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Subject: Response to Portion of NRC Request for Additional Information Letter No. 101 - Containment Systems - RAI Number 6.2-173

Enclosure 1 contains the GE Hitachi Nuclear Energy (GEH) response to the subject NRC RAI transmitted via the Reference 1 letter.

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

Sincerely,

Kathy Sedney for

James C. Kinsey
Vice President, ESBWR Licensing

D068
NRO

Reference:

1. MFN 07-357, Letter from U.S. Nuclear Regulatory Commission to Robert Brown, *Request for Additional Information Letter No. 101 Related to ESBWR Design Certification Application*, June 21, 2007

Enclosure:

1. MFN 07-539 - Response to Portion of NRC Request for Additional Information Letter No. 101 - Related to ESBWR Design Certification Application - Containment Systems - RAI Number 6.2-173

cc:

AE Cubbage	USNRC (with enclosures)
GB Stramback	GEH/San Jose (with enclosures)
RE Brown	GEH/Wilmington (with enclosures)
eDRF	0000-0073-5385

Enclosure 1

MFN 07-539

Response to Portion of NRC Request for

Additional Information Letter No. 101

Related to ESBWR Design Certification Application

Containment Systems

RAI Number 6.2-173

NRC RAI 6.2-173:

ESBWR relies on the Passive Containment Cooling System for providing water to the Gravity Driven Cooling System for core cooling and for providing containment heat removal for 72 hours after a loss of coolant accident. Beyond 72 hours, ESBWR relies also on the Fuel and Auxiliary Pools Cooling System. DCD Tier 2 Revision 3, Table 19A-2 identifies that Fuel and Auxiliary Pools Cooling System operating in suppression pool cooling and low pressure coolant injection modes is a Regulatory Treatment of Non-Safety Systems function.

However, DCD Tier 2 Revision 3, Table 1C-2 states that NRC Bulletin 95-02, "Unexpected Clogging of a Residual Heat Removal (RHR) Pump Strainer While Operating in Suppression Pool Cooling Mode," is not applicable to ESBWR because it does not have a safety-related suppression pool cooling system. The same table states that the following NRC Bulletins do not apply to ESBWR because it provides emergency core cooling by GDCS and that the GDCS pools do not have the debris transport mechanisms that the Suppression Pool is subject to:

- *93-02, "Debris Plugging of Emergency Core Cooling Suction Strainers"*
- *93-02 Supplement 1, "Debris Plugging of Emergency Core Cooling Suction Strainers"*
- *96-03, "Potential Plugging of Emergency Core Cooling Suction Strainers by Debris in Boiling-Water Reactors"*
- *98-04, "Potential for Degradation of the Emergency Core Cooling System and the Containment Spray System After a Loss-of-Coolant Accident Because of Construction and Protective Coating Deficiencies and Foreign Material in Containment."*

Please explain why debris plugging issues described in the above bulletins should not be applied to the debris plugging of the suppression pool suction strainer for operation of the Fuel and Auxiliary Pools Cooling System to ensure proper operation beyond 72 hours after a loss-of-coolant accident.

GEH Response:

Because the functions of Suppression Pool Cooling and Low Pressure Coolant Injection are now classified as a Regulatory Treatment of Non-Safety Systems (RTNSS) function, DCD Tier 2, Appendix 1C will be revised to indicate that these bulletins and generic letters are applicable to the Fuel and Auxiliary Pools Cooling System (FAPCS) suppression pool suction strainer. In addition, DCD Tier 2, Subsection 9.1.3.2, will be revised to require that the design of the suppression pool suction strainer consider the operating experience addressed by these bulletins and generic letters.

DCD Impact:

DCD Tier 2, Tables 1C-1 and 1C-2, and Subsection 9.1.3.2, will be revised as shown in the attached markup.

Table 1C-1

Operating Experience Review Results Summary – Generic Letters

No.	Issue Date	Title	Evaluation Result or Topic's Tier 2 Location(s)
96-06	9/30/96	Assurance of Equipment Operability And Containment Integrity During Design-Basis Accident Conditions	PCCS provides containment air cooling during design basis accidents as described in Subsections 6.2.1 and 6.2.2, and is not subject to water hammer effects. The Chilled Water System provides cooling water to the Drywell Cooling System during normal operation, and is isolated on a LOCA signal as discussed in Subsections 9.2.7.5 and 6.2.4.3.2.1. Fluid-filled piping associated with containment penetrations that automatically isolate during DBAs is designed in accordance with ASME Code Section III to accommodate thermal transient loadings as described in Subsection 3.9.3.4 and Table 3.9-2.
96-06s1	11/13/97	NRC Generic Letter 96-06, Supplement 1: Assurance of Equipment Operability and Containment Integrity During Design-Basis Accident Conditions	Subsections 6.2.1, 6.2.2 and 6.2.4.3.2.1 and 9.2.7.5.
97-04	10/7/97	NRC Generic Letter 97-04: Assurance of Sufficient Net Positive Suction Head for Emergency Core Cooling and Containment Heat Removal Pumps	Not applicable, the ESBWR does not use pumps for ECCS or safety-related containment cooling functions.
98-01	5/11/98	NRC Generic Letter No. 98-01: Year 2000 Readiness of Computer Systems at Nuclear Power Plants	Outdated concern
98-01s1	1/14/99	NRC Generic Letter No. 98-01 Supplement 1: Year 2000 Readiness of Computer Systems at Nuclear Power Plants	Outdated concern
98-04	7/14/98	Potential for Degradation of the Emergency Core Cooling System and the Containment Spray System After a Loss-of-Coolant Accident Because of Construction and Protective Coating Deficiencies and Foreign Material in Containment	~~Not applicable to the ESBWR GDCS~~Applicable only to the suppression pool as described in Subsection 9.1.3. The GDCS pools do not have the debris transport mechanisms that the Suppression Pool is subject to. The PCCS pools are not subject to LOCA debris. There is no safety-related containment spray.
99-02	6/3/99	NRC Generic Letter 99-02: Laboratory Testing of Nuclear-Grade Activated Charcoal	Chapter 16, Section 5.5.13.c

Table 1C-2

Operating Experience Review Results Summary – IE Bulletins

No.	Issue Date	Title	Evaluation Result or Topic's Tier 2 Location(s)
93-02	5/11/93	Debris Plugging of Emergency Core Cooling Suction Strainers	~~Not applicable to the ESBWR GDCS~~Applicable only to the suppression pool as described in Subsection 9.1.3. The GDCS pools do not have the debris transport mechanisms that the Suppression Pool is subject to.
93-02s1	2/18/94	Debris Plugging of Emergency Core Cooling Suction Strainers	Applicable only to the suppression pool as described in Subsection 9.1.3~~Not applicable to the ESBWR GDCS~~. See above.
93-03	5/28/93	Resolution of Issues Related to Reactor Vessel Water Level Instrumentation in BWRs	The ESBWR includes a continuous purge of water to the reference leg to prevent the buildup of non-condensable gases. The CRD Hydraulics provides this flow. Subsections 4.6.1.2.6 and 7.7.1.2
94-01	4/14/94	Potential Fuel Pool Draindown Caused by Inadequate Maintenance Practices at Dresden Unit 1	The FAPCS is designed to prevent the possibility of draining water from the Spent Fuel Storage Pool. Subsection 9.1.3
95-02	10/17/95	Unexpected Clogging of a Residual Heat Removal Pump Strainer While Operating in Suppression Pool Cooling Mode	Applicable only to the suppression pool as described in Subsection 9.1.3~~Not Applicable. The ESBWR does not have a safety-related suppression pool cooling system~~.
96-02	4/11/96	Movement of Heavy Loads Over Spent Fuel, Over Fuel in the Reactor Core, or Over Safety-Related Equipment	Subsection 9.1.5
96-03	5/6/96	Potential Plugging of Emergency Core Cooling Suction Strainers by Debris in Boiling-Water Reactors	Applicable only to the suppression pool as described in Subsection 9.1.3~~Not applicable to the ESBWR GDCS~~. See response to IE Bulletin 93-02
96-04	7/5/96	Chemical, Galvanic, or Other Reactions in Spent Fuel Storage and Transportation Casks	Related to dry cask storage, which is not part of the ESBWR Standard Plant design.

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 the Spent Fuel Pool and IC/PCC pools is accomplished by allowing the water to heat and boil. Sufficient pool capacity exists for pool boiling to continue for at least 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.

Detailed System Description

The FAPCS is provided with two cooling and cleanup (C/C) trains with 100% capacity during normal operation. Each FAPCS train is physically separated and has one pump, one heat exchanger and one water treatment unit consisting of a prefilter and a demineralizer.

A manifold of four motor operated valves is attached to each end of the FAPCS C/C trains [refer to Figure 9.1-1]. These manifolds are used to connect the FAPCS C/C train with one of the two pairs of suction and discharge piping loops to establish the desired flow path during FAPCS operation. One loop is used for the fuel pools and auxiliary pools, and the other loop for the GDCS pools and suppression pool and for injecting water to drywell spray sparger and reactor vessel via the RWCU/SDC System and feedwater pipes.

The use of manifolds with proper valve alignment and separate suction-discharge piping loops 1) allows operating of one train independent of the other train to permit on-line maintenance or dual mode operation using separate trains if necessary, 2) prevents inadvertent draining of the pool and minimizes mixing of contaminated water in the Spent Fuel Pool with cleaner water in other pools.

Each water treatment unit is equipped with a prefilter, a demineralizer and a post strainer. A bypass line is provided to permit bypass of the water treatment unit, when necessary. To protect demineralizer resin, the water treatment units are bypassed automatically on a high temperature signal. The prefilter and demineralizers of the water treatment units are located in shielding cells so that radiation exposure of plant personnel is within acceptable limits.

Proper physical separation is provided between the active components of the two redundant trains to assure operation of one train in the event of failure of the other train.

A reactor makeup water discharge line is provided for injecting suppression pool water or water from the Fire Protection System to the reactor vessel via Reactor Water Cleanup/Shutdown Cooling System (/SDC) Loop B and Feedwater Loop A discharge pipes. The suction location in the suppression pool shall be designed with consideration given to the strainer plugging issues encountered in previous operating experience. This injection line includes redundant shutoff