May 14, 2008

Mr. Robert E. Brown
Senior Vice President, Regulatory Affairs
GE Hitachi Nuclear Energy
3901 Castle Hayne Road MC A-45
Wilmington, NC 28401

SUBJECT: REQUEST FOR ADDITIONAL INFORMATION LETTER NO. 190 RELATED TO ESBWR DESIGN CERTIFICATION APPLICATION

Dear Mr. Brown:

By letter dated August 24, 2005, GE Hitachi Nuclear Energy (GEH) 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.

If you have any questions or comments concerning this matter, you may contact me at (301) 415-2890 Andrea.Johnson@nrc.gov or you may contact Thomas Kevern at (301) 415-0224 or Thomas.Kevern@nrc.gov.

Sincerely,

/RA/

Andrea Johnson, Project Manager
ESBWR/ABWR Projects Branch 1
Division of New Reactor Licensing
Office of New Reactors

Docket No. 52-010

Enclosure:
Request for Additional Information

cc w/encl: See next page

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SUBJECT: REQUEST FOR ADDITIONAL INFORMATION LETTER NO. 190 RELATED TO ESBWR DESIGN CERTIFICATION APPLICATION DATED MAY 14, 2008

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Request for Additional Information (RAI)
ESBWR Design Control Document (DCD), Revision 4

RAI Number	Reviewer	Question Summary	Full Text
12.4-28 S02	Hinson	Justify the apparent discrepancy between the applicant's response to RAI 12.4-28 S01 and the information in Table 7.1-1 concerning the applicability of RG 1.97 and BTP 7-10 to the CMS and the ARMS.	RAI 12.4-28 S01 asked the applicant to discuss whether the Containment Monitoring System (CMS) followed the guidance provided in Revision 3 or Revision 4 of RG 1.97. Although Revision 4 is the most recent revision of RG 1.97, this version does not include tables specifying instrument ranges. In the applicant's response to this RAI, the applicant stated that version 4 of RG 1.97 is applicable to the ESBWR. The applicant also stated that the radiation monitoring instrumentation will follow the guidance provided in NRC Branch Technical Position, BTP 7-10. BTP 7-10 states that the ranges and footnotes for radiation instrumentation that are provided in Revision 3 of RG 1.97 should also be applicable for plants using Revision 4 of RG 1.97. Although the applicant's response to this RAI indicates that the CMS will comply with the guidance of RG 1.97 and BTP 7-10, Table 7.1-1 (Regulatory Requirements Applicability Matrix) does not list either RG 1.97 or BTP 7-10 as being applicable to either the CMS or the ARMS. Clarify this apparent discrepancy between your response to RAI 12.4-28 S01 and Table 7.1-1.
12.5-1 S01	Hinson	This supplement 01 to RAI 12.5-1 requests that the applicant make a number of changes to revised Section 12.4 including reinserting text deleted from the previous version, comparing ESBWR dose and time estimates with	RAI 12.5-1 asked the applicant to provide a complete tabulated dose assessment with a scope and detail consistent with the guidance provided in RG 8.19. The applicant responded to the staff's RAI by completely rewriting Section 12.4 of the DCD to incorporate the guidance of RG 8.19. The staff has formulated the following supplemental questions based on its review of the proposed DCD Tier 2, Revision 5, Section 12.4. One general comment which applies throughout the revised Section 12.4 is that this section should be more consistent in providing comparisons of projected person-hours and dose rates for the ESBWR with similar values for the current fleet of conventional BWRs. Some sections in the revised Section 12.4 include estimates of person-hour reductions over conventional BWRs based on ESBWR improvements while other sections merely list the estimated person-hours for ESBWR operations without stating how these compare with corresponding person-hours for conventional BWRs.

		conventional BWR values, correcting inconsistencies between dose/time estimates in the text and in the associated tables, and correcting editorial mistakes.	1. In order to ensure that occupational doses are ALARA (in accordance with 10 CFR 20.1101), Regulatory Guide 8.19 “Occupational Radiation Dose Assessment in Light-Water Reactor Power Plants Design Stage Man-Rem Estimates” states, in part, that the basis for entries in the dose assessment tables should be explained in the text of the report (e.g., expected (reduced) values due to design and engineering improvements). The staff requests that GEH modify the proposed Section 12.4 to re-insert the following sections (which were included in the Revision 4 version of Section 12.4 but were deleted in the proposed version) which provide specific examples of improvements in equipment design, maintenance/surveillance requirements, or building layout to reduce personnel doses: a) Insert the sentences beginning with "The Nuclear Boiler System..." and "The MSIVs require periodic..."on page 12.4-13 into the section on special maintenance in the drywell on page 12.4-7. b) Insert the first two sentences in the fifth paragraph on page 12.4-13 (beginning with “Early studies on…”) into the first paragraph on page 12.4-8. c) Insert the second, third, and seventh bulleted items on page 12.4-14 into the second paragraph in section 12.4.5 on page 12.4-6. d) Insert the first 6 lines of the paragraph beginning with "Simplified systems..."on page 12.4-14 into the second paragraph in section 12.4.2 on page 12.4-3. e) Insert the five lines starting with "It has been arranged..." in the first paragraph in Section 12.4.2 on page 12.4-15 into the second paragraph in Section 12.4.2 on page 12.4-3. f) Insert the first three sentences in the sixth paragraph on page 12.4-17 (beginning with “The condensate system…”) into the section on special maintenance in the turbine building on page12.4-10. g) Insert the sentence beginning with "More of the radwaste operations..." in the first paragraph on page 12.4-18 into the third paragraph in Section 12.4.3 on page 12.4-4.

			2. (page 12.4-1) Describe to what extent data from the BWR and ABWR product lines were used in developing the dose estimates in Section 12.4 and provide references to historical data used. 3. (page 12.4-3) The second paragraph on page 12.4-3 states that "Additional shielding is provided to reduce radiation levels in routinely occupied areas during power operation from N-16 sources." State where the use of additional shielding for N-16 is described in the DCD. 4. (page 12.4-3) The second paragraph on page 12.4-3 states that the ESBWR is expected to have reduced general radiation levels during operation compared to the typical BWR due to "two percent reactor water clean up capacity" (among other things). Describe the dose benefits of having a 2% RWCU cleanup capacity and compare the RWCU cleanup capacity of the ESBWR design with that of a standard BWR design. 5. (page 12.4-7) Describe the purpose of using of main steam line plugs (mentioned in Section 12.4.6) and how their use reduces overall maintenance requirements. 6. (page 12.4-8) The last paragraph on page 12.4-8 states that the LRPM/AFIP (Local Power Range Monitors with fixed in-core detectors) assemblies are removed remotely from beneath the reactor vessel, cut up, and placed in a shielded cask for disposal. Describe the dose benefits of using this method of removing and disposing of the LRPM/AFIP assemblies. 7. (page 12.4-9) Provide the basis for the person-hours estimates for special maintenance on valves (1500 hours) and on instrumentation (1000 hours) in the drywell. 8. (page 12.4.8) The first paragraph on page 12.4-8 states that the effective dose rate in the drywell/steam tunnel is 18 μSv/hr. Figure 12.3-10 shows this area to be a zone E area (<100 μSv/hr). Explain this apparent discrepancy in dose rates.

			9. (page 12.4-9) The first paragraph on page 12.4-9 states that the average dose rate for special maintenance on miscellaneous drywell valves is estimated to be 40 μSv/hr and 50 μSv/hr for the maintenance on miscellaneous drywell instrumentation. Explain the reasoning for the difference in effective dose rates for these two jobs. 10. (pages 12.4-21, 22, and 26) Table 12.4-2 states that the dose rate associated with CRD/HCU surveillance is 150 μSv/hr while Tables 12.4-3 and 12.4-7 state that the dose rate associated with CRD HCU maintenance is only 30 μSv/hr. Explain the difference in dose rates for these jobs that apparently will be performed in the same area. 11. (Tables 12.4-2 through 12.4-7) Add a footnote to these tables stating that the person-hours for those jobs that can only be performed during refueling outages (once every 24 months) are twice the annual person-hours shown on these tables. 12. (page 12.4-5) The first paragraph on page 12.4-5 states that operation of the Radwaste Building Control Room is assumed to occur in a dose rate of 10 μSv/hr. Table 12.4-4 states that the estimated average dose rate for this control room is 8 μSv/hr. Explain this apparent discrepancy. 13. (page 12.4-5) The first paragraph on page 12.4-5 states that miscellaneous activities in high dose rate areas will be require the expenditure of 208 person-hrs/yr (4 hrs/wk times 52 weeks per year). Table 12.4-4 states that these activities will require the expenditure of 200 person-hours/yr. Correct this apparent discrepancy. 14. (page 12.4-7) The first paragraph on page 12.4-7 states that in-service inspection work will require 750 person-hours/yr. Table 12.4-6 shows that ISI work will require 766 person-hours/yr. Correct this apparent discrepancy. 15. (page 12.4-10) The third paragraph on page 12.4-10 states that reactor building instrumentation work that cannot be performed during normal operation is assumed to require 600 person-hours/yr. Verify that this work will be done during the 24 month refueling outage for a total of 1200 person-hours per outage.

			16. (page 12.4-10) The fourth paragraph on page 12.4-10 states that additional reactor building outage maintenance items will involve 3400 person-hours/yr. Specify whether this work be done on a continuing basis, or only during outages (in which it would require 6800 person-hours per outage). 17. (page 12.4-5) The first paragraph on page 12.4-5 states that shipments of concentrated wet solid wastes in HICs will require 1664 person-hours (8 hours/week x 52 weeks/yr x 4 workers/job). Table 12.4-4 shows that this activity will require the expenditure of only 832 person-hours/yr. Explain this apparent discrepancy. <u>Editorial corrections</u> E1. (page 12.4-5) Insert the word "access" after the word "drywell" in the last sentence in the second paragraph in Section 12.4.4. E2. The third paragraph in Section 12.4.4 contains some superfluous sentences that make the dose assessment hard to follow. This section can be clarified by making the following modifications: (page 12.4-5) Delete the sentence beginning with "This reduces the operator effective dose rate...". (page 12.4-6) Delete the first portion ("This is accomplished using the automated refueling machine and") of the first full sentence on page 12.4-6 and begin the sentence with "It is estimated...". E3. (page 12.4-8) Insert a space between the words "titanium" and “or” in the 9th line on page 12.4-8. E4. (page 12.4-8) Delete one of the words (either "assumed" or "required") in the 5th line in the third paragraph on page 12.4-8.

			E5. (page 12.4-10) The last paragraph on page 12.4-10 states that the Turbine Building valve and pump maintenance requirements will require 2000 person-hours per outage (1000 person-hours per year). Table 12.4-7 indicates that this work will require 910 person-hours per year. Explain this apparent discrepancy.
12.7-5	C. Hinson	Using the guidance provided in RG 4.21, the applicant should address how they will comply with the requirements of 10 CFR 20.1406, both as they apply to Chapter 12, as well as how they apply to other sections of the DCD. (This RAI supersedes the previously issued version of RAI 12.7-5)	This RAI supersedes the previous RAI 12.7-5 sent to GEH by memo dated December 27, 2007 (ML#073550176). This RAI also addresses remaining staff concerns with GEH's responses to RAIs 12.7-1, 12.7-2, and 12.7-3 S01. These RAIs will be closed out and their issues tracked by the revised RAI 12.7-5 listed below. This RAI consists of parts A), B), C), and D) as shown below: <u>Background</u> The staff developed Regulatory Guide 4.21 (issued in draft as DG-4012) in order to provide guidance to the industry on how to meet the requirements of 10 CFR 20.1406 with respect to minimizing, to the extent practicable, contamination of the facility and the environment, facilitating eventual decommissioning, and minimizing, to the extent practicable, the generation of radioactive waste. The following 9 design and operational objectives summarize the objectives contained in the Regulatory Position section of RG 4.21. Appendix A of RG 4.21 contains examples of measures that might be taken to address the requirements of 10 CFR 20.1406. 1) Minimize leaks and spills and provide containment in areas where such events may occur, 2) Provide for adequate leak detection capability to provide prompt detection of leakage for any structure, system, or component which has the potential for leakage, 3) Use leak detection methods (e.g., instrumentation, automated samplers) capable of early detection of leaks in areas where it is difficult or impossible to conduct regular inspections (such as for spent fuel pools, tanks that are in contact with the ground, and buried, embedded, or subterranean piping) to avoid release of

			contamination from undetected leaks and to minimize contamination of the environment, 4) Reduce the need to decontaminate equipment and structures by decreasing the probability of any release, reducing any amounts released, and decreasing the spread of the contaminant from the source, 5) Periodically review operational practices to ensure that, operating procedures are revised to reflect the installation of new or modified equipment, personnel qualification and training are kept current, and facility personnel are following the operating procedures, 6) Facilitate decommissioning by a) maintenance of records relating to facility design and construction, facility design changes, site conditions before and after construction, onsite waste disposal and contamination and results of radiological surveys, b) minimizing embedded and buried piping, and c) designing the facility to facilitate the removal of any equipment and/or components that may require removal and/or replacement during facility operation or decommissioning, 7) Minimize the generation and volume of radioactive waste both during operation and during decommissioning (by minimizing the volume of components and structures that become contaminated during plant operation) 8) Develop a conceptual site model (based on site characterization and facility design and construction) which will aid in the understanding of the interface with environmental systems and the features that will control the movement of contamination in the environment, 9) Evaluate the final site configuration after construction to assist in preventing the migration of radio-nuclides offsite via unmonitored pathways,

			The above list contains a mixture of design and operational objectives. Since Chapter 12 deals with radiation protection related issues, some of these objectives are partially addressed in various sections of Chapter 12 of the DCD. The subject matter of others (e.g., item number 8 on the conceptual site model) dictates that they be addressed in detail in other sections of the DCD. A) In Section 12.3 of the DCD, provide a general description of how each of the objectives will be met. Some of these objectives can be met by incorporating specific design features into the design while others, which are more operational or procedural in nature, can be addressed by the addition of COL action items (to be implemented by the COL applicant) to the appropriate sections of the DCD. The general description of how each of these objectives will be met should be accompanied by a pointer in DCD Section 12.3 pointing the reader to the appropriate section of the DCD where each of these objectives will be addressed in a more detailed manner. B) For each of the listed design objectives (item numbers 1-4, 6b, 6c, and 7), provide several examples of ESBWR design features that illustrate how these design objectives are met by the ESBWR design. These examples should be provided in the appropriate sections of the DCD (note that the examples listed in Section 12.6 of the DCD should be relocated to DCD Sections 12.1 or 12.3 and Section 12.6 deleted). COL action items addressing the remaining listed objectives, which are more operational or procedural in nature (item numbers 5, 6a, 8, and 9), should be provided in the appropriate sections of the DCD, as mentioned in A above (see issue described in part D3 below for an example of an operational issue that should be addressed as a COL action item). C) The information presented in Chapter 12 of DCD Tier 2, Rev. 4 identifies some ESBWR general design features that would minimize the contamination of the facility and environment and would minimize the generation of radioactive waste. However, this information does not address design features that are unique to system designs or their locations in the plant warranting more technical details, and does not identify issues that should be addressed as COL action items. For each of the systems listed below (and for any other plant systems which may generate

			radioactive waste or could result in the contamination of non-radioactive systems), describe specific design features which are incorporated into the ESBWR design to comply with the requirements of 10 CFR 20.1406. Nuclear Steam Supply Isolation Condenser System Fuel Storage and Handling Condensate Storage and Transfer System Process Sampling System Equipment, Floor, Chemical, and Detergent Drain Systems Standby Liquid Control System Building heating, ventilating and air conditioning systems used to process radioactive process and effluent streams Turbine Main Steam System Other Features of Steam and Power Conversion System List these specific design features and/or COL action items in the appropriate section of the DCD where the system is described and include a reference to these sections in Chapter 12.3 of the DCD. D) GEH did not adequately address the following issues in its response to RAI 12.7-3 S01. Please provide your response to the following (note that since issue 3 below concerns operational rather than design issues, it should be addressed in the appropriate section of the DCD as a COL action item): 1) Describe any design features to detect leakage (large acute or small, long term) from the piping in the radwaste tunnels. 2) Verify that there are no piping runs which contain or could potentially contain contaminated fluids that will be buried in the ground and not routed through one of the radwaste tunnels.

			3) Add a new COL action item which commits the COL applicant to describe the criteria which govern the frequency of performing periodic visual inspections of the piping in the radwaste tunnels to check for leaks and of the floor/wall expansion joints in the radwaste tunnels to ensure that no spills or leaks on the floors enter unmonitored areas beneath the floors and foundations.

DC GE - ESBWR Mailing List (Revised 04/28/2008)

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