ArevaEPRDCPEm Resource

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Sent: Thursday, August 19, 2010 9:52 AM
To: Tesfaye, Getachew
Cc: KOWALSKI David (AREVA); Hearn, Peter
Subject: FW: DRAFT RESPONSES FOR FSAR Chapter 9 Weekly NRC Telecon
Attachments: Blank Bkgrd.gif; DRAFT RESPONSE RAI 361 Q.09.02.02-101.pdf

Importance: High

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Subject: DRAFT RESPONSES FOR FSAR Chapter 9 Weekly NRC Telecon
Importance: High

Marty:

Please transmit to Getachew Tesfaye the attached partial set of DRAFT responses to RAI 361 questions. If the NRC reviewers have sufficient time to review this response, it can be discussed at today's (8/19/10) FSAR Chapter 9 Weekly Telecon/GoToMeeting with the NRC, or can be scheduled for a future telecon.

Attached are the following DRAFT response(s):

- Response to RAI 361 - Question 09.02.02-101 (reflects NRC comments made during 8/17 telecon).

Note that this DRAFT response has not been through the final Licensing review/approval process; nor does it reflect technical editing.

Please call me if you have any questions. Thanks

David J. Kowalski, P.E.
Principal Engineer

New Plants Regulatory Affairs

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Mail Envelope Properties (BC417D9255991046A37DD56CF597DB710742A532)

Subject: FW: DRAFT RESPONSES FOR FSAR Chapter 9 Weekly NRC Telecon
Sent Date: 8/19/2010 9:52:02 AM
Received Date: 8/19/2010 9:52:07 AM
From: BRYAN Martin (EXTERNAL AREVA)

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Files	**Size**	**Date & Time**
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DRAFT RESPONSE RAI 361 Q.09.02.02-101.pdf	565783	

Options
Priority: High
Return Notification: No
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Sensitivity: Normal
Expiration Date:
Recipients Received:

RAI 361

Question 09.02.02-101:

Follow-up to RAI 174, Question 09.02.02-53

The safety chilled water system (SCWS) must be capable of removing heat from structures, systems and components (SSCs) important to safety during normal operating and accident conditions over the life of the plant in accordance with general design criteria (GDC) 44 requirements. Based on the staff's review of the applicant's response to RAI 174, Question 9.2.2-53, Supplement 5 and information provided in the associated markup of the Final Safety Analysis Report (FSAR), Section 9.2.8, "Safety Chilled Water System" the staff found a significant design change to the system. The safety chilled water system (SCWS) design now utilizes "cross-ties" between Trains 1 and 2 and between Trains 3 and 4, instead of the independent four-train system structure utilized in the original design. In order to satisfy the above requirements, address the following regarding instrumentation and controls (I&C):

a. Clarify the difference between a single pump tripping/failing and multiple pumps tripping/failing along with the logic for maintaining the proper flow to ensure adequate cooling for both trains.

    1. Table 2.7.2-3, "Safety Chilled Water ITAAC," Item 4.4 states that the standby chiller and its pump(s) start on a trip of the running chiller or its pump(s). Describe the SCWS response (i.e. how many pumps start) on a loss of a single pump in the operating train. Also describe the SCWS response to a loss of both pumps in the operating train.

    2. Final Safety Analysis Report (FSAR) Section 9.2.8.6 states that the affected chilled water system train is deactivated by "pump" failure. Clarify if this is deactivation occurs for the loss of a single pump or requires loss of both pumps.

b. FSAR Section 9.2.8.6 indicates the cross-tied loops isolate on low-low system pressure. The staff requests that the applicant address if there is a similar isolation based on low expansion tank level. If not, describe the SCWS would response to a slow leak of the inventory lost but no activation of the low-low pressure trip.

c. Technical Specification (TS) Bases B3.7.9 states that the chiller standby units start on trip of the running chiller. Address the SCWS response to increasing temperatures if the running chiller is overloaded or degraded but not tripped.

d. Address any I&C logic associated with the motor-operated cross-tie valves (auto-close or auto-open) if applicable.

Response to Question 09.02.02-101:

a. For full load, cross-tie operation of SCWS, two pumps in the operating train are required to operate. If one pump fails, the standby train is automatically started and the operating train is manually stopped from the MCR.

    As indicated in the response to RAI 356 Supplement 4, Question 09.02.02-86 markup of FSAR Tier 2, Section 9.2.8.6:

"Instrument display location, and input to alarm and automatic or manual functions for instruments shown in Figure 9.2.8-1 are provided in Table 9.2.8-3.

An automatic switchover to operate the opposite chiller train occurs if the chilled water flow through the evaporator reaches a MIN-2 set point for the running train. Then, if the cross-tie valves are open and the opposite chiller is in stand-by, the opposite (non-running) chiller pumps are started automatically. When differential pressure across the opposite chiller evaporator is greater than MIN-1, then the opposite chiller is automatically started and the initial running chiller train is stopped manually from the MCR."

As indicated in the response markup to FSAR Tier 2, Section 9.2.8.6 for RAI 356 Supplement 4 Question 09.02.02-92, "In the event the operating train fails, the opposite stand-by train starts within one minute." This means that within one minute of the fault signal that initiates the automatic switchover sequence, the pumps and the chiller in the standby train will start.

As indicated in the response markup to FSAR Tier 2, Section 9.2.8.6 for RAI 356 Supplement 4 Question 09.02.02-93, "Running pumps will trip on a pump fault, chiller fault, low evaporator flow (MIN-2), or MIN-3 pressure in the expansion tank. In cross-tie operation, any of these faults causes a switchover to the standby train in the divisional pair. In cross-tie operation, the switchover occurs for failure of a single pump or for simultaneous failure of two pumps in the operating train

The SCWS is designed to withstand the effects of running opposing pumps during auto switchover sequence. During the switchover, at least one bypass control valve in the divisional pair will be operating, which will bypass some of the excess pump flow.

As indicated in response markup to U.S. EPR FSAR Tier 2, Section 9.2.8.2.2 for RAI 356 Supplement 4 Question 09.02.02-86, "The design pressure is based on the total of pump shut-off head, the operating static pressure, and the lowest elevation in the SCWS."

As indicated in the response for RAI 361 Supplement 1 Question 09.02.02-98, "The initial testing program will include testing to verify that auto train swap to standby train due to pump/chiller failure does not indicate evidence of water hammer."

As indicated in the response for RAI 361 Supplement 1 Question 09.02.02-100, "FSAR Chapter 14.2 will be revised to include parallel pump testing as part of the initial test program."

SCWS is a closed loop system. Flow direction is from the SCWS pumps discharge, through the chiller unit, to the user heat exchangers, and back to the suction side of the pumps. Reverse flow in the system is prevented by a check valve in each pump discharge line.

The following additional information will be added to U.S. EPR FSAR Tier 2, Section 9.2.8.6.

The following automatic functions represent the generic steps in train switchover and will be performed or validated as a result of the abnormal condition in the affected train.

- Standby train prerequisites are met for train startup
- Cross-tie MOVs are open-Validate MOV position
- Start Standby Train Pump 1
- Start Standby Train Pump 2
- Start Standby Train Chiller Unit
- Enable the control loop for the differential pressure across the evaporator which starts system flow regulation by the bypass control valve in the standby train.
- Enable the pressure monitoring loop for system pressure

Annunciation will occur on automatic switchover.

Once the standby train is in operation, the following actions will be initiated manually from the control room to stop the previously operating train.

- Standby train is in operation – Validate operation
- Stop Operating Chiller (if running)
- Stop Operating Train Pump 1 (if running)
- Stop Operating Train Pump 2 (if running)
- Disable the operating train pressure monitoring loop for system pressure
- Close the operating train bypass control valve
- Disable the operating train control loop for differential pressure across the evaporator

b. SCWS pressure is maintained by the nitrogen pressure in the tank. There is no permanently connected nitrogen source and nitrogen supply is not connected during normal operation, so the effect of a nitrogen leak would be the same as a slow water leak. There is no similar isolation based on low expansion tank level. A slow leak of the inventory would activate a low pressure alarm. The operator would check nitrogen charge, check for water leaks and provide makeup water.

Refer to response to RAI 356 Question 09.02.02-86b for additional information on SCWS instrumentation.

c. The chiller evaporator outlet temperature is monitored. An alarm occurs if temperature reaches high set point. An automatic switchover to the standby train occurs if temperature reaches high–high set point.

d. Refer to response to RAI 174 Supplement 5, Question 09.02.02-53 markup of US EPR FSAR Tier 2, Section 9.2.8.6.
"If the system experiences excessive leakage in excess of system makeup capability, the cross-tie isolation MOVs close on Low-2 system pressure. The non-operating standby train automatically starts on Low-2 pressure. The train without excessive leakage returns to pressure and the train with excessive leakage is manually stopped from the DCS."

The above paragraph will be changed in U.S. EPR FSAR Tier 2, Section 9.2.8.6 to indicate that the cross-tie isolation MOVs are closed manually from the control room.

As indicated in the response to RAI 356 Supplement 4, Question 09.02.02-86 markup of FSAR Tier 2, Table 9.2.8-3, in the table:
Function = "MIN-2 (pressure) Manual Isolation Div. 1 and 2 (for divisional pair 3 and 4 – "Manual Isolation Div. 3 and 4"). Purpose = "MIN-2 alarm alerts operators to close cross-tie valves for inventory protection of a division".

FSAR Impact:

a. The U.S. EPR FSAR Tier 2, Section 9.2.8.6 will be revised as described in the response and indicated in the attached markup.

b. The U.S. EPR FSAR will not be changed as a result of this question.

c. The U.S. EPR FSAR Tier 2, Section 9.2.8.6 will be revised as described in the response and indicated in the attached markup.

d. The U.S. EPR FSAR Tier 2, Section 9.2.8.6 will be revised as described in the response and indicated in the attached markup.

Section 3.9.6 and Section 6.6 describe the inservice testing and inspection requirements, respectively. Refer to Section 16.0, Surveillance Requirement (SR) 3.7.9 for surveillance requirements that verify continued operability of the SCWS.

9.2.8.6 Instrumentation Requirements

The SCWS system is controlled by the safety automation system (SAS). The normal indication, manual control, and alarm functions are provided by the process information and control system (PICS). Instrument display location, and input to alarm and automatic or manual functions for instruments shown in Figure 9.2.8-1 are provided in Table 9.2.8-3.

INSERT 1

An automatic switchover to operate the opposite chiller train occurs if the chilled water flow through the evaporator reaches a MIN-2 set point for the running train. Then, if the cross-tie valves are open and the opposite chiller is in stand-by, the opposite (non-running) chiller pumps are started. When differential pressure across the opposite chiller evaporator is greater than MIN-1, then the opposite chiller is automatically started and the initial running chiller train is stopped manually from the MCR.

INSERT 2

System pressure is monitored with the aid of two pressure measurements for each train. The two measurements are combined in one measuring point. If the pressure falls to MIN-1, an alarm is issued for operators to check nitrogen charge or provide makeup with demineralized water. The SCWS expansion tank MIN-1 pressure alarm is below the lowest normal system operating pressure with sufficient margin to avoid a spurious alarm. SCWS expansion tank MIN-2 pressure is below MIN-1, but above the inventory margin required for seven days of normal operation. SCWS expansion tank MIN-3 pressure is below the seven day normal makeup margin, but high enough to provide sufficient NPSH and prevent pump cavitation and still retain sufficient inventory margin in the expansion tank.

are closed manually from the MCR

If the system experiences excessive leakage in excess of system makeup capability, the cross-tie isolation MOVs close on Low-2 system pressure. The non-operating standby train automatically starts on Low-2 pressure. The train without excessive leakage returns to pressure and the train with excessive leakage is manually stopped from the DCS.

If the pressure falls to MIN-3, the following measures are initiated automatically for the affected train:

- Chilled water system "Protection OFF" alarms. The MIN-3 system pressure setpoint trip occurs before the pressure corresponding to the minimum required available NPSH is reached.
- Refrigeration unit shuts down.

Revised IAW RAI 361 Q 09.02.02-101

Insert 1 to U.S. EPR FSAR Tier 2, Section 9.2.8.6
RAI 361 Q 09.02.02-101c

The chiller evaporator outlet temperature is monitored. An alarm occurs if temperature reaches high set point. An automatic switchover to the standby train occurs if temperature reaches high–high set point.

Insert 2 to U.S. EPR FSAR Tier 2, Section 9.2.8.6
RAI 361 Q 09.02.02-101a

The following automatic functions represent the generic steps in train switchover and will be performed or validated as a result of the abnormal condition in the affected train.

- Standby train prerequisites are met for train startup
- Cross-tie MOVs are open-Validate MOV position
- Start Standby Train Pump 1
- Start Standby Train Pump 2
- Start Standby Train Chiller Unit
- Enable the control loop for the differential pressure across the evaporator which starts system flow regulation by the bypass control valve in the standby train.
- Enable the pressure monitoring loop for system pressure

Annunciation will occur on automatic switchover.

Once the standby train is in operation, the following actions will be initiated manually from the control room to stop the previously operating train.

- Standby train is in operation – Validate operation
- Stop Operating Chiller (if running)
- Stop Operating Train Pump 1 (if running)
- Stop Operating Train Pump 2 (if running)
- Disable the operating train pressure monitoring loop for system pressure
- Close the operating train bypass control valve
- Disable the operating train control loop for differential pressure across the evaporator