HITACHI

GE Hitachi Nuclear Energy

James C. Kinsey
Vice President, ESBWR Licensing

PO Box 780 M/C A-55
Wilmington, NC 28402-0780
USA

T 910 675 5057
F 910 362 5057
jim.kinsey@ge.com

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Subject: **Response to Portion of NRC Request for Additional Information Letter No. 98 Related to ESBWR Design Certification Application Startup Tests RAI Number 14.2-89**

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) sent by the Reference 1 NRC letter. GEH response to RAI Number 14.2-89 is addressed in Enclosures 1 and 2.

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

Sincerely,

James C. Kinsey

James C. Kinsey
Vice President, ESBWR Licensing

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NRO

Reference:

1. MFN 07-317, Letter from U.S. Nuclear Regulatory Commission to Robert E. Brown, GEH, *Request For Additional Information Letter No. 98 Related To ESBWR Design Certification Application*, dated May 29, 2007.

Enclosures:

1. MFN 07-689 – Response to Portion of NRC Request for Additional Information Letter No. 98 – Related to ESBWR Design Certification Application Startup Tests – RAI Number 14.2-89
2. MFN 07-689 – Response to Portion of NRC Request for Additional Information Letter No. 98 – Related to ESBWR Design Certification Application Startup Tests – RAI Number 14.2-89 – DCD Markup

cc: AE Cubbage USNRC (with enclosure)
GB Stramback GEH/San Jose (with enclosure)
RE Brown GEH/Wilmington (with enclosure)
eDRF 0000-0077-7443

Enclosure 1

MFN 07-689

Response to Portion of NRC Request for

Additional Information Letter No. 98

Related to ESBWR Design Certification Application

Startup Tests

RAI Number 14.2-89

NRC RAI 14.2-89

Startup testing to characterize flow regime instability

Staff calculations indicate that the flow regime in the ESBWR chimney will transition from slug/churn to annular regime between 30 percent and 70 percent power. Each chimney partition will transition at a different power level. During the transition, flow oscillations may develop in the chimney partitions, which will affect the void fraction and local power of their associated fuel bundles.

Provide a startup testing plan to identify the impact, if any, of operation at reduced power levels where flow-transition-induced flow oscillations may be possible. One possible methodology to perform these startup tests would involve frequency-domain analysis of data from LPRM detectors at different power levels.

GEH Response

According to the TRACG steady state analysis at rated condition (100% rated power) that was performed in response to RAI 4.4-11 by applying 1-D PIPE components with fine nodalization for modeling all chimney regions, the two-phase flow in the ESBWR chimney is either in the transition between bubbly and annular flow or in the bubbly flow regime. Therefore, GEH expects that there will be no annular flow pattern in the chimney region during the power ascension considering that the void fraction and vapor axial velocity will be lower at reduced power. However, GEH agrees that a startup test is desirable to identify the impact of any possible flow oscillations and therefore an additional single plant startup test will be developed.

This additional test will have an objective to determine ESBWR stability of the core during power ascension and confirm that variation in the flow regime in the chimney does not materially affect reactor stability. To perform this testing, LPRM data will be obtained from the ESBWR Neutron Monitor System and decay ratio will be determined using an algorithm similar to that used in previous Forsmark stability testing.

DCD Impact

DCD Tier 2, Chapter 14, Subsection 14.2.8.2.7 will be revised in Revision 5 as noted in the attached markup.

Enclosure 2

MFN 07-689

Response to Portion of NRC Request for

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Related to ESBWR Design Certification Application

Startup Tests

RAI Number 14.2-89

14.2.8.2.7 Core Performance Test

Purpose

The objective of this test is to demonstrate that the various core and reactor performance characteristics such as power and flow, core power distributions, and those parameters used to demonstrate compliance with core thermal limits and plant license conditions are in accordance with design limits and expectations.

Prerequisites

The applicable preoperational tests have been completed and plant management has reviewed the test procedure(s) and approved the initiation of testing. For each scheduled testing iteration, the plant shall be in the appropriate operational configuration with specified prerequisite testing complete. Applicable instrumentation shall have been checked and calibrated, as appropriate.

Description

This test collects data sufficient to demonstrate that reactor and core performance characteristics remain within design limits and expectations for the operational conditions the plant is normally expected to encounter. Beginning with rod withdrawal and continuing through initial criticality, plant heatup, and the ascension to rated power, pertinent data is collected at various rod patterns and powers sufficient to determine the axial and radial core power distributions, compliance with core thermal limits, and the level of consistency with predicted core reactivity and core flow versus core power. Core flow is calculated from a heat and mass-flow balance on the downcomer. Core power is calculated from a heat and mass-flow balance on the nuclear boiler.

A First Of A Kind (FOAK) test will be conducted for observation of reactor stability. The objective of this test is to characterize the stability performance during power ascension, where chimney partition may experience flow-regime-transition-induced flow oscillation. The test will begin at 20% thermal power and the first time the reactor achieves a new 5% power increment above that point. The test will collect pertinent LPRM data to identify stability performance characteristics and determine a decay ratio during the ascension to rated reactor power. The monitored LPRM signals are filtered to remove noise components with frequencies above the range of stability related power oscillation. This data will be collected at sufficient instances to capture the development of instability pattern (if any) that may occur during in the accent to rated power.

Criteria

Technical Specification and license condition requirements involving core thermal limits, maximum power level, and any observed reactivity anomalies or core instabilities shall be met.