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Subject: **Response to Portion of NRC Request for Additional Information Letter No. 158 Related to ESBWR Design Certification Application - Auxiliary Systems - RAI Number 9.1-49**

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) sent by NRC letter dated February 29, 2008, Reference 1. GEH response to RAI Number 9.1-49 is addressed in Enclosure 1.

Verified DCD changes associated with this RAI response are identified in the enclosed DCD markups by enclosing the text within a black box. The marked-up pages may contain unverified changes in addition to the verified changes resulting from this RAI response. Other changes shown in the markup(s) may not be fully developed and approved for inclusion in DCD Revision 5.

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

Sincerely,

James C. Kinsey
Vice President, ESBWR Licensing

D068
NRO

Reference:

1. MFN 08-209, Letter from U.S. Nuclear Regulatory Commission to Robert E. Brown, GEH, *Request For Additional Information Letter No. 158 Related To ESBWR Design Certification Application*, dated February 29, 2008

Enclosure:

1. Response to Portion of NRC Request for Additional Information Letter No. 158 Related to ESBWR Design Certification Application - Auxiliary Systems - RAI Number 9.1-49

cc: AE Cubbage USNRC (with enclosure)
GB Stramback GEH/San Jose (with enclosure)
RE Brown GEH/Wilmington (with enclosure)
DH Hinds GEH/Wilmington (with enclosure)
eDRF 0000-0082-5661

Enclosure 1

MFN 08-312

*Response to Portion of NRC Request for

Additional Information Letter No. 158

Related to ESBWR Design Certification Application

Auxiliary Systems

RAI Number 9.1-49

***Verified DCD changes associated with this RAI response are identified in the enclosed DCD markups by enclosing the text within a black box. The marked-up pages may contain unverified changes in addition to the verified changes resulting from this RAI response. Other changes shown in the markup(s) may not be fully developed and approved for inclusion in DCD Revision 5.**

NRC RAI 9.1-49

The responses to RAI 9.1-44 and RAI 9.1-9 S02 reference GEH's Spent Fuel Pool (SFP) Boil-Off Analysis (0000-0038-9392 R3) and Buffer Pool Boil-off & Make Up Capacity analysis (0000-0076-3483) respectively. The staff found the responses to RAI 9.1-44 and 9.1-9S02 acceptable. However, during an audit performed on January 30, 2008, the staff reviewed the applicant's SFP boil-off analysis, and determined that some of the information presented in the analysis should be included in the DCD. Revise DCD Tier 2 and Tier 1 to include the following:

1) The normal water level of the SFP and the reactor buffer pool

2) The water level above the top of active fuel in both pools 72 hours following a loss of forced cooling without makeup

3) A detailed drawing of the spent fuel pool and the buffer pool including critical dimensions

GEH Response

1) The normal water levels of the SFP and the buffer pool will be added to Tier 1 and Tier 2.

2) The requirement is that the water levels remain above the top of the active fuel (TAF). Accordingly, DCD Tier 2 will be revised to list the normal water levels and minimum free volumes above TAF for the SFP and buffer pool to ensure water is available for at least 72 hours of boil-off. DCD Tier 1 will be revised to add an ITAAC to verify by as-build inspections/measurements the pool water levels and free volumes above TAF.

3) Detailed drawings of the SFP and buffer pool are beyond the level of detail of the DCD and will not be added.

DCD Impact

DCD Tier 1, Subsection 2.6.2 and Table 2.6.2-2 will be revised in Revision 5 as noted in the attached markup.

DCD Tier 2, Subsection 9.1.3 will be revised in Revision 5 as noted in the attached markup.

2.6.2 Fuel And Auxiliary Pools Cooling System

Design Description

The Fuel and Auxiliary Pools Cooling System (FAPCS) provides cooling and cleaning of pools located in the containment, reactor building and fuel building, during normal plant operation. The FAPCS provides flow paths for filling and makeup of these pools during normal plant operation and under post-accident condition. The FAPCS provides suppression pool cooling and LPCI as active backup of the passive containment heat removal systems.

The FAPCS is as shown in Figure 2.6.2-1.

(1) The functional arrangement of the FAPCS is as described in the Design Description of this Subsection 2.6.2 and as shown in Figure 2.6.2-1.

(2) ASME Code Section III

a. The components ~~and piping~~ identified in Table 2.6.2-1 as ASME Code Section III are designed, fabricated, installed, and inspected ~~and constructed~~ in accordance with ASME Code Section III requirements.

b. The piping identified in Table 2.6.2-1 as ASME Code Section III are designed, fabricated, installed, and inspected in accordance with ASME Code Section III requirements.

(3) Pressure Boundary Integrity

a. Pressure boundary welds in components ~~and piping~~ identified in Table 2.6.2-1 as ASME Code Section III meet ASME Code Section III requirements.

b. Pressure boundary welds in piping identified in Table 2.6.2-1 as ASME Code Section III meet ASME Code Section III requirements.

(4) The components and piping identified in Table 2.6.2-1 as ASME Code Section III retain their pressure boundary integrity ~~under internal pressure that will be experienced during service~~at their design pressure.

(5) The Seismic Category I equipment and piping identified in Table 2.6.2-1 can withstand seismic design basis load without loss of structural integrity and safety function.

(6) The containment isolation portions of the FAPCS are addressed in Tier 1, Subsection 2.15.1.

(7) The FAPCS performs the following nonsafety-related functions:

a. Suppression pool cooling mode

b. Low-pressure coolant injection mode.

c. External connection for emergency water to IC/PCC pool and Spent Fuel Pool.

(8) FAPCS minimum inventory of alarms, displays, and status indications in the main control room (MCR) are addressed in Section 3.3.

(9) Level instruments with adequate operating ranges are provided for the Spent Fuel Pool and IC/PCC pools.

(10) Equipment qualification for the FAPCS is addressed in Tier 1 Section 3.8.

(11) Following a loss of active cooling without makeup that persists for 72 hours, the water level in the Spent Fuel Pool remains above the top of active fuel.

(12) Following a loss of active cooling without makeup that persists for 72 hours, the water level in the Buffer Pool remains above the top of active fuel.

Inspections, Tests, Analyses and Acceptance Criteria

Table 2.6.2-2 provides a definition of the inspections, tests and/or analyses, together with associated acceptance criteria for the FAPCS.

Table 2.6.2-2

ITAAC For The Fuel and Auxiliary Pools Cooling Cleanup System

Design Commitment	Inspections, Tests, Analyses	Acceptance Criteria
11. Following a loss of active cooling without makeup that persists for 72 hours, the water level in the Spent Fuel Pool remains above the top of active fuel.	Inspection of the Spent Fuel Pool as-built dimensions will be performed to determine the elevation of the pool weir relative to the bottom of the pool and the free volume between the top of the active fuel and the weir elevation.	A report or analysis exists and concludes that the elevation of the Spent Fuel Pool weir relative to the bottom of the pool is at least 14.35 m and that there is at least 1690 m^3 of free volume above the top of the active fuel that can be filled with water.
12. Following a loss of active cooling without makeup that persists for 72 hours, the water level in the Buffer Pool remains above the top of active fuel.	Inspection of the Buffer Pool as-built dimensions will be performed to determine the elevation of the pool weir relative to the bottom of the pool and the free volume between the top of the active fuel and the weir elevation.	A report or analysis exists and concludes that the elevation of the Buffer Pool weir relative to the bottom of the pool is at least 6.7 m and that there is at least 288 m^3 of free volume above the top of the active fuel that can be filled with water.

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 following safety-related items:

- Containment isolation valves,
- 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 (IC/PCC) 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/PCC 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 are 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).

During a loss of the FAPCS cooling trains, ~~the~~ cooling ~~to~~ of the Spent Fuel Pool, buffer pool and IC/PCC pools is accomplished by allowing the water to heat and boil. The Spent Fuel Pool has a normal water level of at least 14.35 m and a free volume above the top of active fuel (TAF) of at least 1690 m^3. The buffer pool has a normal water level of at least 6.7 m and a free volume above TAF of at least 288 m^2. For both pools, the water levels and free volumes are sufficient to ensure that following a loss of active cooling without makeup that persists for 72 hours, the water levels in the pools remain above TAF. ~~Sufficient pool capacity exists for pool boiling to continue for at least~~ After 72 hours ~~post accident, at which point~~ post accident makeup water can be provided through safety-related connections to the Fire Protection System (FPS) or another onsite or offsite water source.

All operating modes (refer to Table 9.1-2) are manually initiated and controlled from the Main Control Room (MCR), except the SPC mode, which is initiated either manually, or automatically on high suppression pool water temperature signal. Instruments are provided for indication of operating conditions to aid the operator during the initiation and control of system operation. Provisions are provided to prevent inadvertent draining of the pools during FAPCS operation by including anti-siphon holes on all FAPCS piping that is normally submerged.

The FAPCS is designed to provide for the collection, monitoring, and drainage of pool liner leaks from the spent fuel pools, auxiliary pools, and IC/PCC pools (refer to Table 9.1-1) to the Liquid Waste Management System.

Containment isolation valves are provided on the lines that penetrate the primary containment and are powered from independent safety-related sources. Pneumatic-operated valves with containment isolation function are designed to fail in the position of greatest safety upon loss of its electric power or air supply. All containment isolation valves fail to the closed position with the exception of isolation valves needed for the functions of SPC which fail as-is.

With the exception of valves needed to perform accident recovery functions described above, the containment isolation valves are automatically closed upon receipt of a containment isolation signal from the Leakage Detection and Isolation System (LD&IS), with the exception of the containment isolation valves needed for post-accident recovery modes, which do not receive an isolation signal.

The FAPCS is a nonsafety-related system with the exception of piping and components required for:

- Containment isolation;
- Refilling of the IC/PCC pools and the Spent Fuel Pool with post-accident water supplies from the Fire Protection System or another onsite or offsite source.
- The high-pressure interface with the Reactor Water Cleanup/Shutdown Cooling system used for low pressure coolant injection.

The piping and components needed for the following functions are classified as RTNSS:

- Suppression pool cooling
- Low pressure coolant injection

The FAPCS piping and components that are required to support safety-related and/or accident recovery function have Quality Group B or C and Seismic I classification (Table 9.1-3). A Seismic I classification is required for all safety-related functions listed above. A Seismic II classification is sufficient for the remaining nonsafety-related piping and components that support accident recovery functions. This classification satisfies the requirements of SRP 9.1.3 Section I.1.