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Subject: **Response to Portion of NRC Request for Additional Information Letter No. 124 Related to ESBWR Design Certification Application – Auxiliary Systems - RAI Number 9.2-21**

Enclosure 1 contains GEH's response to the subject RAI transmitted via Reference 1.

Should you have any questions about the information provided here, please contact me.

Sincerely,

James C. Kinsey
Vice President, ESBWR Licensing

D068
NRO

Reference:

1. MFN 08-029, Letter from U.S. Nuclear Regulatory Commission to Robert E. Brown, *Request for Additional Information Letter No. 124 Related to the ESBWR Design Certification Application,* January 14, 2008.

Enclosure:

1. Response to Portion of NRC Request for Additional Information Letter No. 124 Related to ESBWR Design Certification Application – Auxiliary Systems - RAI Number 9.2-21.

cc:

AE Cubbage	USNRC (with enclosure)
RE Brown	GEH/Wilmington (with enclosure)
DH Hinds	GEH/Wilmington (with enclosure)
GB Stramback	GEH/San Jose (with enclosure)
eDRF	0000-0076-0916

Enclosure 1

MFN 08-179

Response to Portion of NRC Request for

Additional Information Letter No. 124

Related to ESBWR Design Certification Application

Auxiliary Systems

RAI Number 9.2-21

NRC RAI 9.2-21

In Revision 4, DCD, Tier 2, it was determined that portions of the HVAC systems perform RTNSS function. The chilled water system provides cooling for the HVAC systems. The RTNSS function is an important safety function. Discuss the compliance of GDC 4, 44, 45, and 46 in Section 9.2.7.

GEH Response

In regard to GDC 4, the Chilled Water System (CWS) is designed to mitigate the possibility of water hammer as addressed in GEH's responses to RAIs 9.2-15 and 9.2-15 Supplement 01 (MFN 07-591 dated November 8, 2007 and MFN 08-178 dated March 8, 2008). In addition, CWS meets the intent of GDC 4. The CWS is designed in accordance with applicable environmental conditions associated with normal operation, maintenance, and testing. Furthermore, it is designed to be appropriately resistant to dynamic effects, including the effects of missiles, jet impingement, pipe whipping, and discharging fluids, that may result from equipment failures and from events and conditions outside the nuclear power unit. Design considerations include pipe routing, material selection, pipe size, pipe schedule, protective barriers, and supports and restraints.

Compliance with GDC 44 requires that a system be provided to transfer heat from safety-related SSCs to an Ultimate Heat Sink (UHS), and that the system must be capable of operating under normal and accident conditions assuming a single failure and a loss of offsite power. The ESBWR CWS provides cooling during normal conditions and is not required to perform safety functions to mitigate design basis accidents. CWS is non-safety related; however, within ESBWR, the Nuclear Island Chilled Water Subsystem (NICWS) of CWS is designed to perform accident recovery functions. The NICWS provides cooling to Nuclear Island (NI) HVAC loads and cooling support for the Fuel and Auxiliary Pool Cooling System (FAPCS) 72 hours after postulated accidents.

The CWS is designed to be a robust and reliable system to maintain plant reliability for power operation by incorporating redundant chilled water trains for Regulatory Treatment of Non-Safety System (RTNSS) loads, parallel arrangement of major equipment, and sub-system cross-connects. The CWS is designed to transfer heat to the RCCWS for NI RTNSS loads under normal conditions assuming a single failure and a loss of offsite power. Furthermore, in order to perform accident recovery functions, the NICWS is designed to withstand the post-accident environment (not in the scope of 10 CFR 50.49 or 10 CFR 50, App B) and function following a seismic event (not a Seismic I or II system). NICWS falls under the Regulatory Treatment of Non-Safety Systems (RTNSS) to provide cooling post 72-hour and post-seismic event. This system meets the RTNSS requirements specified in DCD Appendix 19A.

Although NICWS is a nonsafety-related system, it meets the intent of the requirements of GDC 44 by providing a chilled water system capable of rejecting heat to the RCCWS and ultimately to a plant heat sink under all normal conditions and part of accident recovery. These functions can be performed assuming a single failure concurrent with a loss of offsite power using nonsafety-related diesel power and the ability to isolate components automatically or manually by use of redundant active components and cross-connected piping. Additionally, the NICWS is designed to withstand post-accident environments and remain functional after an SSE.

Compliance with GDC 45 requires that the CWS be designed to permit appropriate periodic inspection of important components (e.g., heat exchangers and piping) to ensure integrity and capability of the system. The CWS is designed for periodic inspection of components to ensure the capability and integrity of the system per DCD Subsection 9.2.7.4. This is accomplished by providing adequate space for component dismantling and inspection as required, local displays to indicate all vital parameters, and sampling locations for chilled water chemical analysis as required. Therefore, although the CWS is a nonsafety-related system, it meets the intent of the requirements of GDC 45.

Compliance with GDC 46 requires that the CWS be designed to permit appropriate periodic pressure and functional testing to ensure the leak-tight integrity and operability of components, as well as the operability of the system as a whole, at conditions as close to the design basis as practical. As stated in DCD Tier 2, Revision 4, Subsection 9.2.7.4, the CWS contains provisions for inspection of major equipment as well as indicators for vital parameters required for testing and inspection. Also, the CWS design provides surge tank level instrumentation to assist in leakage detection from the system (DCD Subsection 9.2.7.5). Therefore, although the CWS is a nonsafety-related system, it meets the intent of the requirements of GDC 46.

DCD Impact

DCD Tier #2, Subsection 9.2.7.1, will include the attached markup pages in Revision 5.

Subsection 9.2.7.1 will also be modified to address GDC 5 (which is not applicable to CWS) to be consistent with Subsection 9.2.1.1, for the Plant Service Water System (PSWS), and Subsection 9.2.2.1 for the Reactor Component Cooling Water System (RCCWS).

In addition, Subsections 9.2.1.1 and 9.2.2.1 will be modified to be consistent with the proposed modification for Subsection 9.2.7.1, in regard to compliance with GDCs 44, 45, and 46 as indicated in the attached markups for those Subsections.

9.2.1 Plant Service Water System

9.2.1.1 Design Bases

Safety (10 CFR 50.2) Design Bases

The Plant Service Water System (PSWS) does not perform any safety-related function. There is no interface with any safety-related component.

The PSWS has Regulatory Treatment of Non-Safety Systems (RTNSS) functions to provide post 72-hour cooling. Performance of RTNSS functions is assured by applying requirements for redundant trains, physical and electrical separation of trains, seismic requirements, ~~and~~ the ability to withstand category 5 hurricane wind and missiles, and flood protection. Appendix 19A provides the level of oversight and additional requirements to meet the RTNSS functions.

The PSWS meets the requirements of GDC 2 as it pertains to Position C.2 of Regulatory Guide 1.29. The PSWS also meets the intent of GDC 2 as it pertains to Position C.1 of Regulatory Guide 1.29.

~~The PSWS meets GDC 4 with respect to dynamic effects associated with water hammer. The PSWS is vented at components and high points vents and operation and maintenance procedures are used to assure sufficient measures are taken to avoid water hammer.~~

The PSWS meets the intent of the acceptance criteria of GDC 4 for normal operation, maintenance, and testing. The PSWS meets the intent of the acceptance criteria of GDC 4 with respect to dynamic effects associated with water hammer. The PSWS is vented at components and high points vents and operation and maintenance procedures are used to assure sufficient measures are taken to avoid water hammer. The PSWS also meets the intent of the acceptance criteria of GDC 4 for other dynamic effects, including the effects of missiles, jet impingement, pipe whipping, and discharging fluids, as clarified by the following design considerations:

- Pipe routing;
- Piping design considerations, such as material selection, pipe size and schedule;
- Protective barriers as necessary; and
- Appropriate supports and restraints.

The PSWS meets GDC 5 for shared systems and components important to safety. The PSWS Standard Plant design does not share any SSC with any other unit.

Although the PSWS is a nonsafety-related system, it meets the intent of certain acceptance criteria of GDCs 44, 45 and 46, as clarified by the following design considerations:

~~The ESBWR PSWS meets the acceptance criteria of GDC's 44, 45, and 46 by providing the following design considerations:~~

- Capab~~l~~eility of transferring heat loads from SSC's to a heat sink under normal and accident conditions;

- Component redundancy so the system remains functional assuming a single active failure coincident with a loss of offsite power;
- Capability to isolate components or piping so system function is not compromised; and
- Design provisions to permit inspection and operational testing of components and equipment.

9.2.2 Reactor Component Cooling Water System

9.2.2.1 Design Bases

Safety (10 CFR 50.2) Design Bases

The Reactor Component Cooling Water System (RCCWS) does not perform any safety-related function. Therefore, the RCCWS has no safety design basis.

The RCCWS has Regulatory Treatment of Non-Safety Systems (RTNSS) functions to provide post 72-hour cooling to the nuclear island chillers and diesel generators. Performance of RTNSS functions is assured by applying requirements for redundant trains, physical and electrical separation of trains, seismic requirements, ~~and~~ the ability to withstand Category 5 hurricane wind and missiles, and flood protection. Appendix 19A provides the level of oversight and additional requirements to meet the RTNSS functions.

The RCCWS meets the requirements of GDC 2 as it pertains to Position C.2 of Reg. Guide 1.29. The RCCWS also meets the intent of GDC 2 as it pertains to Position C.1 of Reg. Guide 1.29.

~~The RCCWS meets GDC 4 with respect to dynamic effects associated with water hammer. The RCCWS has high point vents and operation and maintenance procedures assure sufficient measures are taken to avoid water hammer.~~

The RCCWS meets the intent of the acceptance criteria of GDC 4 for normal operation, maintenance, and testing. The RCCWS meets the intent of the acceptance criteria of GDC 4 with respect to dynamic effects associated with water hammer. The RCCWS has high point vents and operation and maintenance procedures assure sufficient measures are taken to avoid water hammer. The RCCWS also meets the intent of the acceptance criteria of GDC 4 for other dynamic effects, including the effects of missiles, jet impingement, pipe whipping, and discharging fluids, as clarified by the following design considerations:

- Pipe routing;
- Piping design considerations, such as material selection, pipe size and schedule;
- Protective barriers as necessary; and
- Appropriate supports and restraints.

The RCCWS meets GDC 5 for shared systems and components important to safety. The RCCWS design does not share any SSC with any other unit.

Although the RCCWS is a nonsafety-related system, it meets the intent of certain acceptance criteria of GDCs 44, 45 and 46, as clarified by the following design considerations: ~~The ESBWR RCCWS meets the acceptance criteria of GDC's 44, 45, and 46 by providing the following design considerations:~~

- Capability~~le~~ of transferring heat loads from SSC's to a heat sink under normal and accident conditions;

- Component redundancy so the system remains functional assuming a single active failure coincident with a loss of offsite power;
- Capability to isolate components or piping so system function is not compromised; and
- Design provisions to permit inspection and operational testing of components and equipment.

9.2.7 Chilled Water System

The Chilled Water System (CWS) consists of the Nuclear Island Chilled Water Subsystem (NICWS) and the Balance of Plant Chilled Water Subsystem (BOPCWS).

9.2.7.1 Design Bases

Safety (10 CFR 50.2) Design Bases

The Chilled Water System (CWS) does not perform or ensure any safety-related function, and thus, has no safety design basis, except for the containment isolation valves.

The NICWS has Regulatory Treatment of Non-Safety Systems (RTNSS) functions to provide post 72-hour cooling to nuclear island HVAC loads and cooling support for FAPCS. Performance of RTNSS functions is assured by applying requirements for redundant trains, physical and electrical separation of trains, seismic requirements, the ability to withstand Category 5 hurricane wind and missiles, and flood protection. Appendix 19A provides the level of oversight and additional requirements to meet the RTNSS functions.

The CWS meets GDC 2, by compliance with Regulatory Guide (RG) 1.29. The applicable sections of RG 1.29 include Position C.1 for safety-related portions and Position C.2 for nonsafety-related portions. The seismic and quality group classifications are identified in Table 3.2-1.

The CWS meets the intent of the acceptance criteria of GDC 4 for normal operation, maintenance, and testing. The CWS meets the intent of the acceptance criteria of GDC 4 with respect to dynamic effects associated with water hammer. The potential for water hammer is mitigated through the use of various system design and layout features, such as high point vents, valve cycle times, and surge tanks. Additionally, CWS operation and maintenance procedures incorporate necessary steps, such as proper line filling, to avoid water hammer. The CWS also meets the intent of the acceptance criteria of GDC 4 for other dynamic effects, including the effects of missiles, jet impingement, pipe whipping, and discharging fluids, as clarified by the following design considerations:

- Pipe routing;
- Piping design considerations, such as material selection, pipe size and schedule;
- Protective barriers as necessary; and
- Appropriate supports and restraints.

The CWS meets GDC 5 for shared systems and components important to safety. The CWS Standard Plant design does not share any SSC with any other unit.

Although the NICWS is a nonsafety-related system, it meets the intent of certain acceptance criteria of GDCs 44, 45 and 46, as clarified by the following design considerations:

- Capability of transferring heat loads from SSCs to a heat sink, via the Reactor Component Cooling Water System (RCCWS) and Plant Service Water System (PSWS), under normal and accident conditions;
- Component redundancy so the system remains functional assuming a single active failure coincident with a loss of offsite power;
- Capability to isolate components so system function is not compromised; and
- Design provisions to permit inspection and operational testing of components and equipment.