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Subject: **Response to Portion of NRC Request for Additional Information Letter No. 70, Related to ESBWR Design Certification Application - RAI Number 14.3-67**

Enclosure 1 contains GE's response to the subject NRC RAI transmitted via the Reference 1 letter.

If you have any questions or require additional information regarding the information provided here, please contact me.

Sincerely,

Kathy Sedney for

James C. Kinsey
Project Manager, ESBWR Licensing

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Reference:

1. MFN 06-382, Letter from U.S. Nuclear Regulatory Commission to David Hinds, *Request for Additional Information Letter No. 70 Related to ESBWR Design Certification Application,* October 10, 2006

Enclosure:

1. MFN 07-272 – Response to a Portion of NRC Request for Additional Information Letter No. 70 Related to ESBWR Design Certification Application Chapter 14 – Selection of Tier 1 Criteria and Processes For ICS and PCCS RAI Numbers 14.3-67

cc:	AE Cubbage	USNRC (with enclosures)
	DH Hinds	GE (with enclosures)
	RE Brown	GE (w/o enclosures)
	eDRF Section	0000-000060-2457, R4

Enclosure 1

MFN 07-272

Response to a Portion of NRC Request for

Additional Information Letter No. 70

Related to ESBWR Design Certification Application

Chapter 14 – Selection of Tier 1 Criteria and Processes For ICS and PCCS

RAI Numbers 14.3-67

NRC RAI 14.3-67

DCD Tier 1, Revision 1, Sections 2.5, 2.6, and 2.16 list inspections, tests, analyses, and acceptance criteria (ITAAC) related to fuel storage and handling systems. The staff has found the listed ITAAC incomplete with respect to the requirements of 10 CFR 52.47(a)(vi) for the following features:

1) Adequate cooling of fuel located in the inclined fuel transfer system. (GDC 61)

2) Numerical performance values for makeup to the IC/PCCS and SFP from the FPS and the offsite water sources. (GDC 61)

3) Numerical performance values for NPSH available, flow rates, and, heat removal rates for the various modes of FAPCS operation, including fuel pool cooling, low pressure coolant injection, containment spray, and suppression pool cooling. (GDC 34, 38, and 61)

4) Location and operating range of fuel storage pool level and temperature instrumentation. (GDC 63)

5) Verification that weirs and anti-siphon devices are installed at appropriate elevations to prevent inadvertent or accidental loss of fuel storage pool inventory below the minimum water level required for shielding. (GDC 61)

6) Verification that sumps, equipment drains, and leakage collection devices are installed to prevent undetected releases of radioactive material to the environment, and verification that through-liner leakage can be captured or adequate makeup can be provided to prevent a significant reduction in coolant inventory. (GDC 61)

7) Test of interlocks preventing movement of heavy loads over stored fuel. (GDC 4)

8) Inspections to verify key features necessary to conform to NUREG-0554 guidance and applicable industry standards have been correctly implemented for refueling machine, fuel handling machine, RB crane, and FB crane. (GDC 4)

9) Inspections and load tests of special lifting devices as specified in Tier 2. (GDC 4)

Describe appropriate ITAAC related to key design features, controls, interlocks, and numerical performance values for the fuel storage and handling systems.

GE Response

1) Adequate cooling of fuel located in the IFTS is provided by ensuring that the fuel is contained in water, which for normal operations is already ensured by Table 2.5.10-1, Item 3. However, in the event (for any reason) the fuel transport cart with fuel loaded within the IFTS cannot be moved (i.e., fuel cannot be removed from the within the IFTS), procedures will be implemented that ensure that the operators maintain the IFTS filled with water, until

the fuel can be removed. Tier 1 Subsection 2.5.10 and ITAAC Table 2.5.10-1 were revised in Revision 3, to assure the adequacy of this off-normal operations IFTS procedure.

2) The minimum flow rate required from the Fire Protection System for the purposes of refilling the spent fuel pool and IC/PCC pools at 72 hours post-accident is contained in the response to RAI 9.1-13. DCD Tier 1 has been modified as part of that response to indicate the numerical performance value as well as the testing and acceptance criteria (See Tier 1 Rev. 3, Table 2.16.3-3).

   The water from offsite sources is not credited until 7 days post-accident at which point there is less decay heat being generated than during the three day post-accident period. Therefore, by setting the capacity of the offsite water supply equivalent to the capacity of the Fire Protection System, adequate protection under GDC 61 is assured.

   DCD Tier 1, Table 2.6.2-1, Item 3 has been updated in Rev. 3 to specify the flowrate. However, Item 3 incorrectly references Table 2.16.3-2. This will be changed for Rev. 4 as shown in the attached markup such that it references the correct table: 2.16.3-3.

3) Table 2.6.2-1 contains an ITAAC for the testing of the performance values for NPSH, hydraulic losses, flow rates, and heat removal capacity. However, the wording and acceptance criteria used in this ITAAC could be clearer.

   The preferred method of demonstrating the adequacy of these performance values is by analysis, not testing. Instead of providing numerical performance values as part of an ITAAC table, these performance requirements (including NPSH, hydraulic losses, flow rates, heat removal rates, etc.) shall be determined by analysis, and the component manufacturer shall deliver pumps, heat exchangers, etc. that satisfy these requirements. An ITAAC for testing and specific numerical performance values is therefore unnecessary. Specific numerical performance values shall be contained in the analysis, which will be referenced in the ITACC table.

   DCD Tier 1 Table 2.6.2-1, Item 4 shall be modified in Revision 4 as shown in the attached markup.

4) The level transmitters in the Spent Fuel Pool (SFP) are designed to operate from the elevation of normal water level down to the top of the active fuel. This range spans all elevations required for safe operation.

   The level instruments in the IC/PCCS pools operate from the elevation of normal water level down to the midpoint of the heat transfer tube on the ICS heat exchangers. This range spans all elevations required for safe operation.

   The temperature instruments in the SFP and IC/PCCS pools do not perform any safety-related function. During a loss of FAPCS active cooling, the pools are allowed to heat and boil. The safety-related cooling is accomplished by ensuring an adequate volume of water to absorb the decay heat as described in Tier 2 Subsection 9.1.3. Because the temperature

instruments are not required to detect conditions that may result in the loss of residual heat removal and excessive radiation levels, they do not fall under the scope of GDC 63 and have not been included in Tier 1.

DCD Tier 1, Table 2.6.2-1, Item 10 was updated in Rev. 3 to include this information.

5) A more detailed description of the anti-siphoning provisions for the pools has been added to DCD Tier 2 as a result of the response to RAI 9.1-11. For all pools that are equipped with skimmers, the weir elevation shall (by default) be at the elevation of normal water level. The submerged piping in these pools shall be equipped with anti-siphon holes located at an elevation designed to preserve the minimum allowable water level in the event of a pipe break at a lower elevation.

   DCD Tier 1, Table 2.6.2-1, Item 11 will be added for Revision 4, as shown in the attached markup, to show an ITACC for verification of the location of the weirs and anti-siphon holes.

6) A new item will be added to DCD Tier 1, Table 2.6.2-1 to require verification that leak collection / detection equipment is installed.

   The rate of pool makeup required as a result of leakage is limited by the design of the pool liner as addressed in the response to RAI 9.1-6 and 9.1-15, which adds the statement "Pool liners will be evaluated to ensure structural integrity under fuel handling accidents". Therefore the maximum required rate of makeup water is bounded by the rate of water boil-off due to maximum heat loads. The Fire Protection System flow rate is greater than this boil-off rate, as described in the response to RAI 9.1-13.

   DCD Tier 1, Table 2.6.2-1, Item 12 will be added for Revision 4 as shown in the attached markup.

7, 8, 9) The information requested in items 7, 8, and 9 has already been incorporated into DCD Tier 1 Tables 2.5.5-1 and 2.16.1-1.

DCD Impact

Tier 1 Table 2.6.2-1 will be modified as shown in the attached markup.

Table 2.6.2-1

ITAAC For The Fuel and Auxiliary Pools Cooling Cleanup System

Design Commitment	Inspections, Tests, Analyses	Acceptance Criteria
1. The FAPCS configuration is as described in Design Description of Subsection 2.6.2 and Figure 2.6.2-1.	1. Inspections of the as-built system will be conducted.	1. The FAPCS configuration is as shown on Figure 2.6.2-1.
2. The safety-related FAPCS piping and components and those that are required to support accident recovery functions are constructed to Quality Group B or C.	2. Conduct hydrostatic tests on those components per ASME Code to demonstrate their ability to retain their pressure boundary integrity under internal pressures that will be experienced during service.	2. The test results meet acceptance criteria defined in ASME Code Subsection III.
3. FAPCS provides flow paths and adequate flow capacity for the emergency makeup of the IC/PCCS pools and the Spent Fuel Pool from the Fire Protection System and offsite water supplies.	3. Perform a test to confirm flow path and flow capacity from the Fire Protection System and offsite water sources to the pools.	3. Makeup water flow path is demonstrated and confirmed by operation of the function. Flow capacity for offsite water supplies is demonstrated to be no less than the capacity of the Fire Protection System, which is tested under the criteria in Table 2.16.3-~~2~~3.
4. FAPCS is capable of providing its design functions.	4. Perform an analysis to determine the required performance values necessary to satisfy the functions described in the system design specification.~~Perform hydraulic tests and/or analyses to determine:~~	4. An analysis exists that shows the performance values of FAPCS components are satisfactory to accomplish the system's design functions. ~~Tests and/or analyses exist that demonstrate:~~ ~~□NPSH available is greater than~~

Design Commitment	Inspections, Tests, Analyses	Acceptance Criteria
	~~□NPSH available~~ ~~□System hydraulic losses~~ ~~□Flow rates~~ ~~□Heat removal rates~~	~~NPSH required as determined by the pump manufacturer.~~ ~~□System hydraulic loss is less than pump developed head.~~ ~~□Flow rate and heat removal rate are equal to or greater than the design values for each operating mode.~~
5. SPC mode is automatically initiated on high suppression pool water temperature.	5. Initiate SPC mode automatically with simulated high suppression pool temperature signals.	5. The control circuit successfully initiates the SPC mode.
6. FAPCS pumps are automatically tripped on trip signals.	6. Conduct a pump trip test with simulated trip signals.	6. The pump successfully tripped as designed.
7. Upon receipt of a containment isolation signal from the LD&IS, the following valves are closed: • Inboard and outboard isolation valves on GDCS pool suction line. • Outboard isolation valve on GDCS pool return line.	7. Perform the following tests: • Logic test with simulated containment isolation signals. • Valve stroke test against normal operating dP.	7. Test results and/or analyses demonstrate that: • The containment isolation valve automatically closes. • The valve stroke time is less than 30 seconds
8. Leakage of all containment isolation valves is acceptable.	8. Perform valve leakrate tests in accordance with Type C valve leakrate test of 10 CFR 50 Appendix J.	8. Leakrate is less than the acceptance criterion established per the leak rate program (or IST).
9. A reactor pressure interlock prevents opening of LPCI injection valve.	9. Perform a logic test with a simulated high reactor pressure signal.	9. The LPCI injection valves automatically close and cannot be opened while a high pressure single is present.

Design Commitment	Inspections, Tests, Analyses	Acceptance Criteria
10. Level instruments with adequate operating ranges are provided for monitoring and controlling the water levels in the Spent Fuel Pool (SFP) and IC/PCCS pools.	10. Perform instrument calibration and simulated makeup water control test.	10. Water level instruments indicate accurate water levels. Makeup water control valves open and close upon receipt of water level signals as designed. Operating range for SFP level instruments spans the normal water level down to the top of the active fuel. Operating range for the IC/PCCS pools spans the normal water level down to the midpoint of the IC heat exchanger tube.
11. Weirs and/or anti-siphon holes are provided in the following pools at locations which, in the event of a pipe break, will ensure an adequate volume of water is preserved to achieve the pool's safety function. a. Spent fuel pool b. Auxiliary pools c. GDCS pools d. Suppression pool e. IC/PCC pools	11. Perform visual inspections of the elevations of the weirs and anti-siphon holes.	11. Weirs and/or anti-siphon holes are located at an elevation above the pool floor of no less than: a. 14.3 m (46.9 ft) for the spent fuel pool b. 6.7 m (22.0 ft) for the auxiliary pools c. 6.5 m (21.3 ft) for the GDCS pools d. 5.4 m (17.7 ft) for the suppression pool e. 4.8 m (15.7 ft) for the IC/PCC pools
12. Sumps, equipment drains, and leakage collection devices are installed to prevent undetected releases of radioactive material to the environment.	12. Perform visual inspections of the leak collection devices.	12. Equipment is designed and installed to effectively collect and measure leakage.