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MFN 06-309
Supplement 6

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Subject: **Response to Portion of NRC Request for Additional Information Letter No. 54 –Auxiliary Systems– RAI Number 9.1-3 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

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NRO

Reference:

1. E-mail dated May 3, 2007, from L. Quinones (NRC) to P. Jordan (GEH).
2. MFN 06-302, Letter from U.S. Nuclear Regulatory Commission to David H. Hinds, *Request for Additional Information Letter No. 54 Related to the ESBWR Design Certification Application*, August 23, 2006.
3. MFN 06-309, Letter from GE to U.S. Nuclear Regulatory Commission, *Response to Portion of NRC Request for Additional Information Letter 54 Related to ESBWR Design Certification Application – Auxiliary Systems – RAI Numbers 9.1-1 through 9.1-26 and Amended Response to RAI Number 2.4-23 from NRC RAI Letter 32,* September 8, 2006.

Enclosure:

1. MFN 06-309, Supplement 6 – Response to Portion of NRC Request for Additional Information Letter No. 54 – RAI Number 9.1-3 S01.

cc:	AE Cubbage	USNRC (with enclosure)
	BE Brown	GEH/Wilmington (with enclosure)
	LE Fennern	GEH/San Jose (with enclosure)
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	eDRF:	0000-0070-3497

Enclosure 1

MFN 06-309
Supplement 6

Response to Portion of NRC Request for Additional Information Letter No. 54 Related to ESBWR Design Certification Application

Auxiliary Systems

RAI Number 9.1-3 S01

For historical purposes, the original text and GE response to RAI 9.1-3 is included.

NRC RAI 9.1-3:

DCD Tier 2, Section 9.1.2.3 states that the fuel storage racks provided in the SFP in the fuel building (FB) provide storage of irradiated fuel assemblies resulting from 10 calendar years of plant operation plus one full core off load. Section 9.1.2.3 also states that the fuel storage racks in the RB buffer pool deep pit can hold a total of 154 spent fuel assemblies.

Standard Review Plan (SRP), Section 9.1.2, Revision 3, July 1981, Criterion III.1, provides guidance indicating high-density storage would be reviewed on a case-by-case basis. If high-density storage (i.e. storage configurations where solid neutron absorbers are necessary to satisfy reactivity limits) is necessary to achieve the indicated storage capacity in either the SFP or the buffer pool, provide justification for the reduced cooling effectiveness relative to low-density storage. Clarify whether any fuel rack storage locations will be used for storage of irradiated components other than fuel. Finally, describe how the size of the SFP and the buffer pool as defined in DCD Tier 1 drawings were verified to accommodate the specified storage capacities.

GE Response

It is anticipated that the spent fuel storage racks in the fuel building and the RB buffer pool pit will be a high density fuel storage rack design. Low density is not, nor has been a design basis for ESBWR.

The number of fuel assemblies to be stored (10 calendar years plus one full core offload) determines the required capacity of the FAPCS as well as the number of fuel storage cells.

FAPCS
The discussion of the bulk cooling capability of the FAPCS is discussed in Section 9.1.3.

Fuel Storage Racks
For the Tier 1 drawings, the size of the spent fuel storage racks and hence the pool is based on typical high density fuel storage rack designs with typical fuel to fuel spacing that includes the fuel assembly at the expected maximum bow and bulge, associated neutron absorbers, and any additional structural material. For the FB building fuel storage pool, with a typical pitch-to-pitch spacing determined, an array is developed to accommodate the required number of fuel assemblies based on the pitch and the expected number of fuel assemblies to meet the design basis for number of discharged fuel bundles. Similarly for the RB deep pit the size is based on the pitch except a specific number, 154, was chosen based on historical information regarding the nominal number of fuel bundles that might be expected to be temporarily removed during a fuel shuffle/reload.

The racks are analyzed for cooling as follows. Using the FAPCS system capacity the racks are designed to handle the heat load from the expected number of fuel bundles to be discharged. The hydraulic resistance of the rack[s] with fuel is determined. Natural circulation is assumed.

No forced flow under the rack is assumed. Based on natural circulation and inlet conditions at the bottom of the rack, the exhaust temperature of an individual cell is determined. Additionally the rack array in relation to the pool walls, floors, downcomers, and weir drains is determined. Based on FAPCS flow input volume, temperature, position, and output position a bulk analysis of the racks is performed.

The fuel storage racks are not designed to accommodate items other than fuel.

There are no identified DCD changes.

Supplemental request received via e-mail dated 5/3/07 from L. Quinones (NRC) to P. Jordan (GEH):

NRC RAI 9.1-3 S01:

Response is insufficient to conclude that measures have been taken to provide adequate cooling for high density racks. Provide information such as assembly dimensions, center-to-center distance, array layouts and location within the pool to facilitate NRC review.

In addition, there is no basis for concluding that the adequate cooling will be provided since neither the size of the pool nor the required cooling capacities are known. This information should be provided in the DCD to complete the review.

GEH Response:

Assembly dimensions, center-to-center distance, array layouts, and location within the pool are dependent on completion of dynamic load analysis for the high-density spent fuel racks.

As described in subsection 9.1.3.3, the size of the spent fuel pool is defined and water inventory is analyzed as adequate to keep the fuel covered through 72 hours post-accident, thereby avoiding heat up of the fuel and potential for fission product release.

The standard ESBWR plant design is to provide sufficient fuel racks for storage of spent fuel resulting from 10 years of plant operation plus one full core off-load. These criteria are also defined in DCD Tier 2, Revision 2, and were used as the original bases for design/sizing of the FAPCS. These criteria, specified in the original RAI response, were valid at the time of that response.

Exceeding the space required to meet the standard ESBWR plant design as discussed above, the spent fuel pool is sufficient in size to accommodate enough fuel racks for storage of spent fuel resulting from 20 years of plant operation plus one full core off-load. Therefore, the criteria for sizing of the FAPCS were re-defined for DCD Tier 2, Revision 3. In normal spent fuel pool heat load conditions (spent fuel resulting from 20 years of plant operation), analysis concludes that a single train of the Fuel and Auxiliary Pool Cooling System (FAPCS) is designed to maintain spent fuel pool water temperature below 120°F. During maximum spent fuel pool heat load conditions (full core off-load plus spent fuel resulting from 20 years of plant operation), analysis concludes that both trains are needed to maintain temperature below 140°F. These conditions are the bases for design/sizing of the FAPCS.

DCD Impact:

DCD Tier #2, Subsection 9.1.3, is to be revised as noted in the attached markup.

9.1.3 Fuel and Auxiliary Pools Cooling System

9.1.3.1 Design Bases

Safety Design Basis

Fuel and Auxiliary Pools Cooling System (FAPCS) is a Nonsafety-Related system, except for the containment isolation valves, the high-pressure interface with the Reactor Water Cleanup / Shutdown Cooling System, and emergency water supply flow paths.

Power Generation Design Basis

FAPCS provides continuous cooling and cleaning of the spent fuel storage pool during normal plant operation. It also provides occasional cooling and cleaning of various pools located inside the containment during normal plant operation and refueling outage.

9.1.3.2 System Description

System Description Summary

The FAPCS consists of two physically separated cooling and cleanup (C/C) trains, each with 100% capacity during normal operation. Each train contains a pump, a heat exchanger and a water treatment unit for cooling and cleanup of various cooling and storage pools except for the Isolation Condenser and Passive Containment Cooling System (IC/PCCS) pools (refer to Figure 9.1-1). A separate subsystem with its own pump, heat exchanger and water treatment unit is dedicated for cooling and cleaning of the IC/PCCS pools independent of the FAPCS C/C train operation during normal plant operation (refer to Figure 9.1-1).

The primary design function of FAPCS is to cool and clean pools located in the containment, Reactor Building and Fuel Building (refer to Table 9.1-1) during normal pant operation. FAPCS provides flow paths for filling and makeup of these pools during normal plant operation and during post accident conditions, as necessary.

FAPCS is also designed to provide the following accident recovery functions in addition to the Spent Fuel Pool cooling function:

- Suppression pool cooling (SPC);
- Drywell spray;
- Low pressure coolant injection (LPCI) of suppression pool water into the RPV; and
- Alternate Shutdown Cooling.

In addition to its accident recovery function, suppression pool cooling (SPC) mode is also designed to automatically initiate during normal operation in response to a high temperature signal from the suppression pool.

Redundancy and physical separation will be provided in accordance with SECY 03-087 for active components in lines dedicated to LPCI and SPC modes.

During normal plant operation, at least one FAPCS C/C train is available for continuous operation to cool and clean the water of the Spent Fuel Pool, while the other train can be placed in standby or other mode for cooling the Gravity Driven Cooling System (GDCS) pools and

suppression pool. If necessary during refueling outage, both trains may be used to provide maximum cooling capacity for cooling the Spent Fuel Pool. The water treatment units can be bypassed when necessary, and will be bypassed automatically on a high temperature signal downstream of the heat exchangers.

Each FAPCS C/C train has sufficient flow and cooling capacity to maintain Spent Fuel Pool bulk water temperature below 48.9°C (120°F) under normal Spent Fuel Pool heat load conditions. (normal heat load condition is defined as irradiated fuel in the Spent Fuel Pool resulting from 20 years of plant operations). During the maximum Spent Fuel Pool heat load conditions of a full core off-load plus irradiated fuel in the Spent Fuel Pool resulting from 20 years of plant operations, both FAPCS C/C trains are needed to maintain the bulk temperature below 60°C (140°F).