GE Hitachi Nuclear Energy

Richard E. Kingston
Vice President, ESBWR Licensing

PO Box 780 M/C A-65
Wilmington, NC 28402-0780
USA

T 910 819 6192
F 910 362 6192
rick.kingston@ge.com

MFN 10-049, Revision 1

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Subject: **Revised Response to NRC Request for Additional Information Letter No. 408 Related to ESBWR Design Certification Application - Fuel and Auxiliary Pool Cooling System - RAI Number 9.1-151**

The letter submits the GE Hitachi Nuclear Energy (GEH) revised response to the U.S. Nuclear Regulatory Commission (NRC) Request for Additional Information (RAI) 9.1-151 sent by NRC Letter No. 408, Reference 1.

The GEH revised response to RAI Number 9.1-151 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

Reference:

1. MFN 10-047, Letter from the U.S. Nuclear Regulatory Commission to Jerald G. Head, Request for Additional Information Letter No. 408, Related To ESBWR Design Certification Application, dated January 27, 2010

Enclosures:

1. Revised Response to NRC Request for Additional Information Letter No. 408 Related to ESBWR Design Certification Application - Fuel and Auxiliary Pool Cooling System - RAI Number 9.1-151

2. Revised Response to NRC Request for Additional Information Letter No. 408 Related to ESBWR Design Certification Application - Fuel and Auxiliary Pool Cooling System - RAI Number 9.1-151 – 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	0000-0113-0507 R1

Enclosure 1

MFN 10-049, Revision 1

Revised Response to NRC Request for Additional Information Letter No. 408 Related to ESBWR Design Certification Application

Fuel and Auxiliary Pool Cooling System

RAI Number 9.1-151

NRC RAI 9.1-151

On November 3, 2009, the staff issued draft ISG-019 "Gas Accumulation Issues in Safety Related Systems" for public comment. GL 2008-01 provides additional background information.

Gas accumulation in safety related nuclear power plant systems has been known to cause water hammer, gas binding in pumps, and inadvertent relief valve actuation that may damage pumps, valves, piping, and supports and may lead to loss of system operability.

Address this operating experience in the DCD for the FAPCS system which is categorized as a RTNSS system.

GEH Revised Response

Most of the events described in GL 2008-01 are the result of inadequate venting or backleakage from high pressure systems (HPCI and Core Spray, recirculation piping, ECCS suction, etc.).

Although FAPCS does interface with a high pressure system (RWCU/SDC), this interface is normally isolated and prevented from opening by a high pressure interlock as described in DCD Tier 2, Subsection 9.1.3.2. Additionally, the FAPCS is designed to minimize the risk of gas accumulation that could result from gas buildup following maintenance activities or long periods of non-use. Piping is sloped to minimize the number of locations where gas can accumulate, and high point vents are provided at these points to ensure the system can be purged of any gases that are present. Also, plant operation and maintenance procedures are required to assure that piping and components are vented to avoid water hammer and gas binding in pumps. The FAPCS is not relied upon to perform immediate, automatic, safety-related functions as described in DCD Tier 2, Subsection 19A.8.4.7, therefore adequate time is available for operators to implement these procedures to ensure the system is properly vented. For this reason, there is no need to include additional requirements in Tier 1. Tier 2 of the DCD will be revised to include discussion of this topic.

DCD Impact

DCD Tier 2, Subsections 9.1.3.2 and 13.5.2 will be revised as noted in the attached markup.

Enclosure 2

MFN 10-049, Revision 1

Revised Response to Portion of NRC Request for Additional Information Letter No. 408 Related to ESBWR Design Certification Application

Fuel and Auxiliary Pool Cooling System

RAI Number 9.1-151

DCD Markups

- The fuel storage pools have adequate water shielding for the stored spent fuel. See Subsection 9.1.3 relative to the control of water level in these pools.

RG 1.13 is applicable to spent fuel storage facilities. The RB and FB, which contains the fuel storage facilities, including the storage racks and pool, are designed to protect the fuel from damage caused by:

- Natural events such as earthquake, high winds and flooding; and
- Mechanical damage caused by dropping of fuel assemblies, bundles, or other objects onto stored fuel.

Summary of Radiological Considerations

By adequate design and careful operational procedures, the design bases of the spent fuel storage arrangement are satisfied. Thus, the exposure of plant personnel to radiation is maintained well below regulatory limits and in accordance with As Low As Reasonably Achievable (ALARA) principles. Further details of radiological considerations, including those for the spent fuel storage arrangement, are presented in Chapter 12.

9.1.3 Fuel and Auxiliary Pools Cooling System

9.1.3.1 Design Bases

Safety Design Basis

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,
- Emergency water supply flow paths to the spent fuel pool and Isolation Condenser/Passive Containment Cooling System (IC/PCCS) pools; and
- Gravity Driven Cooling System (GDCS) interconnecting pipes.

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 outages.

9.1.3.2 System Description

System Description Summary

The FAPCS consists of two physically separated cooling and cleanup 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 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 cooling and cleanup train operation during normal plant operation (refer to Figure 9.1-1). The FAPCS includes high point vents and component vents necessary to avoid gas accumulation. Operation and maintenance procedures are used to assure sufficient measures are taken to avoid water hammer and gas binding in pumps per the requirements in Subsection 13.5.2.

The primary design function of FAPCS is to cool and clean pools located in the containment, RB and FB (refer to Table 9.1-1) during normal plant 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 Reactor Pressure Vessel (RPV); and
- Alternate Shutdown Cooling.

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

A crosstie to the Reactor Water Cleanup/Shut Down Cooling (RWCU/SDC) System is provided in the suppression pool suction and discharge headers such that this system may be used as an alternative for post-accident decay heat removal. For details regarding the crosstie, refer to Subsection 5.4.8.

Redundancy and physical separation are provided in accordance with SECY-93-087 for active components in lines dedicated to LPCI and SPC modes.

During normal plant operation, at least one FAPCS cooling and cleanup 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 GDCS pools and suppression pool. If necessary during a refueling outage, both trains may be used to provide maximum 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 cooling and cleanup 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 offload plus irradiated fuel in the Spent Fuel Pool resulting from 20 years of plant operations, both FAPCS cooling and cleanup trains are needed to maintain the bulk temperature below 60°C (140°F).

During a loss of the FAPCS cooling trains, cooling of the Spent Fuel Pool, buffer pool and IC/PCCS pools is accomplished by allowing the water to heat and boil. The Reactor Building (RB) and Fuel Building (FB) are equipped with normally closed pressure relief devices that open passively to relieve excessive positive pressure generated by steam buildup during pool boiling. The pressure set point is equivalent to the full tornado pressure drop described in Section 3.3.2.2.

13.5 PLANT PROCEDURES

Plant procedures are developed to provide control for activities that are important for safe operation of the facility. The applicable portions of Regulatory Guide 1.33 Rev. 2 (Reference 13.5-5) concerning plant procedures shall be followed.

13.5.1 Administrative Procedures

An Administrative Procedures Plan shall be generated and describe administrative procedures that provide administrative control over activities that are important to safety for operation of the facility. These procedures include those which provide the administrative controls with respect to procedures, and those which define and provide controls for operational activities of the plant staff.

The COL Applicant will develop the Administrative Procedures (COL 13.5-1-A).

13.5.2 Operating and Maintenance Procedures

The development of Operating Procedures is generally described in Section 18.9 (Procedure Development).

A Plant Operating Procedures Development Plan shall be generated and have the following attributes:

- That the scope encompassed by the procedures development process includes those operating procedures defined in Subsection 13.5.2, which direct operator actions during normal, abnormal and emergency operations. The procedure development process will also include consideration of plant operations during periods when plant systems/equipment are undergoing test, maintenance or inspection.
- The procedure development process will address methods and criteria for the development, verification and validation, implementation, maintenance and revision of procedures. The methods and criteria shall be in accordance with TMI I.C.1, NUREG-0737 (Reference 13.5-3).

The development of Operating and Maintenance Procedures is the responsibility of the COL Applicant (COL 13.5-2-A).

Implementation of the Plant Operating Procedures Development Plan shall establish:

- Procedures that are consistent with the requirements of 10 CFR Part 50 and the TMI requirements described in NUREG-0737 (Reference 13.5-3) and Supplement 1 to NUREG-0737 (Reference 13.5-7).
- Requirements that the procedures developed shall include, as necessary, the elements described in American National Standards Institute (ANSI)/American Nuclear Society (ANS)-3.2-1994; R1999 (Reference 13.5-2). Elements of ANSI/ANS-3.2-1994; R1999 addressing water hammer and gas binding shall be applied in the development of procedures for RTNSS systems.
- That the operator basis for plant operating procedures shall use actions identified in the operational task analysis and Probabilistic Risk Assessment (PRA) efforts in support of the Standardized Design certification, Standardized Plant Design Emergency Procedure