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Subject: **Response to Portion of NRC Request for Additional Information Letter No. 388 Related to ESBWR Design Certification Application – Leakage Monitoring - RAI Number 12.7-5 S02**

The purpose of this letter is to submit the GE Hitachi Nuclear Energy (GEH) response to the U.S. Nuclear Regulatory Commission (NRC) Request for Additional Information (RAI) 12.7-5 S02 sent by NRC Letter 388, Reference 1. The response to RAI Number 12.7-5 S01 was previously submitted to the NRC via Reference 2 in response to Reference 3.

GEH response to RAI Number 12.7-5 S01 is addressed in Enclosure 1. Enclosure 2 contains the DCD markups associated with this response.

If you have any questions or require additional information, please contact me.

Sincerely,

Richard E. Kingston

Richard E. Kingston
Vice President, ESBWR Licensing

References:

1. MFN 09-689, Letter from U.S. Nuclear Regulatory Commission to Jerald G. Head, *Request for Additional Information Letter No. 388 Related to ESBWR Design Certification Application*, November 2, 2009
2. MFN 09-507, Response to Portion of NRC Request for Additional Information Letter Number No. 348 Related to ESBWR Design Certification Application – Radiation Protection - RAI Number 12.7-5 S01, August 14, 2009
3. MFN 09-396, Letter from U.S. Nuclear Regulatory Commission to Jerald G. Head, *Request for Additional Information Letter No. 348 Related to ESBWR Design Certification Application*, June 5, 2009

Enclosures:

1. Response to Portion of NRC Request for Additional Information Letter No. 388 Related to ESBWR Design Certification Application – Leakage Monitoring - RAI Number 12.7-5 S02
2. Response to Portion of NRC Request for Additional Information Letter No. 388 Related to ESBWR Design Certification Application – Leakage Monitoring - RAI Number 12.7-5 S02 – DCD Markups

cc:	AE Cubbage	USNRC (with enclosures)
	JG Head	GEH/Wilmington (with enclosures)
	DH Hinds	GEH/Wilmington (with enclosures)
	TL Enfinger	GEH/Wilmington (with enclosures)
	eDRF Section	0000-0104-9044, Revision 1

Enclosure 1

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Response to Portion of NRC Request for Additional Information Letter No. 388 Related to ESBWR Design Certification Application

Leakage Monitoring

RAI Number 12.7-5 S02

NRC RAI 12.7-5 S02

Your response to item c.i. of RAI 12.7-5 S01 addresses the ESBWR design features implemented to minimize the potential for unmonitored, uncontrolled releases of radioactivity to the environment from those SSCs which have buried piping. In your response, you state that the following SSCs will have associated piping segments which will be run underground; Condensate Storage Tank (CST) and CST Retention Area Drain, Radwaste Effluent Discharge Pipeline, Hot Machine Shop Drain Line, and Cooling Tower Blowdown Line. For the first three of these SSCs, you state that underground piping will be designed to preclude inadvertent or unidentified releases to the environment by either enclosing the piping within a guard pipe which is monitored for leakage or making the piping accessible for visual inspection via an accessible trench or tunnel. The staff finds that these methods of monitoring for leakage meet the intent of 10 CFR 20.1406.

However, you state that GEH finds that it is impractical to implement these features for the underground portion of the cooling tower blowdown line because this line is significantly larger and longer than the pipes for the other three SCCs listed above. You also state that it is GEH's opinion that this line does not require these additional design features because, from a radiological viewpoint, the contents of this line are already released to the environment. You state that the radiological monitoring and control that is performed for radwaste effluent occurs upstream (i.e. before) it is introduced to the cooling tower blowdown sump and, if radioactivity levels in the radwaste effluent exceed the pre-established setpoint, flow will be shutdown before it reaches the cooling tower blowdown sump. As such, you state that, for radiological discharges, the cooling tower blowdown sump is treated as the environment.

This description of the discharge path beyond the cooling tower blowdown is inconsistent with NRC guidance of RGs 1.143 and 1.206 and SRP Section 11.2. The NRC guidance states that applicants should define the boundary of the LWMS beginning at the interface from plant systems provided for the collection of process streams and radioactive liquid wastes to the point of controlled discharge to the environment (as would be defined in an Offsite Dose Calculation Manual (ODCM)), or at the point of recycling to the primary or secondary water system storage tanks for liquids and liquid wastes produced during normal operation and anticipated operational occurrences. The description provided in you response to part c.i of this RAI appears to exclude a segment of the discharge path, i.e., from the cooling tower blowdown to the point of release into the environment beyond the owner-controlled area or EAB.

Modify you response to show how you plan to monitor the cooling tower blowdown line for leakage in order to minimize the potential for unmonitored, uncontrolled releases of radioactivity to the environment.

GEH Response

GEH will include the cooling tower blowdown line with the other three underground lines in that it will be designed to preclude inadvertent or unidentified leakage to the environment by either enclosing it within a guard pipe to permit monitoring for leakage or allowing for visual inspections via a trench or tunnel.

Minor wording changes will also be made to DCD Tier 2, Subsection 12.3.1.5.1 to accommodate the fact that final material selection has not been made for the cooling tower blowdown line.

DCD Impact

DCD Tier 2, Subsection 12.3.1.5.1 will be revised as noted on the attached markup to indicate the above changes.

Enclosure 2

MFN 09-724

Response to Portion of NRC Request for Additional Information Letter No. 388 Related to ESBWR Design Certification Application

Leakage Monitoring

RAI Number 12.7-5 S02

DCD Markups

condition. For example, the Leakage Detection and Isolation System (LD&IS) would also serve to detect any leakage near the reactor coolant pressure boundary.

Table 12.3-18 shows design features in the specified DCD chapters and subsections that address the requirements of 10 CFR 20.1406.

12.3.1.5.1 Design Considerations

The following design objectives summarize the objectives contained in Regulatory Position C.1 through C.4 of Regulatory Guide 4.21:

- Objective 1 - Minimize leaks and spills and provide containment in areas where such events might occur.
- Objective 2 - Provide adequate leak detection capability to provide prompt detection of leakage from any structure, system, or component that has the potential for leakage.
- Objective 3 - Use leak detection methods (e.g., instrumentation, automated samplers) capable of early detection of leaks in areas where it is difficult (inaccessible) to conduct regular inspections (such as spent fuel pools, tanks that are in contact with the ground, and buried, embedded, or subterranean piping) to avoid release of contamination.
- Objective 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.
- Objective 5 - Facilitate decommissioning by (1) minimizing embedded and buried piping, and (2) designing the facility to facilitate the removal of any equipment or components that may require removal or replacement during facility operation or decommissioning.
- Objective 6 - Minimize the generation and volume of radioactive waste during operation and decommissioning (by minimizing the volume of components and structures that become contaminated during plant operation).

ESBWR design features that address the above design objectives are described in individual DCD sections and subsections. Table 12.3-18 provides a cross reference of applicable DCD chapters and subsections for structures/systems that address the six design objectives. Note that the systems/structures that employ the subject design features are of varied construction and purpose and can provide differing functions. As such, not all of the above design concepts are present as a design feature in each system/structure. Additionally, examples of generic and specific design features present in the ESBWR are listed below.

Generic ESBWR design features used to minimize contamination and generation of radioactive waste and facilitate decommissioning include the following:

- Design of equipment to minimize the buildup of radioactive material and to facilitate flushing of crud traps;
- Provisions for design features to plant systems such as the RWCU/SDC System, liquid and solid radwaste systems and the condensate demineralizer to minimize crud buildup;
- Provisions for draining, flushing, and decontaminating equipment and piping;

- Penetrations through outer walls of a building containing radiation sources are sealed to prevent miscellaneous leaks to the environment;
- Equipment drain sump vents are hard-piped directly to the RW HVAC System to collect airborne contaminants released from discharges to the sump;
- Appropriately sloped floors around floor drains in areas where the potential for a spill exists to limit the extent of contamination. The floor drains are monolithic in construction to minimize possibility of liquid penetrating at embedment boundaries. No grout is used in the installation of floor drains. Periodic visual inspections of the installation around the floor drains are performed to ensure no bypass exists in these floor drain areas;
- Provisions for decontaminable epoxy-type wall and floor coverings, which provide smooth surfaces to ease decontamination. Epoxy-type coatings are applied to both steel surfaces and concrete areas appropriate for contamination control. These areas consist of the walls and floors of the RB, FB, and TB, radwaste areas, rooms containing equipment with liquid radioactive sources, floor drain areas, washdown bays, and the RW Tunnel;
- Equipment and floor drain sumps are stainless steel lined to reduce crud buildup due to corrosion and provide surfaces that are easily decontaminated;
- For all areas with the potential for airborne radioactivity, the ventilation systems are designed such that during normal and maintenance operations, airflow between areas is always from an area of lower potential contamination to an area of higher potential contamination;
- The ESBWR is designed to limit the use of cobalt bearing materials on moving components that have historically been identified as major sources of radioactivity in reactor coolant;
- To facilitate decommissioning, the RB, FB, TB, and RW are designed for large equipment removal, consisting of entry doors from the outside and numerous cubicles with equipment hatches inside the buildings;
- To facilitate decommissioning and ease of access, the radwaste process systems are skid-mounted and located in the RW to allow truck access, and system skid loading and unloading; and
- For some piping, feed-throughs with short sections, the piping may be embedded in concrete as discussed in DCD Subsection 12.3.1.2.4. Minimization of short sections with embedded piping to the extent practicable facilitates the dismantlement of the systems and decommissioning.
- The following piping contain segments that will have to run underground:
  - Condensate Storage Tank (CST) Piping and CST Retention Area Drain
  - Radwaste Effluent Discharge Pipeline
  - Cooling Tower Blowdown Line
  - Hot Machine Shop Drain

  As such, these lines will be kept as short and direct as practicable.

The underground piping associated with ~~the CST, Radwaste Effluent and the Hot Machine Shop~~these lines will be designed to preclude inadvertent or unidentified leakage to the environment. They are either enclosed within a guard pipe and monitored for leakage, or are accessible for visual inspections via a trench or tunnel. ~~All joints are welded with no threaded or flanged connections used underground.~~Threaded and flanged connections will be kept to a minimum. Other joints will be welded or otherwise permanently bonded depending on the piping material. Furthermore, fittings will be kept to a minimum and no in-line components (e.g., valves) will be incorporated into these lines. These features substantially reduce the potential for unmonitored and uncontrolled releases to the environment and support compliance with RG 4.21.

~~The cooling tower blowdown line also includes underground piping; however, enclosing this line within a guard pipe or in an accessible trench or tunnel is not practicable because the line is significantly larger and longer than the previously discussed lines. However, this line does not require these additional design features because, from a radiological viewpoint, the contents of this line are already released to the environment. The radwaste effluent discharge line discharges to the cooling tower blowdown sump, which in turn discharges to the lake, river or bay. The radiological monitoring and control that is performed for radwaste effluent occurs upstream (i.e. before) it is introduced to the cooling tower blowdown sump. If radioactivity levels in the radwaste effluent exceed the pre-established setpoint; flow will be shutdown before it reaches the cooling tower blowdown sump. As such, for radiological discharges, the cooling tower blowdown sump is treated as the environment. Furthermore, the control of flow is significantly easier with radwaste effluent than with cooling tower blowdown. The flow rate for radwaste effluent is 100 gallons per minute or less and affects only the associated radwaste pump and valves, whereas the cooling tower blowdown flow rate is several thousand gallons per minute and would affect additional equipment including cooling tower operation and therefore plant operation. It is for these practical reasons that the cooling tower blowdown line will not be considered for the same design features as the CST piping, radwaste effluent pipeline or Hot Machine Shop Drain.~~

Specific ESBWR design features used to minimize the generation of radioactive waste include the following:

- LWMS is divided into several subsystems, so liquid wastes from various sources can be segregated and processed separately, based on the most efficient process for each specific type of impurity and chemical content. This segregation allows for efficient processing and minimization of overall liquid waste.
- During liquid processing by LWMS, radioactive contaminants are removed and the bulk of the liquid is purified and either returned to the condensate storage tank or discharged to the environment, minimizing overall liquid waste. The radioactivity removed from liquid waste is concentrated in filter media ion exchange resins and concentrated waste. The filter sludge, ion exchange resins and concentrated waste are discharged to SWMS for further processing.
- SWMS is designed to segregate and package wet and dry types of radioactive solid waste for off-site shipment and storage. This segregation allows for efficient processing and minimization of overall quantity of solid waste.