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 10-280, Supplement 1

Docket No. 52-010

October 13, 2010

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

Subject: **Transmittal of ESBWR DCD Markups to Tier 1 Related to NRC ITAAC Prioritization Protocol Comments**

Enclosure 1 contains supplemental markups of DCD Tier 1 in response to the NRC suggestion for GEH to review Tier 1 for similar comments to those stemming from the NRC's ITAAC prioritization review. These additional changes are summarized below.

Affected Section	Description of Change
Section 2.2.15	Changed text of design description items 19a, 20a1, 20a2, 21a, 23a, 23b, and 24a to match wording in corresponding design commitment.
Table 2.2.15-2	Changed text to ITAAC 11a7 to match wording in corresponding design description.
Section 2.4.2	Changed text of design description 10 to match wording in corresponding design commitment.
Section 2.6.2	Changed text of design description item 14 to match wording in corresponding design commitment.
Section 2.11.1	Changed text of design description item 8 to match wording in corresponding design commitment.
Table 2.16.5-2	Added bullet to item 6 acceptance criteria to align with design commitment bullets.
Section 2.19.1 and Table 2.19-1	Editorial change to clarify/simplify ITAAC numbering.

D068
NRO

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

Sincerely,

Richard E. Kingston

Richard E. Kingston
Vice President, ESBWR Licensing

Enclosure:

1. Transmittal of ESBWR DCD Markups to Tier 1 Related to NRC ITAAC Prioritization Protocol Comments - DCD Markups

cc:

AE Cubbage	USNRC (with enclosures)
JG Head	GEH/Wilmington (with enclosures)
DH Hinds	GEH/Wilmington (with enclosures)
LF Dougherty	GEH/Wilmington (with enclosures)
eDRF Section	0000-0123-8679 Rev 1

Enclosure 1

MFN 10-280 Supplement 1

Transmittal of ESBWR DCD Markups to Tier 1 Related to NRC ITAAC Prioritization Protocal Comments

DCD Markups

17b2. Criteria 6.1 and 7.1, Automatic Control: The as-built software project's normal operation end-to-end sense, command, and execute plant process control loops (including the associated DCIS components involved with determinant data processing and communications) do not use the following features;

- Non-deterministic data communications;
- Non-deterministic computation;
- Interrupts;
- Multi-tasking;
- Dynamic scheduling; and
- Event-driven actions.

178a. Criteria 6.2 and 7.2, Manual Control: The software projects hasve features in the main control room to manually initiate and control the automatically initiated safety-related functions at the division level.

178b. Criteria 6.2 and 7.2, Manual Control: The as-built software projects hasve features in the main control room to manually initiate and control the automatically initiated safety-related functions at the division level.

189a. Criterion 6.4, Derivation of System Inputs: Sense and command feature inputs for the software project's design basesareis derived from signals that are direct measures of the desired variables specified in the plants design bases.

189b. Criterion 6.4, Derivation of System Inputs: Sense and command feature inputs for the as-built software project's design basisareis derived from signals that are direct measures of the desired variables specified in the plant's design bases.

19a120a1. Criteria 6.6 and 7.4, Operating Bypasses: The software project's design bases provides for s automatically preventing the activation of an operating bypass, whenever the applicable permissive conditions for an operating bypass are not met.

1920a2. Criteria 6.6 and 7.4, Operating Bypasses: The software project's design bases provides fors automatically removeing activated operating bypass(es), if the plant conditions change so that an activated operating bypass is no longer permissible.

1920b1. Criteria 6.6 and 7.4, Operating Bypasses: The as-built software projects automatically prevents the activation of an operating bypass, whenever the applicable permissive conditions for an operating bypass are not met.

19b220b2. Criteria 6.6 and 7.4, Operating Bypasses: The as-built software projects shows that they it automatically removes activated operating bypass(es), if the plant conditions change so that an activated operating bypass is no longer permissible.

201a. Criteria 6.7, 7.5, and 8.3, Maintenance Bypasses: The software project's design bases provides the s are capabilitye of performing itstheir safety-related functions, when one division is in maintenance bypass.

201b1. Criteria 6.7, 7.5, and 8.3, Maintenance Bypasses: The as-built software projects ensures that theyit areis capable of performing theirits safety-related functions, when one division is in maintenance bypass.

201b2. Criteria 6.7, 7.5, and 8.3, Maintenance Bypasses: The as-built software projects ensures that itthey isare capable of performing theirits safety-related functions, when one power supply division is in maintenance bypass.

212a. Criterion 6.8, Setpoint: The software project's setpoints for safety-related functions are determined by a defined setpoint methodology.

212b. Criterion 6.8, Setpoint: Any changes to the setpoints have been reconciled for the as-built software project.

223a. Criterion 8.1, ~~Electrical~~ Power Source Requirements: The software project's design bases ensures that electrical components receive power from their respective, divisional, safety-related power supplies.

223b. Criterion 8.1, ~~Electrical~~ Power Source Requirements: The as-built software project's as-built electrical components receive power from their respective, divisional, safety-related power supplies.

234a. Criterion 8.2, Non-electrical Power Sources: The software project's design bases ensures that actuators receive non-electric power from safety-related sources.

234b. Criterion 8.2, Non-electrical Power Sources: The as-built software project's actuators receive non-electric power from safety-related sources.

Inspections, Tests, Analyses, and Acceptance Criteria

Table 2.2.15-2 defines the inspections, tests, and analyses, together with acceptance criteria for the software projects.

Subsections 2.1.2, 2.2.2, 2.2.4, 2.2.5, 2.2.7, 2.2.10, 2.2.12, 2.2.13, 2.2.14, 2.2.16, 2.3.1, 2.4.1, 2.4.2, 2.15.1, and 2.15.7, 2.16.2.2, 2.16.2.3 define the inspections, tests, and analyses, together with associated acceptance criteria for the sensors, actuators, functional arrangement, functional performance, controls, interlocks, and bypasses associated with the software projects.

Table 2.2.15-2

ITAAC For IEEE Std. 603 Compliance Confirmation

Design Commitment	Inspections, Tests, Analyses	Acceptance Criteria
11a7. Criteria 5.6, Independence and 6.3, Interactions Between the Sense and Command Features and Other Systems: The SSLC/ESF software project's design bases for intra-divisional input/output data communications have the following features; • Sensor inputs at the RMUs are measured with triple redundancy; • Sensor inputs and outputs sent to and from the RMUs are on a dedicated triply redundant communication backplane bus to triply redundant controller application processors; • Sensor inputs from the RMUs are sent via triply redundant optical fibers • Actuator outputs from the RMUs are determined using commands from the triply redundant controller application processors; and • Actuator commands are sent via triply redundant optical fibers.	Inspection of the software project's design phase summary BRR will be performed to verify that the design for intra-divisional input/output data communications have the following features; • Sensor inputs at the RMUs are measured with triple redundancy; • Sensor inputs and outputs sent to and from the RMUs are on a dedicated triply redundant communication backplane bus to triply redundant controller application processors; • Data links for sensor inputs from the RMUs are sent via triply redundant optical fibers • Actuator outputs from the RMUs are determined using commands from the triply redundant controller application processors; and • Data links for actuator commands are sent via triply redundant optical fibers. {{Design Acceptance Criteria}}	The software project's design phase summary BRR show that the design bases for intra-divisional input/output data communications have the following features; • Sensor inputs at the RMUs are measured with triple redundancy; • Sensor inputs and outputs sent to and from the RMUs are on a dedicated triply redundant communication backplane bus to triply redundant controller application processors; • Data links for sensor inputs from the RMUs are sent via triply redundant optical fibers • Actuator outputs from the RMUs are determined using commands from the triply redundant controller application processors; and • Data links actuator commands are sent via triply redundant optical fibers. {{Design Acceptance Criteria}}

(6) (Deleted)

(7) (Deleted)

(8) a. The GDCS injection lines provide sufficient flow to maintain water coverage above (Top of Active Fuel) TAF for 72 hours following a design basis LOCA.

b. The GDCS equalizing lines provide sufficient flow to maintain water coverage above TAF for 72 hours following a design basis LOCA.

(9) The GDCS squib valves used in the injection and equalization lines open as designed.

(10) a. Check valves ~~shown~~ designated on Figure 2.4.2-1 open and close under system pressure, fluid ~~flow, and temperature~~ conditions.

b. The GDCS injection line check valves meet the criterion for maximum fully open flow coefficient in the reverse flow direction.

(11) (Deleted)

(12) GDCS squib valves maintain RPV backflow leak tightness and maintain reactor coolant pressure boundary integrity during normal plant operation.

(13) Each GDCS injection line includes a nozzle flow limiter to limit break size.

(14) Each GDCS equalizing line includes a nozzle flow limiter to limit break size.

(15) Each of the GDCS divisions is powered from its respective safety-related power division.

(16) Each GDCS mechanical train located inside the containment is physically separated from the other train(s) so as not to preclude accomplishment of the intended safety-related function.

(17) The GDCS pools A, B/C, and D are sized to hold a minimum drainable water volume.

(18) The GDCS pools A, B/C, and D are sized to hold a specified minimum water level.

(19) The elevation change between low water level of GDCS pools and the centerline of GDCS injection line nozzles is sufficient to provide gravity-driven flow.

(20) The minimum drainable volume from the suppression pool to the RPV is sufficient to meet long-term post-LOCA core cooling requirements.

(21) The long-term GDCS minimum equalizing driving head is based on RPV Level 0.5.

(22) The GDCS Deluge squib valves open as designed.

(23) (Deleted)

(24) The GDCS injection piping is installed to allow venting of non-condensable gases to GDCS pools and to RPV, to prevent collection in the GDCS injection pipes.

(25) Deluge system has redundant nonsafety-related Programmable Logic Controllers (PLCs) that are connected to thermocouples in each cell of the lower drywell Basemat-Internal Melt Arrest Coolability (BiMAC) system.

(7) a. The FAPCS performs the nonsafety-related suppression pool cooling functions.

b. The FAPCS performs the nonsafety-related low-pressure coolant injection function.

c. The FAPCS provides the nonsafety-related external connection for emergency water to IC/PCCS pool and Spent Fuel Pool functions.

(8) (Deleted)

(9) Safety-related level instruments with adequate operating ranges are provided for the Spent Fuel Pool, buffer pool, and IC/PCCS pools.

(10) (Deleted)

(11) Following a loss of active cooling without makeup that persists for 72 hours, the water level in the Spent Fuel Pool remains above the top of the irradiated fuel assemblies~~active fuel~~.

(12) Following a loss of active cooling without makeup that persists for 72 hours, the water level in the Buffer Pool remains above the top of the irradiated fuel assemblies~~active fuel~~.

(13) a. Valves on lines attached to the RPV that require maintenance have maintenance valves such that freeze seals will not be required.

b. The as-built location of valves on lines attached to the RPV in the FAPCS that require maintenance shall be reconciled to design requirements

(14) Lines that are submerged in the spent fuel pool or buffer pool enter the pools above the normal water level and are equipped with redundant anti-siphon holes that will preserve a water inventory above the top of the irradiated fuel assemblies~~TAF sufficient for safe shielding~~ in the event of a break at a lower elevation.

(15) For all low-pressure coolant injection piping and components between the RWCU/SDC System and the FAPCS, including the check valves and motor operated valves, the ultimate rupture strength can withstand the full reactor pressure.

(16) The nonsafety-related control cables, instrument cables and power cables for equipment in the FAPCS trains A and B are electrically independent.

(17) The nonsafety-related control cables, instrument cables and power cables for equipment in the FAPCS trains A and B are physically separated.

(18) a. The electrical equipment supporting the two FAPCS trains is routed to the Reactor Building and Fuel Building through separate areas that do not contain installed equipment for lifting heavy loads.

b. Heavy loads that are being transported in the Reactor Building or the Fuel Building (where the majority of FAPCS equipment is located) that have the potential to simultaneously compromise both FAPCS trains would be handled by single failure-proof cranes.

Inspections, Tests, Analyses, and Acceptance Criteria

Table 2.6.2-2 provides a definition of the inspections, tests and analyses, together with associated acceptance criteria for the FAPCS.

(5) TMSS piping, which consists of the piping (including supports) for the MSL from the seismic interface restraint (or seismic guide) to the turbine stop valves (non-inclusive), turbine bypass valves (non-inclusive) and the connecting branch lines (nominal 6.35 cm. (2.5 in.) and larger up to and including the first isolation valve which is either normally closed or capable of automatic closure during all modes of normal reactor operation, is classified as Seismic Category II.

(6) The integrity of the as-built MSIV leakage path to the condenser (main steam piping, bypass piping, required drain piping, and main condenser as shown on Figure 2.11.1-1) is not compromised by non-seismic systems, structures and components.

(7) The non-seismic portion of the MSIV leakage path to the condenser (main steam piping from the stop valve (inclusive) to turbine nozzle, bypass piping, required drain piping, and main condenser) maintains structural integrity under SSE loading conditions.

(8) The TMSS piping is sized to ensure that reactor pressure vessel (RPV) dome to turbine stop valve pressure drop, total ~~main steam system~~ volume, and steamline length are consistent with assumptions in ~~AOO~~ Abnormal Event analyses.

(9) a. The TMSS piping portion designated as ASME Code Section III is designed in accordance with ASME Code Section III requirements and Seismic Category II requirements.

b. The as-built TMSS piping portion designated as ASME Code Section III shall be reconciled with the piping design requirements.

c. The TMSS piping portion designated as ASME Code Section III is fabricated, installed, and inspected in accordance with ASME Code Section III requirements..

(10) a. Pressure boundary welds in the ASME Code Section III components of TMSS meet ASME Code Section III non-destructive examination requirements.

b. Pressure boundary welds in the ASME Code Section III piping of the TMSS meet the ASME Code Section III non-destructive examination requirements.

(11) a. Valves on lines attached to the RPV that require maintenance have maintenance valves installed such that freeze seals will not be required.

b. The as-built location of valves on lines attached to the RPV in the TMSS that require maintenance shall be reconciled to design requirements.

(12) The non-return valves shown on functional arrangement Figure 2.11.1-2 and 2.11.1-3 are spring assisted to close.

Inspections, Tests, Analyses, and Acceptance Criteria

Table 2.11.1-1 provides a definition of the inspections, tests, and analyses, together with associated acceptance criteria for the TMSS.

Table 2.16.5-2

ITAAC For The Reactor Building

Design Commitment	Inspections, Tests, Analyses	Acceptance Criteria
6. For external flooding, the RB incorporates structural provisions into the plant design to protect the structures, systems, or components from postulated flood and groundwater conditions. This approach provides: • Wall thicknesses below flood level designed to withstand hydrostatic loads; • Water stops in all expansion and construction joints below design basis maximum flood and groundwater levels; • Waterproofing of external surfaces below design basis maximum flood and groundwater levels; • Water seals in external walls at pipe and electrical penetrations below design basis maximum flood and groundwater levels; ~~and~~ • Roofs designed to prevent pooling of large amounts of water in excess of the structural capacity of the roof for design loads; and~~.~~ • Exterior access opening sealed in external walls below flood and groundwater levels.	Inspection of the as-built flood control features will be conducted.	The as-built RB conforms with the following flood protection features specified in the Design Description of this subsection 2.16.5. • Wall thicknesses below flood level are designed to withstand hydrostatic loads; • Water stops in all expansion and construction joints below design basis maximum flood and groundwater levels; • Waterproofing of external surfaces below design basis maximum flood and groundwater levels; • Water seals in external walls at pipe penetrations below design basis maximum flood and groundwater levels; ~~and~~ • Roofs are built to prevent pooling of large amounts of water in excess of the structural capacity of the roof for design loads; and. • Exterior access opening sealed in external walls below flood and groundwater levels.

2.19 PLANT SECURITY SYSTEM

Design Description

The physical security system of the standard plant provides physical features to detect, delay, assist response to, and defend against the design basis threat (DBT) for radiological sabotage. The physical security system consists of physical barriers and an intrusion detection system. The details of the physical security system are categorized as Safeguards Information. The physical security system provides protection for vital equipment and plant personnel.

(1) a. Vital equipment is located only within a vital area.

b. Access to vital equipment requires passage through a vital area barrier.

(2) (Deleted)

(3) (Deleted)

(4) (Deleted)

(5) (Deleted)

(6) The external walls, doors, ceiling and floors in the Main Control Room and Central Alarm Station are bullet resistant to at least Underwriter's Laboratories (UL) 752 (2006) Level 4.

(7) (Deleted)

(8) a. (Deleted)

b. (Deleted)

(9) (Deleted)

(10) Unoccupied vital areas are locked and alarmed with activated intrusion detection systems that annunciate in the Central Alarm Station.

(11) a. (Deleted)

b. The Central Alarm Station is located inside a protected area and the interior is not visible from the perimeter of the protected area.

(12) The secondary security power supply system for alarm annunciator equipment contained in the Central Alarm Station and non-portable communications equipment contained in the Central Alarm Station is located within a vital area.

(13) a. Security alarm devices including transmission lines to annunciators are tamper indicating and self-checking, (e.g. an automatic indication is provided when failure of the alarm system or a component occurs, or when on standby power) and alarm annunciation indicates the type of alarm (e.g., intrusion alarms, emergency exit alarms) and location.

b. Intrusion detection and assessment systems provide visual display and audible annunciation of the alarm in the Central Alarm Station.

(14)		Intrusion detection systems recording equipment exists to record onsite security alarm annunciation including the location of the alarm, false alarm, alarm check, and tamper indication and the type of alarm, location, alarm circuit, date, and time.
(15)		Emergency exits through the vital area boundaries are alarmed and secured by locking devices that allow prompt egress during an emergency.
(16)	a.	The central Alarm Station has conventional (land line) telephone service with the control room and local law enforcement authorities.
	b.	The central Alarm Station is capable of continuous communication with security personnel.
	c.	Non-portable communications equipment in the Central Alarm Station must remain operable from an independent power source in the event of the loss of normal power.

Inspections, Tests, Analyses, and Acceptance Criteria

Table 2.19-1 provides a definition of the inspections, tests and analysis, together with associated acceptance criteria for physical security system.

Table 2.19-1

ITAAC For The Plant Security

	Design Commitment	Inspections, Tests, Analyses	Acceptance Criteria
1a.	Vital equipment is located only within a vital area.	Inspections will be performed of all vital equipment locations.	Vital equipment is located only within a vital area.
1b~~-1~~.	Access to vital equipment requires passage through a vital area barrier.	Inspections will be performed of all vital equipment locations.	Vital equipment is located such that access to the vital equipment requires passage through a vital area barrier.
2.	(Deleted)		
3.	(Deleted)		
4.	(Deleted)		
5.	(Deleted)		
6a.	The external walls, doors, ceiling and floors in the Main Control Room and Central Alarm Station are bullet resistant to at least Underwriter's Laboratories (UL) 752 (2006) Level 4.	Type test, analysis or a combination of type test and analysis of the external walls, doors, ceilings, and floors in the Main Control Room and Central Alarm Station will be performed.	The external walls, doors, ceilings, and floors in the Main Control Room and the Central Alarm Station are bullet resistant to at least UL 752 Level 4.
7.	(Deleted)		
8a.	(Deleted)		
8b.	(Deleted)		
9.	(Deleted)		

Table 2.19-1

ITAAC For The Plant Security

	Design Commitment	Inspections, Tests, Analyses	Acceptance Criteria
10.	Unoccupied vital areas are locked and alarmed with activated intrusion detection systems that annunciate in the Central Alarm Station.	Tests, inspections, or a combination of tests and inspections of unoccupied vital area intrusion detection equipment and locking devices will be performed.	Unoccupied vital areas are locked and intrusion is detected and annunciated in the Central Alarm Station.
11a.	(Deleted)		
11b.	The Central Alarm Station is located inside a protected area and the interior is not visible from the perimeter of the protected area.	Inspections of the Central Alarm Station location will be performed.	The Central Alarm Station is located inside a protected area and the interior is not visible from the perimeter of the protected area.
12.	The secondary security power supply system for alarm annunciator equipment contained in the Central Alarm Station and non-portable communications equipment contained in the Central Alarm Station is located within a vital area.	Inspections of the secondary security power supply will be performed.	The secondary security power supply for alarm annunciator equipment contained in the Central Alarm Station and non-portable communications equipment contained in the Central Alarm Station is located within a vital area.

Table 2.19-1

ITAAC For The Plant Security

Design Commitment	Inspections, Tests, Analyses	Acceptance Criteria
13a. Security alarm devices including transmission lines to annunciators are tamper indicating and self-checking, (e.g. an automatic indication is provided when failure of the alarm system or a component occurs, or when on standby power) and alarm annunciation indicates the type of alarm, (e.g., intrusion alarms, emergency exit alarms) and location.	Tests will be performed on all security alarm devices and transmission lines.	Security alarm devices including transmission lines to annunciators are tamper indicating and self-checking (e.g., an automatic indication is provided when failure of the alarm system or a component occurs, or when the system is on standby power) and that alarm annunciation indicates the type of alarm, (e.g., intrusion alarms, emergency exit alarms) and location.
13b. Intrusion detection and assessment systems provide visual display and audible annunciation of the alarm in the Central Alarm Station.	Tests will be performed on intrusion detection and assessment systems.	The intrusion detection and assessment systems provide a visual display and audible annunciation of alarms in the Central Alarm Station.
14. Intrusion detection systems recording equipment exists to record onsite security alarm annunciation including the location of the alarm, false alarm, alarm check, and tamper indication and the type of alarm, location, alarm circuit, date, and time.	Tests will be performed on the intrusion detection systems recording equipment.	Intrusion detection systems recording equipment is capable of recording each onsite security alarm annunciation including the location of the alarm, false alarm, alarm check, and tamper indication and the type of alarm, location, alarm circuit, date, and time.

Table 2.19-1

ITAAC For The Plant Security

Design Commitment	Inspections, Tests, Analyses	Acceptance Criteria
15. Emergency exits through vital area boundaries are alarmed and secured by locking devices that allow prompt egress during an emergency.	Tests, inspections, or a combination of tests and inspections of emergency exits through vital area boundaries will be performed.	Emergency exits through vital area boundaries are alarmed and secured by locking devices that allow prompt egress during an emergency.
16a. The Central Alarm Station has conventional (land line) telephone service with the control room and local law enforcement authorities.	Tests, inspections, or a combination of tests and inspections of the Central Alarm Station conventional (land line) telephone service will be performed.	The Central Alarm Station is equipped with conventional (land line) telephone service with the control room and local law enforcement authorities.
16b. The Central Alarm Station is capable of continuous communication with security personnel.	Tests, inspections, or a combination of tests and inspections of the Central Alarm Station continuous communication capability will be performed.	The Central Alarm Station is capable of continuous communication with security officers, watchmen or armed response individuals, or other security personnel that have responsibilities during a contingency event.
16c. Non-portable communications equipment in the Central Alarm Station must remain operable from an independent power source in the event of the loss of normal power.	Tests, inspections or a combination of tests and inspections of the non-portable communications equipment will be performed.	Non-portable communication devices (including conventional telephone systems) in the Central Alarm Station are wired to an independent power supply that enables those systems to remain operable (without disruption) during the loss of normal power.