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MFN 09-046

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U.S. Nuclear Regulatory Commission
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Subject: **Response to Portion of NRC Request for Additional Information Letter No. 273 - Related To ESBWR Design Certification Application – RAI Number 14.2-99**

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 14.2-99 is addressed in Enclosure 1.

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

Sincerely,

Richard E. Kingston

Richard E. Kingston
Vice President, ESBWR Licensing

D068
NRO

References:

1. MFN 08-925, Letter from U.S. Nuclear Regulatory Commission to Robert E. Brown, *Request For Additional Information Letter No. 273 Related To ESBWR Design Certification Application*, dated November 18, 2008.

Enclosure:

1. MFN 09-046 – Response to Portion of NRC Request for Additional Information Letter No. 273 - Related To ESBWR Design Certification Application – RAI Number 14.2-99
2. MFN 09-046 – Response to Portion of NRC Request for Additional Information Letter No. 273 - Related To ESBWR Design Certification Application – RAI Number 14.2-99 – DCD Markup

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Enclosure 1

MFN 09-046

Response to NRC Request for

Additional Information Letter No. 273

Related to ESBWR Design Certification Application

RAI Number 14.2-99

NRC RAI 14.2-99

Question Summary: *Description of the preoperational testing for DCIS is incomplete.*

Currently as described in DCD Section 14.2.8.1.7, "Distributed Control and Information System (DCIS) Preoperational Test," the description of the Preoperational testing for DCIS is incomplete in that it does not provide sufficient detail to conclude that adequate system testing will be performed.

In DCD Section 14.2.8.1.7, the "Prerequisites" section, the DCD should clarify that construction tests that includes DCIS factory acceptance tests and the I&C-related ITAAC commitment tests discussed in Tier 1, Sections 2.2.15 and 3.2 have been successfully completed.

DCD Section 14.2.8.1.7 should describe the following elements in the "General Test Methods and Acceptance Criteria." After DCIS installation: (1) Conduct of the site acceptance test (SAT) shall include both Q-DCIS and N-DCIS; (2) The SAT shall test all DCIS functions and capabilities as specified in the Technical Design Specification (major elements identified in the life-cycle phase summary baseline review record) of the DCIS. The following items should be considered during the DCIS preoperational tests:

(1) Video display unit (VDU) performance,

(2) Database capacity,

(3) All spare requirements,

(4) Cyber security aspects,

(5) Redundancy features of controllers,

(6) Power supplies,

(7) Data communications and interface requirements, etc.,

(8) The system loop test shall be conducted for each Input/Output (I/O) by connecting all field devices to the DCIS I/O terminals.

The system control logic and man-machine interface design features shall be tested.

GEH Response

Chapter 14 of the ESBWR Design Control Document (DCD) covers preoperational and startup testing. Preoperational testing follows completion of construction (and construction-related) inspections, tests, and acceptance and takes place before fuel is loaded. Startup testing takes place during and after fuel loading. Detail sufficient to conclude that adequate Distributed Control and Information System (DCIS) testing has been performed prior to preoperational and startup testing is, therefore, not included in Chapter 14.

Construction and preoperational testing concepts for the DCIS differ from other systems in that the DCIS must be functional before many other preoperational tests can begin. The DCIS must therefore be installed and shown to be working acceptably during construction, the implementation and installation phases.

The DCIS must satisfy Inspections, Tests, Analyses and Acceptance Criteria (ITAAC) and software management planned testing as part of implementation and installation. This means that testing that might otherwise be considered DCIS preoperational testing is already completed during the implementation and installation phases (of the DCIS construction). Therefore, the only DCIS preoperational tests remaining involve the clearing of any DCIS system diagnostic alarms and any other site-specific testing determined to be necessary. Other systems' preoperational testing turnover packages require a functional DCIS and upon their completion further indicate a fully functional DCIS.

Detail sufficient to conclude that adequate DCIS testing has been performed prior to preoperational and startup testing is, therefore, part of the ITAAC and software management planned testing documentation. The NRC will have access to the detailed test/acceptance records as part of the design implementation process.

The "General Test Methods and Acceptance Criteria" does not cover details of the site acceptance test (SAT) because they are part of the Software Quality Assurance Program documentation.

The DCIS system control logic and man-machine interface design features are tested as part of the other systems' testing and testing committed to in the software plans. Details on software plan tests will be in test plans developed through implementation of the Software Management Program and Software Quality Assurance Program and include, but are not limited to, the following.

(1) Video display unit (VDU) performance,
(2) Database capacity,
(3) All spare requirements,
(4) Cyber security aspects,
(5) Redundancy features of controllers,
(6) Power supplies,
(7) Data communications and interface requirements, etc.

The system loop testing is satisfied for each Input/Output (I/O) through the testing of each system that makes up the DCIS.

Reference in the attached markup to DCD Subsection 14.3.3.2 is intended to point to updates committed in response to RAI 14.3-402 (MFN 09-078).

DCD Impact

DCD Tier 2, Subsection 14.2.8.1.7 will be revised as noted in the attached markup.

Enclosure 2

MFN 09-046

Response to NRC Request for

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DCD Markup

- Verify the self-test portion of the SSLC, including the proper reporting of detected failures;
- Verify the non-interaction of the SSLC self-test system to confirm that the self-test system does not cause a false indication;
- Verify the correct activation of the inputs to the SSLC such as pushbutton switches, control operating switches, key-operated switches and analog inputs;
- Verify the local indication devices on the SSLC properly indicate the correct status;
- Verify the proper interface with diverse protection system;
- Verify proper operation of instrumentation and controls in appropriate design combinations of logic and instrument channel trip; and
- Verify bypass logic and bypass indications.

14.2.8.1.7 DCIS System Preoperational Test

Purpose

The objective of this testing is to verify proper functioning of both the safety-related (Q-DCIS) and nonsafety-related (N-DCIS) plant Distributed Control and Information System (DCIS), ~~including both safety-related (Q-DCIS) and nonsafety-related (N-DCIS) subsystems~~. Proper functioning of the DCIS includes those functions utilized for the preoperational testing of the aggregate plant systems.

Prerequisites

Since the DCIS must be functional for utilization in the preoperational testing of other systems, DCIS testing is completed during the implementation and installation phases of construction. The DCIS implementation and installation testing includes adhering to the commitments of the software plans (see Subsection 14.3.3.2). The commitments of the software plans include such testing as Factory Acceptance Tests and Site Acceptance Tests. That which is not tested during the Factory Acceptance Tests, that which could change in transit, or that which is otherwise determined to need testing at the site is tested during the Site Acceptance Test.

DCIS ~~C~~construction tests have been successfully completed and the SCG has both reviewed the test procedures and approved the initiation of testing. The required AC and DC electrical power sources shall be operational and the appropriate interfacing systems shall be available as required to support the specified testing. ~~Interfacing systems shall be tested and operational. Fiber optic cables have been connected.~~

General Test Methods and Acceptance Criteria

The testing consists of the following:

- Verify that all DCIS diagnostic alarms have been resolved, cleared, and documented as such or have been documented for later resolution during individual/specific system preoperational testing.

~~□Verify the ability to communicate to each nonsafety-related and each safety-related subsystem. Confirm proper addressing of the nonsafety-related and safety-related~~

~~multiplexing networks. Confirm that multiple devices do not answer to or transmit the same address;~~

~~□Verify the ability to transmit and receive data from interfacing systems within specified response times and data rate requirements;~~

~~□Verify the ability to receive error messages from interfacing systems;~~

~~□Verify the synchronization of time signals;~~

~~□Verify the multiplexing system failure recovery capabilities;~~

~~□Verify the ability of the communications software to identify and locate a problem on the network; and~~

~~□Proper Performance Monitoring and Control subsystem function and interfaces to Technical Support Center (TSC).~~

14.2.8.1.8 Leak Detection and Isolation System Preoperational Test

Purpose

The objective of this test is to verify proper response and operation of the Leak Detection and Isolation System (LD&IS) logic.

Prerequisites

The construction tests have been successfully completed and the SCG has reviewed the test procedures and approved the initiation of testing. The required AC and DC electrical power sources shall be operational and the appropriate interfacing systems shall be available as required to support the specified testing.

General Test Methods and Acceptance Criteria

Performance shall be observed and recorded during a series of individual component and integrated system tests to demonstrate the following:

- Proper installation and calibration of instrumentation and controls;
- Proper operation of instrumentation and controls in appropriate design combinations of logic and instrument channel trip;
- Proper functioning of indications, annunciators, and alarms used to monitor system operation and status;
- Proper operation of leakoff and drainage measurement functions such as those associated with the reactor vessel head flange and drywell cooler condensate;
- Proper interface with related systems in regard to the input and output of leak detection indications and isolation initiation commands;
- Proper operation of bypass switches and related logic; and
- Acceptability of instrument channel response times, as measured from each applicable process variable input signal to the applicable process actuator confirmation signal.