GE Energy

David H. Hinds
Manager, ESBWR

PO Box 780 M/C L60
Wilmington, NC 28402-0780
USA

T 910 675 6363
F 910 362 6363
david.hinds@ge.com

MFN 06-389

Docket No. 52-010

October 18, 2006

U.S. Nuclear Regulatory Commission
Document Control Desk
Washington, D.C. 20555-0001

Subject: **Response to Portion of NRC Request for Additional Information Letter No. 60 – Radiation Protection Systems – RAI Numbers 12.3-2, 12.3-3, 12.3-9and 12.4-3**

Enclosure 1 contains GE's response to the subject NRC RAIs transmitted via the Reference 1 letter.

If you have any questions about the information provided here, please let me know.

Sincerely,

Kathy Sedney for

David H. Hinds
Manager, ESBWR

D068

Reference:

1. MFN 06-342, Letter from U.S. Nuclear Regulatory Commission to David Hinds, *Request for Additional Information Letter No. 60 Related to ESBWR Design Certification Application*, September 18, 2006

Enclosure:

1. MFN 06-389 – Response to Portion of NRC Request for Additional Information Letter No. 60 – Radiation Protection Systems – RAI Numbers 12.3-2, 12.3-3, 12.3-9 and 12.4.3

cc: AE Cubbage USNRC (with enclosures)
GB Stramback GE/San Jose (with enclosures)
eDRF 0058-5457

ENCLOSURE 1

MFN 06-389

Response to Portion of NRC Request for

Additional Information Letter No. 60

Related to ESBWR Design Certification Application

Radiation Protection

RAI Numbers 12.3-2, 12.3-3, 12.3-9 and 12.4-3

NRC RAI No. 12.3-2: Indicate whether, and if so how, the applicable guidance provided in ANSI N237, "Source Term Specification," has been followed in the ESBWR design. If not followed, specify what alternative methods were used.

GE Response:

As discussed in DCD Tier 2, Section 11.1, the ESBWR source term was determined based upon the guidance in ANSI/ANS-18.1-1999 "American National Standard Radioactive Term for Normal Operation of Light Water Reactors." This standard is Revision 2 of ANSI N237-1976 "Source Term Specification." A detailed discussion of how ANSI/ANS-18.1-1999 was applied to the ESBWR source term is provided in DCD Tier 2, Section 11.1 and its respective subsections.

No DCD changes will be made in response to this RAI.

NRC RAI No. 12.3-3: DCD Tier 2, Section 12.2.1.1.2 states that the startup source resides in the reactor for its lifetime, and no special shielding is needed after reactor operation. Provide a description of the startup source (including the radioactive isotopes, source strength, half lives, and physical form). Discuss the basis for assuming that the startup source will remain intact, within the reactor, over the lifetime of the facility.

GE Response:

The startup source discussion in DCD Tier 2, Section 12.2.1.1.2 is incorrect and will be revised. The ESBWR startup source is to be a Cf-252 source placed into a stainless steel source holder. The source and source holder is to be removed during the first refueling outage.

DCD Tier 2, Section 12.2.1.1.2 will be revised in DCD Tier 2, Revision 3 as noted in the attached markup.

Reactor Startup Source

The Cf-252 reactor startup source is shipped to the site in a special cask designed with shielding. The source is transferred under water while in the cask and loaded into ~~beryllium~~ a stainless steel ~~containers~~source holder. This is then loaded into the reactor while remaining under water. The source ~~remains within the reactor for its lifetime~~and source holder is removed from the reactor during the first refueling outage. ~~Thus, no unique shielding requirements are required after reactor operation.~~

12.2.1.2 Reactor Building Source Terms

This section provides a summation of the significant radioactive source terms found in the ESBWR reactor building. These source terms consist of those elements which are found to contain significant quantities of radioactive materials but do not include sources due to incidental contamination such as sources in valves and pipes due to deposition of corrosion or fission products species on the surfaces of the components.

The reactor building (RB) is divided into three specific zones:

- Containment
- Contaminated areas,
- Clean areas.

Radioactive Sources in the Reactor Water Cleanup/Shutdown Cooling System.

A description of the Reactor Water Cleanup/Shutdown Cooling System (RWCU/SDC) is given in Subsection 5.4.8. Radioactive sources contained in this system are the result of contamination of components by transit of reactor water through this system and accumulation of radioisotopes removed from the water. Components for this system include regenerative and non-regenerative heat exchangers, pumps, valves, and demineralizers. The accumulated sources in this system are given in Tables 12.2-6 and 12.2-7. The sources present in the demineralizers are present in all modes of operation. Therefore, backwashing capability is provided to remove residual activity with clean water plus chemical decontamination for effective radwaste handling.

12.2.1.2.1 Other Sources

Radioactive Sources in the Fuel and Auxiliary Pools Cooling System (FAPCS)

A description of the FAPCS is given in Subsection 9.1.3. The FAPCS is designed to service the fuel pools, suppression pool, GDCS pool, and isolation condenser/PCCS pools on a rotating basis. The accumulated activity in this system is the result of the accumulation of residual activity in each of the above pools. The filters are backwashed into a backwash receiving tank, which is then routed to the Radwaste Building systems. The sources for the FAPCS are given in Tables 12.2-8 and 12.2-9. Clean water connections are provided for this system to flush lines prior to switching between pools as necessary to prevent ancillary contamination between pools.

NRC RAI No. 12.3-9: Provide a description of any sources (such as calibration sources) needed to construct and operate an ESBWR plant or provide justification why this should be left to the COL applicant.

GE Response:

Sources needed to construct and operate an ESBWR plant, such as calibration sources, should be left to the COL applicant. The COL applicant decides which sources to use for equipment calibration. Special sources that are involved in day-to-day operations of the plant or in construction of the plant should be left to the discretion of the COL applicant, and do not need to be characterized during the certified design phase.

No DCD changes will be made in response to this RAI.

NRC RAI No.12.4-3: *Discuss features of HCU/CRD arrangement to prevent activated corrosion and wear products in the CRDs from settling (by gravity) into the HCUs. The ESBWR design has the hydraulic control units (HCU) located on an elevation lower than the level of the control rod drives (CRD). What design features have been incorporated into this HCU/CRD arrangement to prevent activated corrosion and wear products in the CRDs from settling (by gravity) into the HCUs, essentially making them crud traps?*

GE Response:
During normal operation, the CRD hydraulic system supplies a continuous purge flow of clean, demineralized water to the fine motion control rod drives (FMCRD) through the HCUs and scram insert lines. The purpose of this purge flow is to keep reactor water and associated corrosion products out of the drive mechanisms to prevent long-term drive contamination. This feature also keeps the HCUs and scram insert lines clean and free of contaminants.

As described in Tier 2 DCD Subsection 4.6.1.2.3, each HCU has an orifice to control the normal purge flow rate to the two associated FMCRDs while the drives are stationary. When the FMCRD undergoes a motor-driven insertion movement the hollow piston moves upward, creating an increased volume of water within the drive. During this insertion movement the solenoid-operated purge water makeup valve within the HCU opens to increase the purge water flow rate to offset the volumetric increase and prevents the backflow of reactor water into the drive. Even if purge flow to a drive were stopped for any reason, the configuration of the scram insert line at its connection to the drive will prevent any contamination in the drives from migrating back to the HCUs by gravity. As shown schematically in Tier 2 DCD Figures 4.6-1, 4.6-2 and 4.6-7, the scram insert lines connect to the FMCRD from above the CRD housing flange. Any potential crud would have to make its way back through the ball check valve in the FMCRD flange and up this vertical run of piping before it could make its way back through the long run of scram insert piping to the HCUs.

No DCD changes will be made in response to this RAI.