HITACHI

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

Docket No. 52-010

February 3, 2010

U.S. Nuclear Regulatory Commission
Document Control Desk
Washington, D.C. 20555-0001

Subject: **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**

Enclosure 1 contains the GE Hitachi Nuclear Energy (GEH) response to the U.S. Nuclear Regulatory Commission (NRC) Request for Additional Information (RAI) 9.1-151 (Reference 1).

ESBWR Design Control Document (DCD) markups are provided in Enclosure 2.

If you have any questions about the information provided, 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. 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. 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)
J G Head	GEH/Wilmington (with enclosures)
DH Hinds	GEH/Wilmington (with enclosures)
LF Dougherty	GEH/Wilmington (with enclosures)
eDRF Section	0000-0113-0507

Enclosure 1

MFN 10-049

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

DRAFT Text:

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 Response

Most of the events described in GL 2008-01 are the accumulation of radiolytically generated noncondensable gases in high pressure lines that interface with the reactor (HPCI and Core Spray, recirculation piping, ECCS suction, etc.).

As a low-pressure system that does not handle reactor coolant, the FAPCS is not subject to the accumulation of any amount of noncondensable gases coming from the reactor.

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. Additionally, 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 DCD will be revised to include language describing this design feature.

DCD Impact

DCD Tier 2, Section 9.1.3.2 will be revised as noted in the attached markup.

Enclosure 2

MFN 10-049

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

- 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; andGravity 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.

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 Spent Fuel Pool is maintained at a water level of at least 14.35 m (47 ft) and a free volume above the TAF of at least 1690 m^3 (59700 ft^3). The buffer pool is maintained at a water level of at least 6.7 m (22.0 ft) and a free volume above TAF of at least 288 m^3 (10169 ft^3). For both pools, the water levels