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 09-225 Docket No. 52-010

April 6, 2009

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

Subject: **Response to Portion of NRC Request for Additional Information Letter No. 305 - Related To ESBWR Design Certification Application - RAI Number 14.2-100**

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 14.2-100 is addressed in Enclosures 1 and 2. GEH held a discussion with NRC staff on February 12, 2009. The RAI response addresses all NRC concerns that were discussed.

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

Sincerely,

Richard E. Kingston

Richard E. Kingston
Vice President, ESBWR Licensing

References:

1. MFN 09-112, Letter from U.S. Nuclear Regulatory Commission to Robert E. Brown, *Request For Additional Information Letter No. 305 Related To ESBWR Design Certification Application*, dated February 3, 2009.

Enclosures:

1. MFN 09-225 – Revised Response to Portion of NRC Request for Additional Information Letter No. 305 - Related To ESBWR Design Certification Application – RAI Number 14.2-100
2. MFN 09-225 – Revised Response to Portion of NRC Request for Additional Information Letter No. 305 - Related To ESBWR Design Certification Application – RAI Number 14.2-100 – DCD Markup

cc:	AE Cubbage	USNRC (with enclosure)
	JG Head	GEH/Wilmington (with enclosures)
	DH Hinds	GEH/Wilmington (with enclosures)
	eDRF	0000-0095-4523

Enclosure 1

MFN 09-225

Response to Portion of NRC Request for

Additional Information Letter No. 305

Related to ESBWR Design Certification Application

RAI Number 14.2-100

NRC RAI 14.2-100

Included main generator island mode operation test

DCD, Tier 2, Section 8.3.1.1 states that the UATs provide normal preferred offsite power or generator island mode power to each the plant's two power generation and plant investment protection load groups.

The DC applicant does not include the demonstration of generator island mode operation. Please include in DCD Subsection 14.2.8.2, "Initial Startup Test Description," the main generator island mode operation test or provide justification for not including this test in the startup test program.

GEH Response

Island mode operation is a commercial design requirement that the plant be able to sustain a load rejection or turbine trip from 100% power without scram. For the case of load rejection, this requires that the turbine generator be capable of supplying all the on-site loads, such as main feed water pumps, condensate pumps, etc. Specifically, island mode operation is a requirement on the generator voltage regulator and the turbine speed control system to be able to supply stable voltage and frequency to the plant electrical system when operating at much less than rated capacity while not synchronized to the grid.

If the plant responds as expected following a generator load rejection, no scram will result and island mode operation will be demonstrated. If the plant does not respond as designed, then scram will occur and island mode will not be demonstrated. Both cases are covered by analysis and the plant is safe with either outcome since no credit is taken for nor is any ESBWR safety analysis dependent upon island mode operation. The plant response is of commercial interest but does not enter into a safety determination.

The plant response following the turbine trip test is similar to the generator load rejection test. A major difference is that the power supply will be shifted from the main generator power supply to offsite power supplies (which remain available in this test). If a successful shift to offsite power loads is accomplished, no scram will occur.

Island mode of operation does not meet the Regulatory Guide 1.68 (Reference 1) criteria listed in C.1 a through f, because the plant is in a safe and analyzed state whether island mode is achieved (i.e. results in no scram) or is not achieved (i.e. results in a scram) following a generator load rejection transient.

In DCD Tier 2 Subsection 14.2.8.2.27, the method of testing the turbine trip and generator load rejection will be clarified by adding a statement that delineates which breaker (generator output breaker or switchyard breaker) is opened in which test. In addition, the test success criteria section that the plant shall not SCRAM following a turbine trip or generator load rejection testing will be removed.

References

[1] U.S. Regulatory Guide 1.68, Revision 2 “Initial Test Programs for Water-Cooled Nuclear Power Plants,” August 1978.

DCD Impact

DCD Tier 2, Subsection 14.2.8.2.27 will be revised as noted in the Enclosure 2 markup.

Enclosure 2

MFN 09-225

Response to Portion of NRC Request for

Additional Information Letter No. 305

Related to ESBWR Design Certification Application

RAI Number 14.2-100

DCD Markup

Criteria

Reactor protection system actions shall prevent violation of fuel thermal limits. The ICS and associated plant systems shall function properly without manual assistance to maintain reactor level above the initiation level of ADS and GDCS. The SDGs will start automatically following the loss of both Normal Preferred Power and Alternate Preferred Power and supply power to the 6.9 kV PIP buses. Other systems and equipment shall perform consistent with applicable design and testing specifications.

14.2.8.2.27 Turbine Trip and Generator Load Rejection Test

Purpose

The objective of this test is to verify that the dynamic response of the reactor and applicable systems and equipment is in accordance with design for protective trips of the turbine and generator during power operation.

Prerequisites

The preoperational tests are complete and plant management has reviewed the test procedure and approved the initiation of testing. The plant shall be in the appropriate operational configuration with specified prerequisite testing complete. Applicable instrumentation shall be checked or calibrated, as appropriate, including steamline expansion/vibration sensors.

Description

In the ESBWR design, there is no direct scram because of turbine trip or generator load rejection. From an initial power level of 100%, the main generator is tripped (generator output breaker is opened for the turbine trip test and the switchyard breaker is opened for the generator load rejection test) in order to verify the proper reactor and integrated plant response. This method for initiating the trip is chosen to create a complete loss of electrical load so the turbine is subjected to maximum overspeed potential. Reactor parameters such as vessel dome pressure and simulated fuel surface heat flux are monitored and compared with predictions so that the adequacy and conservatism of the analytical models and assumptions used to license the plant can be verified. Proper response of systems and equipment such as the turbine stop, control, and bypass valves, steamline vibration, the RPS, reduction in reactor power by SCRRI and staggered SRI group insertions, and the feedwater system are also demonstrated. The ability of the feedwater system to control vessel level after a 100% load rejection shall also be verified. Overspeed response of the main turbine shall also be evaluated because the generator is unloaded prior to complete shutoff of steam to the turbine.

For a turbine trip, the generator initially remains synchronized and there is no overspeed. However, the dynamic response of the reactor may be different if the steam shutoff rate is different. If there is expected to be a significant difference, it may be necessary to perform a separate demonstration and evaluation (similar to that discussed above), but initiated by a direct trip of the main turbine.

A turbine or generator trip should also be performed at a lower power level. Reactor dynamic response is not as important for this AOO except for the ability to remain operating as designed. More important is the demonstration of proper integrated plant and system performance.

Criteria

~~The reactor shall not scram during turbine or generator trips.~~ For high power turbine or generator trips, reactor dynamic response shall be consistent with predictions based on expected system characteristics and shall be conservative relative to analysis results based on design assumptions. Feedwater control shall prevent flooding of the steamline following generator or turbine trip. After generator load rejection turbine speed shall not exceed design limits. The positive change in reactor dome pressure and fuel surface heat flux shall not exceed limits assumed in the transient analysis. Other plant systems and equipment shall perform in accordance with the appropriate design and testing specifications.

14.2.8.2.28 Reactor Full Isolation Test

Purpose

The objective of this test is to verify that the dynamic response of the reactor and applicable systems and equipment is in accordance with design for a simultaneous full closure of all MSIVs from near rated reactor power.

Prerequisites

The preoperational tests are complete and plant management has reviewed the test procedure and approved the initiation of testing. The plant shall be in the appropriate operational configuration with specified prerequisite testing complete. Applicable instrumentation shall be checked or calibrated, as appropriate.

Description

A simultaneous full closure of all MSIVs is initiated from near rated power in order to verify proper reactor and integrated plant response. Reactor dynamic response, as determined by such parameters as vessel dome pressure and simulated fuel surface heat flux, is compared with analytical predictions in order to verify the adequacy and conservatism of the models and assumptions used in the plant safety and licensing analysis. Proper response of systems and equipment such as the MSIVs, ICS, the RPS, and the Feedwater System is also demonstrated.

Criteria

The reactor must scram to limit the severity of the neutron flux and simulated fuel surface heat flux transients. Feedwater system settings must prevent flooding of the MSL following the full reactor isolation transient event. The recorded MSIV full closure times must meet the limits specified in the Technical Specifications. The positive change in vessel dome pressure and simulated fuel surface heat flux shall not exceed the limits assumed in transient analysis. Initiation of timing of ICS and system performance shall be within specification.

14.2.8.2.29 Offgas System Test

Purpose

The objective of this test is to verify proper operation of the various components of the Offgas System over the expected operating range of the system.