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Subject: **Response to Portion of NRC Request for Additional Information Letter No. 124 Related to ESBWR Design Certification Application - Mechanical Systems and Components - RAI Number 3.9-199**

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) originally transmitted via the Reference 1 letter. The GEH response to RAI Number 3.9-199 is addressed in Enclosure 1.

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

Sincerely,

James C. Kinsey

James C. Kinsey
Vice President, ESBWR Licensing

D068
NRO

Reference:

1. MFN 08-029, Letter from U.S. Nuclear Regulatory Commission to Mr. Robert E. Brown, Senior Vice President, Regulatory Affairs, GE-Hitachi Nuclear Energy Americas, LLC, *Request For Additional Information Letter No. 124 Related To ESBWR Design Certification Application*, dated January 14, 2008.

Enclosure:

1. Response to Portion of NRC Request for Additional Information Letter No. 124 Related to ESBWR Design Certification Application - Mechanical Systems and Components - RAI Number 3.9-199.

cc:	AE Cubbage	USNRC (with enclosure)
	DH Hinds	GEH/Wilmington (with enclosure)
	GB Stramback	GEH/San Jose (with enclosure)
	RE Brown	GEH/Wilmington (with enclosure)
	eDRF	0000-0081-3336 Rev. 0

Enclosure 1

MFN 08-174

Response to Portion of NRC Request for

Additional Information Letter No. 124

Related to ESBWR Design Certification Application

Mechanical Systems and Components

RAI Number 3.9-199

NRC RAI 3.9-199

NRC Summary:
Designation of Tier 2 components*

NRC Full Text:
Consistent with design certification rules for new reactor designs currently specified in 10 CFR Part 52, GEH is requested to discuss its plans to designate "power-operated valves" as Tier 2 components based on past challenges in providing assurance of their design-basis capability as demonstrated by operating experience at nuclear power plants. These power-operated valves would include, for example, motor-operated, pneumatic-operated, hydraulic-operated, and solenoid-operated valves as applicable to the ESBWR.*

GEH Response

10 CFR 52 includes four appendices containing design certification rules for new reactor designs. In Appendices A and B of 10 CFR 52, for the Advanced Boiling Water Reactor (ABWR) and the System 80+ reactor designs, respectively, only motor-operated valves (MOVs) are designated as Tier 2* components. In Appendices C and D, for the AP600 and AP1000 reactor designs, respectively, motor-operated and power-operated valves (POVs) are designated as Tier 2* components. Since the ESBWR is a passive plant, similar to the AP1000, it is reasonable to designate POVs as Tier 2* components.

This RAI refers to "past challenges in providing assurance of [POV] design-basis capability as demonstrated by operating experience at nuclear power plants." These challenges resulted in the initiation of Generic Safety Issue (GSI) 158, "Performance of Safety- Related Power-Operated Valves Under Design Basis Conditions." Subsequently, three generic letters (GLs) were issued by the NRC related to MOVs. Regulatory Issue Summary (RIS) 2000-003, "Resolution of Generic Safety Issue 158: Performance of Safety-Related Power-Operated Valves Under Design Basis Conditions," informed addressees of the closure of GSI 158 on the basis that MOV issues had been resolved through the issuance of the GLs and "current regulations provide adequate requirements to ensure verification of the design-basis capability of POVs."

There are no MOVs with active, safety-related functions in the ESBWR design; therefore, the issues uniquely associated with MOVs (e.g., rate-of-loading) do not need to be addressed in the ESBWR design. The response to RAI 3.9-188 provided in MFN 08-131 dated February 17, 2008, discusses implementation of RIS 2000-003 and states that the functional qualification of AOVs considers key lessons from industry efforts. The response to RAI 3.9-178 and its associated DCD mark-up provided in MFN 08-131 dated February 17, 2008, shows that functional qualification of active POVs includes key lessons learned from industry effort and are performed using ASME QME-1-2007 as guidance.

Based on the discussion above, it is concluded that POVs should be considered Tier 2* components for the ESBWR, and information in the DCD related to functional qualification of valve performance and incorporation of lessons learned from industry efforts should be marked as Tier 2* information.

DCD Impact

DCD Tier 2, Section 3.9.3.5 will be revised in Revision 5 as noted in the attached markup.

Guide (RG) 1.207 and NUREG/CR-6909. For Class 2 and 3 piping, stresses are calculated on an elastic basis and evaluated in accordance with NC/ND-3600 of the Code. In the event that a NB-3600 analysis is performed for Class 2 or 3 pipe, all the analysis requirements for Class 1 pipe as specified in this document and the ASME code is performed. Table 3.9-9 shows the specific load combinations and acceptance criteria for Class 1 piping systems. For the Class 1 piping that experiences the most significant stresses during operating conditions, the thermal loads per Equation 12 of NB-3600 are less than 2.4 S_m, and are more limiting than the dynamic loads that are required to be analyzed per Equation 13 of NB-3600. The piping considered in this category is the RWCU/SDC, feedwater, main steam, and isolation condenser steam piping within the containment. These were evaluated to be limiting based on differential thermal expansion, pipe size, transient thermal conditions and high energy line conditions. If Code Case N-122-2 is used for analysis of a class 1 pipe, the analysis complying with this Case is included in the Design Report for the piping system.

For submerged piping and associated supports, the applicable direct external loads (e.g. hydrodynamic etc.) applied to the submerged components is included in the analysis.

3.9.3.5 Valve Operability Assurance

~~Active mechanical (with or without electrical operation) equipment designed to perform a mechanical motion for its safety-related function is Seismic Category I. Equipment with faulted condition functional requirements includes active pumps and valves in fluid systems such as the Residual Heat Removal (RHR) System, Emergency Core Cooling System (ECCS), and MS system.~~

This subsection discusses operability assurance of active Code valves, including ~~the~~ actuators ~~that is a part of the valve~~ (Subsection 3.9.2.2).

[Valves that perform an active safety-related function are functionally qualified to perform their required functions. ASME OME-1-2007 is used as guidance in performing this qualification. Qualification specifications (e.g., design specifications) are prepared to ensure the operating conditions and safety functions for which the valves are to be qualified are communicated to the manufacturer or qualification facility. Qualification specifications are consistent with Appendices QV-I and QV-A of OME-1.

*Functional qualification addresses key lessons learned from industry efforts, particularly on air- and motor-operated valves, many of which are discussed in Section QV-G of OME-1.]** For example:

- Evaluation of valve performance is based on a combination of testing and analysis, using design similarity to apply test results to specific valve designs.
- Testing to verify proper valve setup and acceptable operating margin is performed using diagnostic equipment to measure stem thrust and/or torque.
- Sliding friction coefficients used to evaluate valve performance (e.g. disk-to-seat friction coefficients for gate valves and bearing coefficients for butterfly valves) account for the effects of temperature, cycle history, load and internal parts.
- Actuator sizing allows margin for aging/degradation, test equipment accuracy and other uncertainties, as appropriate.

- Material combinations that may be susceptible to galling or other damage mechanisms under certain conditions are not used.

Subsection 3.9.2.2 and Section 3.10 provide details on the seismic qualification of valves. Section 3.11 provides details on the environmental qualification of valves.~~Safety-related valves are qualified by testing and analysis and by satisfying the stress and deformation criteria at the critical locations within the valves. Operability is assured by meeting the requirements of the programs defined in Subsection 3.9.2.2, Section 3.10, Section 3.11 and the following subsections.~~

Section 4.4 of GE's Environmental Qualification Program (Reference 3.9-3) applies to this subsection, and the seismic qualification methodology presented therein is applicable to mechanical as well as electrical equipment.

3.9.3.5.1 Major Active Valves

Some of the major safety-related active valves (Tables 6.2-21, 6.2-42 and 3.2-1) discussed in this subsection for illustration are the main steamline isolation valves and safety relief valves, and standby liquid control valves and depressurization valves. These valves are designed to meet the Code requirements and perform their mechanical motion in conjunction with a dynamic (SSE and other RBV) load event. These valves are supported entirely by the piping (i.e., the valve operators are not used as attachment points for piping supports) (Subsection 3.9.3.7). The dynamic qualification for operability is unique for each valve type; therefore, each method of qualification is detailed individually below.

Main Steamline Isolation Valves (MSIVs)

The typical Y-pattern MSIVs described in Subsection 5.4.5.2 are evaluated by analysis and test for capability to operate under the design loads that envelop the predicted loads during a design basis accident and safe shutdown earthquake.

The valve body is designed, analyzed and tested in accordance with the Code, Class 1 requirements. The MSIVs are modeled mathematically in the main steamline system analysis. The loads, amplified accelerations and resonance frequencies of the valves are determined from the overall steamline analysis. The piping supports (snubbers, rigid restraints, etc.) are located and designed to limit amplified accelerations of and piping loads in the valves to the design limits.

As described in Subsection 5.4.5.3, the MSIV and associated electrical equipment (wiring, solenoid valves, and position switches) are dynamically qualified to operate during an accident condition.

Main Steam Safety Relief Valves

The typical SRV design described in Subsection 5.2.2.2 is qualified by type test to IEEE 344 for operability during a dynamic event. Structural integrity of the configuration during a dynamic event is demonstrated by both the Code Class 1 analysis and test.

- The valve is designed for maximum moments on inlet and outlet, which may be imposed when installed in service. These moments are resultants due to dead weight plus dynamic loading of both valve and connecting pipe, thermal expansion of the connecting pipe, and reaction forces from valve discharge.