GE-Hitachi Nuclear Energy Americas LLC

James C. Kinsey
Project Manager, ESBWR Licensing

PO Box 780 M/C A-55
Wilmington, NC 28402-0780
USA

T 910 675 5057
F 910 362 5057
jim.kinsey@ge.com

MFN 06-226
Supplement 1

Docket No. 52-010

July 25, 2007

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. 32 – Branch Technical Position 11-6 Compliance – RAI Number 2.4-29 S01**

Enclosure 1 contains GEH's response to the subject NRC RAI transmitted via Reference 1 which is a supplemental request to the RAIs transmitted via Reference 2. The original RAI response was submitted to the NRC via Reference 3.

If you have any questions or require additional information regarding the information provided here, please contact me.

Sincerely,

/Kathy Sedney for

James C. Kinsey
Project Manager, ESBWR Licensing

DO68

LIKO

Reference:

1. NRC Supplemental RAI 2.4-29 dated May 22, 2007.
2. MFN 06-174, Letter from U.S. Nuclear Regulatory Commission to David H. Hinds, *Request for Additional Information Letter No. 32 Related to the ESBWR Design Certification Application*, June 7, 2006.
3. MFN 06-226, Letter from GE to U.S. Nuclear Regulatory Commission, *Response to Portion of NRC Request for Additional Information Letter 32 Related to ESBWR Design Certification Application – Hydrological Engineering – RAI Numbers 2.4-3 through 2.4-31,* July 31, 2006.

Enclosure:

1. MFN 06-226, Supplement 1 – Response to Portion of NRC Request for Additional Information Letter No. 32 – RAI Number 2.4-29 S01.

cc:	AE Cubbage	USNRC (with enclosure)
	BE Brown	GEH/Wilmington (with enclosure)
	LE Fennern	GEH/San Jose (with enclosure)
	GB Stramback	GEH/San Jose (with enclosure)
	eDRF:	0000-0068-6409

Enclosure 1

MFN 06-226
Supplement 1

Response to Portion of NRC Request for
Additional Information Letter No. 32
Related to ESBWR Design Certification Application

Branch Technical Position 11-6 Compliance

RAI Number 2.4-29 S01
(Reference RAI Numbers: 2.4.1-2 (NRC Tracking Item)
2.4-26 through 2.4-30, 15.3-4 and 15.3-5)

Original Response previously submitted under MFN 06-226 without DCD updates is included to provide historical continuity during review.

NRC RAI 2.4-29:

The ESBWR design uses a Radwaste Building designed to RG 1.143; therefore, failure of Radwaste Building and the Radwaste storage tanks due to safe shutdown earthquake (SSE) cannot be precluded. Discuss what measures must be taken by the COL applicant in the event of a total release of the entire Radwaste inventory at the site.

GE Response:

The ESBWR Radwaste Building, along with the structures, systems, and components (SSCs) it contains, are assigned a classification of RW-IIa according to Regulatory Guide (RG) 1.143. Table 2 of this RG requires that a ½ SSE be utilized for design of SSCs with this classification. RG 1.143 Table 3 spells out the load combinations to be used in the design. RG 1.143 Table 1 lists the Design Codes to be used, which in combination with RG 1.143 Table 4 contain applicable acceptance criteria.

DCD Subsections 2.4.13, 3.8.4, 3.8.4.1.5, 12.2.1.4, and 15.3.16 will be revised in the next update, as noted in the attached markup.

NRC RAI 2.4-29 S01:

In DCD Tier 2 Rev. 3, Chapter 2, the applicant states that SRP Section 2.4.13 does not apply to an ESBWR due to its mitigation capabilities. This is not in conformance with staff guidance in the SRP Section 11.2 and BTP 11-6. The applicant needs to add a COL action item for evaluating the effects of an accidental release of radioactive liquid waste on surface and ground water, as is necessary to address SRP Section 2.4.13 for a future site suitability assessment. In addition, the applicant needs to provide in the DCD the source term from the single tank (per assumptions BTP 11-6, March 2007) that would be used by the COL applicant for a future site evaluation to address SRP 2.4.13. This is the postulated inventory to be used for site safety assessments.*

The applicant needs to revise DCD Section 15.3.16 in response to RAIs 15.3-4 and 15.3-5 to clarify that sealing of concrete walls cannot be relied upon to contain the release of all of the liquid radwaste in the compartment, since the SRP Section 11.2 and BTP 11-6 preclude this. According to BTP 11-6, the applicant needs to provide additional details on "special design features" to support their statement and update the radiological assessment accordingly. These are features beyond those discussed in RG 1.143. As is stated in DCD Rev. 3, Section 15.3.16,

the approach relies on the use of "a sealant" or "sealed concrete walls" as the mitigating feature of the design. However, BTP-11-6 states that "credit for liquid retention by unlined building foundations will not be given regardless of the building seismic category because of the potential for cracks. Credit is not allowed for retention by coatings or leakage barriers outside the building foundation."

Accordingly, the applicant is requested to update the basis and assumptions used in the analysis presented in DCD Tier 2, Rev. 3, Section 15.3.16 to be consistent with the SRP guidance in BTP 11-6; and discuss why the release of the postulated inventory of radioactive materials to surface or ground water is not limiting in the analysis as compared to the current case where the volatile airborne fraction of radioactivity (as radioiodines) is assumed to be released in the environment; and update the text and tables in DCD Rev. 3, Sections 15.3.16 and 2.4.13, and Table 2.0-2 of DCD Rev. 3, Section 2.0.

** BTP 11-6 is now part of updated SRP Section 11.2 (March 2007), which was previously located in SRP Section 15.7.3.*

GEH Response:

Regarding Combined Operating License (COL) action compliance with Standard Review Plan (SRP) 2.4.13: GEH agrees that the SRP requires the COL applicant to describe the effects of accidental releases of radioactive liquid effluents in ground and surface waters on existing uses and known and likely future uses of ground and surface water resources. Accordingly, DCD Tier 2, Table 2.0-2, Subsection 2.4.13 will be revised to state: "COL applicant to address SRP 2.4.13." ESBWR DCD Parameters, Consideration and/or Limits column of Table 2.0-2 will be revised accordingly to state: "The source term provided in Table 12.2-13a "Liquid Waste Management System Equipment Drain Collection Tank Activity" is used in the effects analysis."

Regarding the submittal of source term for a single tank failure in accordance with Branch Technical Position (BTP) 11-6: The source term was conservatively chosen to include the source term from all permanent plant LWMS tanks and is currently provided in DCD Tier 2, Subsection 15.3.16.3. However, a typographical error exists in the referenced Subsection 15.3.16.3 and will be changed to state: "For the airborne pathway, volatile iodine species in the tank using the cumulative inventories in Tables 12.2-13a through 12.2-13g are considered."

Regarding the BTP 11-6 requirement that sealing of concrete walls cannot be relied upon to contain the release of all of the liquid: GEH agrees that the BTP 11-6 does not allow credit for sealing of concrete walls to contain releases of the liquids from tanks. Accordingly, as stated previously, GEH has incorporated the use of steel liners in the LWMS tank cubicles. Subsection 11.2.2.3 will be revised to indicate: "Tank rooms are lined with steel to prevent accidental

releases to the environment." Subsection 12.2.1.4 "Post-Accident Radioactive Sources" will be revised to state: "The radwaste building is seismically designed in accordance with Regulatory Guide 1.143, Class RW-IIa. The tank cubicle concrete is provided with a sealant and a tank cubicle steel liner, as described in Subsection 11.2.2.3 to prevent any potential water releases from high activity areas." Further, Subsection 15.3.16.2, paragraph 2 will be revised to state: "Liquid releases would be contained within the sealed concrete walls and steel LWMS tank cubicle liners, and would present no . . . ." The results of the SRP 15.7.3 analysis remain valid such that there are no liquid releases to the environment, and the airborne release doses are a fraction of the 25 mSv (2.5 rem) TEDE offsite and 50 mSv (5 rem) onsite criteria.

DCD Impact:

DCD Tier 2, Revision 4 is to include the following changes:

1. Table 2.0-2, Subsection 2.4.13 – Under the Column entitled "ESBWR DCD Parameters, Consideration and/or Limits", the row is to be revised to state: "The source term provided in Table 12.2-13a "Liquid Waste Management System Equipment Drain Collection Tank Activity" is used in the effects analysis." For the Column entitled COL information, the row will be revised to state "COL applicant to address SRP 2.4.13".
2. Subsection 11.2.2.3 – "Tank cubicles are lined with steel to prevent accidental releases to environment."
3. Subsection 12.2.1.4 – "The radwaste building is seismically designed in accordance with Regulatory Guide 1.143, Class RW-IIa. The tank cubicle concrete is provided with a sealant and a tank cubicle steel liner, as described in Subsection 11.2.2.3 to prevent any potential water releases from high activity areas to the environment."
4. Subsection 15.3.16.1, paragraph 3 – "Should a release of liquid wastes occur, the sealed concrete walls and the steel tank cubicle liners will contain the liquid waste, thereby preventing liquid releases into the environment. The liquid waste would then be transferred from the tank cubicle to the radwaste sumps for processing."
5. Subsection 15.3.16.2, paragraph 2 – "Liquid releases would be contained within the sealed concrete walls and steel LWMS tank cubicle liners, and would present no immediate threat to the environment leaving the operator sufficient time (on the order of hours) in which to recover systems to pump the release into holding tanks or emergency tanks."
6. Subsection 15.3.16.3 – "For the airborne pathway, volatile iodine species in the tank using the cumulative inventories in Tables 12.2-13a through 12.2-13g are considered."

DCD Tier 2 markups for the DCD Revision 4 changes are attached.

Table 2.0-2

Limits Imposed on Acceptance Criteria in Section II of SRP by ESBWR Design

Subsection	Subject	ESBWR DCD Parameters, Considerations and/or Limits	COL Information
2.4.11	Cooling Water Supply	None.	COL applicant to supply site-specific information in accordance with SRP 2.4.11.
2.4.12	Groundwater	Per Table 2.0-1.	COL applicant to supply site-specific information in accordance with SRP 2.4.12.
2.4.13	Accidental Releases of Liquid Effluents in Ground and Surface Waters	The source term provided in Table 12.2-13a, "Liquid Waste Management System Equipment Drain Collection Tank Activity," is used in the effects analysis.~~None. DCD Tier 2 Subsection 15.3.16, "Liquid Containing Tank Failure," demonstrates that the ESBWR design precludes accidental releases of radioactive liquid effluent.~~	COL applicant to address SRP 2.4.13~~None. SRP 2.4.13 is not applicable to a site with an ESBWR~~.
2.4.14	Technical Specifications and Emergency Operation Requirements	None.	COL applicant to provide site-specific information in accordance with SRP 2.4.14.
2.5.1	Basic Geologic and Seismic Information	None.	COL applicant to provide site-specific information in accordance with SRP 2.5.1.

11.2.2.3 Detailed System Component Description

The LWMS consists of permanently installed tanks, pumps, pipes, valves, and instruments, and mobile systems for waste processing. Mobile systems provide an operational flexibility and maintainability to support plant operation. The major components of the LWMS are as follows:

Pumps

The LWMS process pumps are constructed of materials suitable for their intended service.

Neutralization chemicals in the LWMS are added with centrifugal or positive displacement pumps (or functionally similar pumps). These pumps are constructed of materials suitable for their intended service.

Tanks

Tanks are sized to accommodate the expected volumes of waste generated in the upstream systems that feed waste into the LWMS for processing. The tanks are constructed of stainless steel to provide a low corrosion rate during normal operation. They are provided with mixing eductors and/or air spargers. The capability exists to sample all LWMS collection and sample tanks. All LWMS tanks are vented through a filtration unit and eventually discharged into the plant vent. Tank cubicles are lined with steel to prevent accidental releases to environment. The LWMS tanks are designed in accordance with the equipment codes listed in Table 11.2-1.

All atmospheric liquid radwaste tanks are provided with an overflow connection at least the size of the largest inlet connection. The overflow is connected below the tank vent and above the high-level alarm setpoint. Each collection tank room is designed to contain the maximum liquid inventory in the event that the tank ruptures.

Mobile Systems

The mobile system is of a skid-mounted design and configured for relatively easy installation and process reconfiguration. In-plant supply and return connections from permanently installed equipment to the mobile system are provided to ensure operational flexibility.

The LWMS mobile systems are located in the Liquid Waste Treatment System bay to allow truck access and mobile system skid loading and unloading. Modular shield walls are provided in the Radwaste Building (RW) to allow shield walls to be constructed to minimize exposure to personnel during operation and routine maintenance.

Mobile Systems for equipment drain processing

The equipment drain mobile system utilizes unit operations such as filters for removing suspended solid and radioactive particulate material, and charcoal adsorbtion for organic material removal. Backwash operation for depth filtration units is performed when the differential pressure across the filter exceeds a preset limit. Depth filtration backwash waste is discharged to a low activity phase separator. Spent organic removal media, if used, is packaged directly into the container when the differential pressure exceeds a preset limit or waste quality of the effluent from the unit exceeds a preset value.

The equipment drain pretreatment unit operations, such as filtration, feeds the chemical reaction equipment, such as mixed-bed ion exchangers. Exhausted resins from a mixed bed ion exchange

unit are sluiced to the low activity spent resin holdup tank when some chosen effluent purity parameter (such as conductivity) exceeds a preset limit or upon high differential pressure across the unit. Fine mesh strainers with backwashing connections are provided in the ion exchange vessel discharge and in the downstream piping to prevent resin fines from being carried over to the sampling tanks.

The mobile system is skid-mounted and is designed and configured for relatively easy installation and process reconfiguration. In-plant supply and return connections from permanently installed equipment to the mobile system are provided to keep operational flexibility.

Mobile Systems for floor drain and chemical drain processing

Floor drain and chemical drain wastes are more complex to process than equipment drains. The floor drain mobile system utilizes unit operations such as pre-filtration equipment for removing suspended solids and organic impurities, filtration equipment that may include units such as a Reverse Osmosis System (RO) for removing ionic impurities, and chemical reactors, such as deep-bed ion exchangers for polishing.

If used, the pre-filtration equipment liquid effluent may either be directly fed to the filtration equipment or collected into a feed tank of the filtration equipment. The feed tank, if used, may serve as a supply surge tank to the process. If a surge tank is used, the liquid is transferred to the filtration unit via a pump. If a surge tank is not used, the direct piped liquid leaving the pre-filtration equipment may not need a pressure increase, therefore the addition of a booster pump may be optional. If used as one of the unit operations, an RO unit uses membranes that are made of a semi-permeable material. When pressure is applied to the feed side of the membrane, the solution passes through the membrane (permeates) and the solids and other impermeable wastes are rejected. Should an RO unit be used, the rejected solids and ionic impurities may be returned to the feed tank and the final permeate may be polished by deep-bed ion exchangers. Typically, if used, ion exchangers following an RO are of the mixed-bed type. Exhausted ion exchange resins may be sluiced to the spent resin tank or directed to a cask when some chosen effluent purity parameter (such as conductivity) exceeds a preset limit or upon high differential pressure. Fine mesh strainers with backwashing connections are provided in the ion exchange vessel discharge and in the downstream piping to prevent resin fines from being carried over to the sampling tanks, should ion exchangers be used.

The chemical drain pre-treatment unit performs a pre-conditioning of chemical waste, such as pH adjustment, prior to processing.

The mobile system is of a skid-mounted design and configured for relatively easy installation and process reconfiguration. In-plant supply and return connections from permanently installed equipment to the mobile system are provided to ensure operational flexibility.

Mobile Systems for detergent drain processing

The detergent drain mobile system typically utilizes unit operations such as a charcoal adsorber to remove organics and a filter to remove suspended solids. When the differential pressure of the filter exceeds a preset value, the filter performance is rejuvenated in accordance with the design of the filter. Discarded spent filter media, if used, are packaged as active solid waste.

Mobile Systems for chemical agent addition

Mobile based chemical addition equipment may be provided as necessary to add chemical agent(s) for maintaining the performance in or recovering the performance of mobile system unit operations such as filtration system(s) and reaction system(s) such as pH control. Depending on the processing equipment and the mechanism causing a reduction in performance, individual equipment-specific chemical treatment may be necessary. Should the equipment drain subsystem processes, operations and potential means for a reduction in performance be substantially similar to that of the floor drain subsystem, the equipment drain subsystem mobile based chemical addition equipment may provide for the addition of chemical agent(s) to the floor drain subsystem. Should the equipment drain subsystem processes, operations and potential means for a reduction in performance not be substantially similar to that of the floor drain subsystem, each subsystem may include individual mobile based chemical addition equipment as necessary to add chemical agent(s) to maintain or recover system performance. Mobile based chemical addition equipment may be provided as necessary to add agents for maintaining the performance in, or recovering the performance of, the processes and operations in each, the chemical drain subsystem and the detergent drain subsystem.

12.2.1.4 Radwaste Building Source Terms

The radwaste building is seismically designed in accordance with Regulatory Guide 1.143, Class RW-IIa. The tank cubicle concrete is provided with a sealant and a tank cubicle steel liner, as described in Subsection 11.2.2.3 to prevent any potential water releases from high activity areas to the environment.~~high activity areas.This section provides a summation of the significant radioactive source terms found in the ESBWR radwaste 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 due to deposition of corrosion or fission products species on the surfaces of the components.~~

Normal Operating Sources

Tables 12.2-13a through 12.2-13g and 12.2-14a through 12.2-14b provide source inventories for the major radwaste components for operation. These sources are based upon the stream concentrations given in Section 11.1 and represent sources for shielding calculations. These inventories should not be construed to represent sources for offsite release. A complete description of the ESBWR radwaste system is given in Sections 11.2 through 11.4.

Post-Accident Radioactive Sources

Potential releases in the radwaste building are contained by isolating the radwaste building atmosphere and sealing any water releases in the building. The radwaste building is seismically designed in accordance with Regulatory Guide 1.143 and the tank area concrete is provided with a sealant and a steel liner, as described in Subsection 15.3.16.1, to prevent any potential water releases from high activity areas.

15.3.16.1 Identification of Causes

An unspecified event causes the complete release of the radioactive inventory in all tanks containing radionuclides in the liquid radwaste system. Postulated events that could cause a release of the inventory of a tank are sudden unmonitored cracks in the vessel or operator error. Small cracks and consequent low level releases are bounded by this analysis and should be contained without any significant release.

The ESBWR Radwaste Building is designed to seismic requirements as specified in Subsection 3.8.4. In addition, the concrete walls of all compartments containing high level liquid radwaste are provided with a sealant up to a height capable of containing the release of all the liquid radwaste in the compartment. Because of these design capabilities, it is considered remote that any major event involving the release of liquid radwaste into these volumes would result in the release of these liquids to the environment via the liquid pathway. Releases as a result of major cracks would instead result in the release of the liquid radwaste to the compartment and then to the building sump system for containment in other tanks or emergency tanks. A complete description of the liquid radwaste system is found in Section 11.2, except for the tank inventories, which are found in Section 12.2.

A liquid radwaste release caused by operator error is also considered a remote possibility. Operating techniques and administrative procedures emphasize detailed system and equipment operating instructions. A positive action interlock system is also provided to prevent inadvertent opening of a drain valve. Should a release of liquid wastes occur, the sealed concrete walls and the steel tank cubicle liners will contain the release. The liquid waste would then be transferred from the tank cubicle to the radwaste sumps for processing. ~~Should a release of wastes occur, the sealed concrete walls would contain the release until the floor drain sump pumps in the building capture and contain such spills.~~

The probability of a complete tank release is considered low enough to warrant this event as an Infrequent Event. The frequency of this event is evaluated in Subsection 15A.3.16.

15.3.16.2 Sequence of Events and Systems Operations

Following a failure, the area radiation alarms would be expected to alarm at one minute with operator intervention following at approximately five minutes after release. However, the rupture of a waste tank would be contained and allow the operator time to develop and setup a means to process the contained waste. Gases would be processed through the Radwaste Building HVAC system as described in Subsections 9.4.3, 11.5.3.2.8 and 12.3.3.2.4.

Liquid releases would be contained within the sealed concrete walls and steel LWMS tank cubicle liners, and would present no immediate threat to the environment leaving the operator sufficient time (on the order of hours) in which to recover systems to pump the release into holding tanks or emergency tanks. ~~Liquid release would be contained within the sealed concrete walls and would present no immediate threat to the environment leaving the operator sufficient time (on the order of hours) in which to recover systems to pump the release into holding tanks or emergency tanks.~~

15.3.16.3 Results

A single pathway is considered for release of fission products to the environment via airborne releases. The liquid pathway is not considered because of the mitigation capabilities of the Radwaste Building, following the guidance of SRP Section 15.7.3.III.1.b. General Design Criterion (GDC) 60 is met, as the release of radioactive materials in this case is suitably controlled.

For the airborne pathway, volatile iodine species in the tank using the cumulative inventories in Tables 12.2-13a through 12.2-13g are considered. ~~For the airborne pathway, volatile iodine species in the tank using the cumulative inventories in Tables 12.2-23a through 12.2-13g are considered.~~ Although isolation is expected within minutes of the occurrence, release of 10% of the iodine inventory is conservatively assumed instanteously with no holdup or plateout. Specific parameters for this analysis are found in Tables 15.3-17 and 15.3-18.

No liquid or significant (from airborne species) ground contamination is expected. Airborne doses are given in Table 15.3-19 and are a fraction of the 2.5 rem TEDE offsite and 5 rem onsite criteria. The effluent concentration limits of 10 CFR 20 Appendix B are met, as no liquid effluent is released to the environment as a result of the tank failure.