to RAI 14.3-139 on DCD Section 2.3.1 as it applies to ITAACs for the associated GWMS process radiation monitors. D. Provide an equipment and process flow diagram for the GWMS. <p>Accordingly, update the DCD as described above to include descriptions of tests, test objectives and requirements, and acceptance criteria addressing the selection and installation of adsorbent media in the GWMS.</p>
14.3-144	Dehmel J-C	Tier 1, Section 2.12.3 and Table 2.12.3-1: define ITAACs for confirming the proper installation and operation of the RCCW radiation monitors.	<p>A review of DCD Tier 1, Rev. 2, Section 2.12.3 and Table 2.12.3-1 indicates that there are no ITAACs defined for confirming the proper installation and operation of the Reactor Component Cooling Water System (RCCW) radiation monitors. Address the following as they relate to installation and operation of the RCCW radiation monitors:</p>

RAI Number	Reviewer	Question Summary	Full Text
			<p>A. Revise Table 2.12.3-1 to include all ITAACs for both radiation monitors (Trains A and B) described in DCD Chapter 9.2.2.</p> <p>B. Revise Figure 2.12.3-1 to show the location of both radiation monitor trains in the RCCW system diagram.</p> <p>C. Describe appropriate ITAACs that will be used to confirm the placement of the radiation monitors (in Trains A and B) to ensure that the system, once in operation, will prevent the contamination of non-contaminated plant systems and avoid uncontrolled and unmonitored radioactive liquid releases to the environment.</p> <p>D. Refer to RAI 14.3-139 on DCD Section 2.3.1 as it applies to ITAACs for the associated RCCW process radiation monitors.</p> <p>Accordingly, update the DCD as described above to include descriptions of tests, test objectives and requirements, and acceptance criteria addressing the proper installation and operation of both radiation monitor trains in the RCCW system.</p>
14.3-145	Dehmel J-C	Tier 1, Section 2.16.9: define ITAACs for confirming the proper installation and operational integration of mobile waste processing system with permanently installed plant systems.	<p>A review of DCD Tier 1, Rev. 2, Section 2.16.9 indicates that there are no ITAACs defined for confirming the proper installation and operational integration of mobile waste processing system with permanently installed plant systems. Address the following as they relate to the installation and operation of radwaste processing and treatment systems within the Radwaste Building:</p> <p>A. Given that the processing of radioactive wastes relies on the use of permanently installed plant systems and mobile waste treatment systems, the ITAACs do not consider how operational interfaces between plant system components and mobile treatment systems and operating characteristics will be confirmed.</p>

RAI Number	Reviewer	Question Summary	Full Text
			<p>B. Describe appropriate ITAACs that will be used to confirm the proper installation of mobile waste treatment systems and their interfaces with plant systems to prevent, once in operation, the contamination of non-contaminated plant systems and avoid uncontrolled and unmonitored radioactive gaseous and liquid releases to the environment.</p> <p>C. Provide definitions of inspections, tests and/or analyses, and all associated acceptance criteria in confirming the operational interfaces with the GWMS, LWMS, and SWMS and in controlling and monitoring effluent releases to Part 20 effluent concentration and dose limits and Part 50 Appendix I dose objectives.</p> <p>D. Refer to RAI 14.3-139 on DCD Section 2.3.1 as it applies to ITAACs for the associated process and effluent radiation monitors.</p> <p>Accordingly, update the DCD as described above to include descriptions of tests, test objectives and requirements, and acceptance criteria addressing the installation and operational integration of mobile waste processing and treatment systems with permanently installed plant systems within the Radwaste Building.</p>

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