ArevaEPRDCPEm Resource

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Sent: Thursday, September 23, 2010 6:07 PM
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Cc: GARDNER Darrell (AREVA)
Subject: FW: RAI 351 Q 09.02.05-25 Part 4, second round response
Attachments: RAI 351 Q25 Draft Response for Review.pdf; 14.2.12.5.8 Test 049 MU.pdf; RAI 351 Question 9 2 5-25(4) Mu 9-08-10.doc

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Subject: RAI 351 Q 09.02.05-25 Part 4, second round response

Darrell,

Attached are the DRAFT response to RAI 351 Question 09.02.05-25, Part 4, markups and inserts. This is for second round review by NRC.

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Hearing Identifier: AREVA_EPR_DC_RAIs
Email Number: 2043

Mail Envelope Properties (BC417D9255991046A37DD56CF597DB7107AC8689)

Subject: FW: RAI 351 Q 09.02.05-25 Part 4, second round response
Sent Date: 9/23/2010 6:06:32 PM
Received Date: 9/23/2010 6:06:54 PM
From: BRYAN Martin (EXTERNAL AREVA)

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Post Office: AUSLYNCMX02.adom.ad.corp

Files	Size	Date & Time
MESSAGE	1043	9/23/2010 6:06:54 PM
RAI 351 Q25 Draft Response for Review.pdf	332787	
14.2.12.5.8 Test 049 MU.pdf	63814	
RAI 351 Question 9 2 5-25(4) Mu 9-08-10.doc	27200	

Options
Priority: Standard
Return Notification: No
Reply Requested: No
Sensitivity: Normal
Expiration Date:
Recipients Received:

NRC Question 09.02.05-25

General Design Criteria (GDC) 44 requires that "A system to transfer heat from structures, systems, and components important to safety, to an ultimate heat sink shall be provided." The staff noted the proper understanding of the function and operation of the ESWS ultimate heat sink (UHS) cooling tower fans is necessary for compliance with GDC 44 since these components support the overall system safety functions including accident mitigation. Accordingly the following questions are provided:

Final Safety Analysis Report (FSAR) Tier 2 Section 9.2.5.4 states that the cooling tower fans have multi-speed drives that have the capability of operating in the reverse directions for short periods in cold weather for deicing purposes. The staff identified the following questions relative to these important components:

1. Describe the seismic class and electrical class (1E) of the fans and fan motors in Section 9.2.5.
2. Provide a description in Section 9.2.5 of bounding fan mechanical properties (e.g. capacity, speeds etc).
3. Confirm that the associated ESWS train is considered inoperable when the fans are operated in the reverse direction for deicing purposes. Confirm that reverse direction operation is bounded by Allowable Outage Times in the Technical Specifications (TS).
4. Since the fans receive an automatic signal in response to an accident, confirm that the TS will bound the scenerio of an accident occurring during reverse fan operation.
5. Provide in either FSAR Section 9.2.1 or 9.2.5 a description of UHS/ESW cooling tower fan automatic start in response to an accident.
6. Describe the selection meth for the proper fan speed during normal/ accident conditions (automatic process or a manual operator action).
7. Describe the speed at which fans on a standby train will be started in response to an accident signal and provide the normal speed for a fan that was previously in operation.
8. Describe the indications and controls for the fans provided to the operator in the main control room (MCR).
9. With respect to the non safety related (NSR) dedicated train; describe the emergency power source for the division four cooling tower fans (used by the dedicated train) during severe accidents. Similarly, describe the emergency power source for the dedicated train filter and motor operated valves. This should be identified in the FSAR.

Based on the staff's review of the applicant's response to RAI 9.2.5-07 (ID1817/6801) AREVA #175, Supplement 2, the following were determined as unresolved and needed further clarification/resolution by the applicant.

With regard to Items 1 and 3, the information that was provided needs to be reflected in Tiers 1 and 2 of the FSAR as appropriate. The procedures referred to in the response for Item 3 need to be specified in FSAR Tier 2, Chapter 13.

The response for Item 4 indicates that FSAR Tier 2, Section 9.2.5.4, will be revised to indicate that cooling tower fans operating in the reverse direction at the onset of a DBA are secured and brought to a complete stop before reenergizing to operate at full speed in the forward direction.

Additional clarification in the FSAR is required to specify that these actions are automatic and do not require operator action. Also, the time it takes for the fans to achieve full speed in the forward direction and the impact of this delay on accident mitigation (either assuming all cooling tower fans are affected or this is not possible) also needs to be described in the FSAR.

The response for Items 2 and 8 indicated that the requested information would not be available until later in the design stage since it is dependent on vendor selection. Consequently, these items will remain open pending submittal of the information that was requested and a schedule for providing this information needs to be established.

Response to NRC Question 09.02.05-25:

To prevent or eliminate ice buildup within the cooling tower fill during low load / low temperature operation, multiple methods are utilized. Operation of a cooling tower fan in the reverse direction is the last option used if all other airside control methods fail to remove ice buildup. When a cooling tower fan is operated in the reverse direction to eliminate ice build-up, the system (associated train) is considered operable. Upon receipt of a Safety Injection (SI) signal, any fan(s) operating in the reverse direction will automatically trip and re-start following coast-down, and accelerate to full speed in the forward direction to dissipate the maximum heat to the environment. Similarly, upon receipt of an SI signal, cooling tower fans in the standby train(s) will automatically start and accelerate to full speed, and the cooling tower fans in the operating train(s) will continue to operate at full speed. If the fans in the operating train(s) are operating at reduced speed at the onsite of a DBA, they will be switched automatically to full speed upon receipt of an SI signal, to dissipate the maximum heat to the environment. All of the above actions are automatic following the receipt of an SI signal, and do not require operator action.

onset

Cooling tower fan start time, as well as the time required for fan coast-down, re-start and acceleration to full speed of a fan(s) operating in reverse, have no impact on the ability of the UHS cooling towers to mitigate the consequences of a DBA. All fans start automatically and accelerate to full speed in response to an SI signal. With respect to cooling tower fan start time, it is noted that the peak heat load on the ESW System occurs hours after the start of the DBA, and thus, hours after the fans have started and accelerated to full speed in response to an SI signal. In the case of cooling tower fans operated in reverse to eliminate ice from the fill, this operating mode is utilized only for brief periods of time (e.g., minutes) during cold weather, when the ESW System temperature is well below the design cold water temperature, and, consequently capable of accommodating the initial heat load. Thus, cooling tower fan start time, as well as the time required for fan coast-down, re-start and acceleration to full speed of fan(s) operating in reverse, have no impact on the ability of the UHS cooling tower to mitigate the consequences of a DBA.

FSAR Impact: Section 9.2.5.4 and Section 14.2.12.5.8 (Test 049)

U.S. EPR FSAR Tier 2, T~~able 9.2.5~~-4, will be revised as described in the response and indicated on the enclosed markup.

INSERT 1

The cooling tower fans are driven with multi-speed drives that are capable of fan operation in the reverse direction. Consistent with vendor recommendations, the fan may be operated in the reverse direction for short periods to minimize ice buildup at the air inlets. Cooling tower fans operating in the reverse direction during normal operation are considered operable at the onset of a design basis accident (DBA). Upon receipt of a safety injection (SI) signal, any fans operating in the reverse direction are secured and brought to a complete stop before re-energizing to operate at full speed in the forward direction. Upon receipt of an SI signal, fans in the operating and standby trains are automatically set to full fan speed to dissipate the maximum heat load to the environment. The cooling tower bypass piping provides a means for diverting ESW return flow directly to the tower basin under low load/low ambient temperature conditions to maintain ESW cold water temperature within established limits and to protect against freezing.

DELETE

Based on the increase in heat removal during a DBA, a temperature of less than or equal to 90°F is maintained in the UHS basin during normal operation, so that the cooling tower basin temperature does not exceed 95°F.

9.2.5.5 Safety Evaluation

The UHS pump buildings and cooling towers are designed to withstand the effects of earthquakes, tornadoes, hurricanes, floods, external missiles and other natural phenomena. Section 3.3, Section 3.4, Section 3.5, Section 3.7 and Section 3.8 provide the basis for the adequacy of the structural design of these structures. The aboveground piping and components are protected by the structures.

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The UHS is designed to remain functional after a safe shutdown earthquake (SSE). Section 3.7 and Section 3.9 provide the design loading conditions that are considered. Section 3.5, Section 3.6 and Section 9.5.1 provide the hazards analyses to verify that a safe shutdown, as outlined in Section 7.4, can be achieved and maintained.

The four division design of the UHS provides complete redundancy; therefore a single failure will not compromise the UHS system safety-related functions. Each division of UHS is independent of any other division and does not share components with other divisions or with other nuclear power plant units.

Considering preventative maintenance and a single failure, two UHS divisions may be lost, but the ability to achieve the safe shutdown state under DBA conditions can be reached by the remaining two UHS divisions. In case of LOOP the four UHS cooling towers have power supplied by their respective division EDGs. Isolation valves can isolate non-safety-related portions of the system if necessary without compromising the safety-related function of the system.

The cooling towers must operate for a nominal 30 days following a LOCA without requiring any makeup water to the source or it must be demonstrated that

Insert 1 for FSAR Section 9.2.5.4

To prevent or eliminate ice buildup within the cooling tower fill during low load / low temperature operation, multiple methods are utilized. Operation of a cooling tower fan in the reverse direction is the last option used if all other airside control methods fail to remove ice buildup. When a cooling tower fan is operated in the reverse direction to eliminate ice build-up, the system (associated train) is considered operable. Upon receipt of a Safety Injection (SI) signal, any fan(s) operating in the reverse direction will automatically trip and re-start following coast-down, and accelerate to full speed in the forward direction to dissipate the maximum heat to the environment. Similarly, upon receipt of an SI signal, cooling tower fans in the standby train(s) will automatically start and accelerate to full speed, and the cooling tower fans in the operating train(s) will continue to operate at full speed. If the fans in the operating train(s) are operating at reduced speed at the onsite of a DBA, they will be switched automatically to full speed upon receipt of an SI signal, to dissipate the maximum heat to the environment. All of the above actions are automatic following the receipt of an SI signal, and do not require operator action.

Cooling tower fan start time, as well as the time required for fan coast-down, re-start and acceleration to full speed of a fan(s) operating in reverse, have no impact on the ability of the UHS cooling towers to mitigate the consequences of a DBA. All fans start automatically and accelerate to full speed in response to an SI signal. With respect to cooling tower fan start time, it is noted that the peak heat load on the ESW System occurs hours after the start of the DBA, and thus, hours after the fans have started and accelerated to full speed in response to an SI signal. In the case of cooling tower fans operated in reverse to eliminate ice from the fill, this operating mode is utilized only for brief periods of time (e.g., minutes) during cold weather, when the ESW System temperature is well below the design cold water temperature, and, consequently capable of accommodating the initial heat load.

2.5 Test instrumentation available and calibrated per applicable procedures.

2.6 Appropriate AC and DC power sources are available.

2.7 UHS basin support systems required for operation of the UHS and ESWS are available, as required.

2.8 The UHS basin is filled to normal operating levels.

3.0 TEST METHOD

3.1 Demonstrate operation of the UHS tower over the design range of operation.

3.1.1 Simulate a UHS operating temperature that corresponds to the lower range of operation.

each speed setting and direction, including reverse.

3.1.2 Demonstrate that fans operate in ~~the reverse direction.~~

3.1.3 Demonstrate that tower bypass paths realign to mitigate ice formation.

3.1.4 Simulate a gradual increase in ambient UHS temperature and terminate the ambient temperature increase at the upper end of the design operation band.

3.1.5 Record changes to tower fans and critical component operation during temperature increase.

3.2 Perform valve performance tests (e.g., valve position response of valves to loss of motive power, thrust, stroke time).

3.3 Demonstrate that UHS makeup flow rate meets design flow requirements.

3.3.1 During normal operation.

3.3.2 During emergency operation.

3.4 Demonstrate that UHS blowdown flow rate meets design flow requirements.

3.4.1 During normal operation.

3.4.2 During emergency operation.

3.5 Demonstrate the operation of UHS level and temperature instruments and alarms.

3.6 Check electrical independence and redundancy of power supplies for safety-related functions by selectively removing power and determining loss of function.

3.7 Demonstrate that the chemical treatment system functions as designed.

3.7.1 Injection flow rate to UHS.

3.7.2 Interlocks with UHS blowdown.

RAI 351 Question 09.02.05-25(4), Insert to FSAR 14.2.12.5.8 (Test 049)

3.1.6 **Verify that the UHS tower is operating with cooling load.**

3.1.7 **Verify that each UHS fan is operating in high speed (forward direction) and record performance data in the following sequence:**

- **Corresponding UHS inlet and outlet temperatures (°F).**
- **Essential service water flow rates (gpm).**
- **UHS air flow rates (cfm).**
- **Duration of described event (seconds).**

3.1.7.1 **Record data from initiation of deicing sequence till fan coasts to stop**.

3.1.7.2 **Record data from fan coasting to stop till fan starts moving in reverse direction**.

3.1.7.3 **Record data from fan starting in reverse direction till fan is operating at normal speed in reverse direction**.

3.1.7.4 **Record data from fan speed stabilizing in reverse direction until fan can be returned to normal forward direction. Observe all applicable starting duty restrictions before returning fan to forward direction**.

3.1.7.5 **Record data from terminating deicing sequence till fan coasts to stop**.

3.1.7.6 **Record data from fan stop till fan starts moving in forward direction**.

3.1.7.7 **Record data from fan starting in forward direction till fan is operating at high speed in the forward direction**.