ArevaEPRDCPEm Resource

From: DUNCAN Leslie E (AREVA NP INC) [Leslie.Duncan@areva.com]
Sent: Thursday, February 25, 2010 2:23 PM
To: Tesfaye, Getachew
Cc: DELANO Karen V (AREVA NP INC); BENNETT Kathy A (OFR) (AREVA NP INC); ROMINE Judy (AREVA NP INC); KOWALSKI David J (AREVA NP INC); BRYAN Martin (EXT)
Subject: Response to U.S. EPR Design Certification Application RAI No. 329, FSAR Ch. 10 OPEN ITEM
Attachments: RAI 329 Response US EPR DC.pdf

Getachew,

Attached please find AREVA NP Inc.'s response to the subject request for additional information (RAI). The attached file, "RAI 329 Response US EPR DC.pdf," provides a technically correct and complete response to the question.

Appended to this file are affected pages of the U.S. EPR Final Safety Analysis Report in redline-strikeout format which supports the response to RAI 329 Question 10.02-7.

The following table indicates the respective pages in the response document, "RAI 329 Response US EPR DC.pdf," that contain AREVA NP's response to the subject question.

Question #	Start Page	End Page
RAI 329 — 10.02-7	2	3

This concludes the formal AREVA NP response to RAI 329, and there are no questions from this RAI for which AREVA NP has not provided responses.

Sincerely,

Les Duncan
Licensing Engineer
AREVA NP Inc.
An AREVA and Siemens Company
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From: Tesfaye, Getachew [mailto:Getachew.Tesfaye@nrc.gov]
Sent: Monday, November 16, 2009 6:47 PM
To: ZZ-DL-A-USEPR-DL
Cc: Reddy, Devender; Hearn, Peter; Segala, John; Colaccino, Joseph; ArevaEPRDCPEm Resource
Subject: U.S. EPR Design Certification Application RAI No. 329 (3824), FSARCh. 10 OPEN ITEM

Attached please find the subject requests for additional information (RAI). **Please note this open item is incorrectly identified in the Safety Evaluation Report with Open Items for Chapter 10 as RAI 91, Question 10.02-7. The new open item number RAI 329, Question 10.02-7 will replace Open Item RAI 91, Question 10.02-7**. A draft of the RAI was provided to you on November 16, 2009, and on the same day November 16, 2009, you informed us that the RAI is clear and no further clarification is needed. As a result, no change is made to the draft RAI. The question in this RAI is an OPEN ITEM in the safety evaluation report for Chapter 10 for Phases 2 and 3 reviews. As such, the schedule we have established for your application assumes technically correct and complete responses prior to the start of Phase 4 review. For any RAI that

cannot be answered prior to the start of Phase 4 review, it is expected that a date for receipt of this information will be provided so that the staff can assess how this information will impact the published schedule.

Thanks,

Thanks,
Getachew Tesfaye
Sr. Project Manager
NRO/DNRL/NARP
(301) 415-3361

Hearing Identifier: AREVA_EPR_DC_RAIs
Email Number: 1176

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Subject: Response to U.S. EPR Design Certification Application RAI No. 329, FSAR Ch. 10 OPEN ITEM
Sent Date: 2/25/2010 2:22:55 PM
Received Date: 2/25/2010 2:22:58 PM
From: DUNCAN Leslie E (AREVA NP INC)

Created By: Leslie.Duncan@areva.com

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Files	**Size**	**Date & Time**
MESSAGE	2524	2/25/2010 2:22:58 PM
RAI 329 Response US EPR DC.pdf	231716	

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

Response to

Request for Additional Information No. 329 (3824), Revision 1
11/16/2009
U.S. EPR Standard Design Certification
AREVA NP Inc.
Docket No. 52-020
SRP Section: 10.02 - Turbine Generator
Application Section: 10.2

QUESTIONS for Balance of Plant Branch 1 (AP1000/EPR Projects) (SBPA)

Question 10.02-7:

OPEN ITEM (This open item replaces Open Item RAI 91, Question 10.02-7 in the Safety Evaluation with Open Item for Chapter 10.)

Follow Up to RAI 243, Question 10.02-6

With respect to turbine-generator (T-G) overspeed control systems of U.S. EPR FSAR, the staff issued Supplemental RAI 243 Question 10.2 -6 as a follow-up to EPR RAI 91, Question 10.2-1. In this supplemental RAI, the staff requested AREVA (the applicant) to provide additional information and revise the FSAR to include: a) a COL information item in the FSAR to instruct the COL applicants, that use the EPR T-G design, to provide schematics and logic diagrams of the digital overspeed control systems, and b) full justification that the EPR T-G control systems meet the single-failure criteria as described in Item 1A of the Standard Review Plan (SRP) Acceptance Criteria in Section II of the SRP Section 10.2 for T-G systems.

AREVA responded to Question 10.2-6 in its response to RAI 243, Revision 0 dated 6/15/2009, and provided the additional information the staff requested. In its response, AREVA provided a new COL information item in Tier 2 FSAR (Table 1.8 -2, Item 10.2-4) to instruct the COL applicants to provide schematics and logic diagrams for the T-G overspeed control systems. The applicant also provided additional details regarding single-failure criteria for the overspeed systems, as described in the SRP.

The staff evaluated AREVA's response regarding the single-failure acceptance criterion, and concluded that the proposed FSAR mark-ups to Revision 2 of the FSAR meet the SRP guidance. The staff also finds the addition of COL information item in the FSAR for the schematics and logic diagrams are acceptable.

In accordance with 10 CFR 52.47(b)(1), the staff requests the applicant to provide Tier 1 inspection, test, analysis and acceptance criteria (ITAAC) for the two redundant electrical overspeed protection systems to confirm that the design diversity between the two redundant electrical overspeed protection systems exists as described within the FSAR mark-ups provided in RAI No. 243 (2991), Revision 0, question 10.02-6.

In accordance with 10 CFR 52.47(a), the NRC staff also requests that the applicant revise the U.S EPR FSAR to include the two below listed figures provided in the response to Request for Additional Information No. 243 (2991), Revision 0, Question 10.02-6:

Figure 10.02-6-1—Overspeed Trip System Schematic

Figure 10.02-6-2—Turbine Trip Block Schematic

Response to Question 10.02-7:

U.S. EPR FSAR Tier 1, Section 2.8.1 and Table 2.8.1-3—Turbine-Generator System ITAAC will be revised to provide ITAAC to confirm that the two redundant overspeed protection systems are diverse.

U.S. EPR FSAR Tier 2, Section 10.2.2.9 will be revised to include the following new figures showing the schematic of the overspeed protection system and turbine trip block:

- U.S. EPR FSAR Tier 2, Figure 10.2-2—Overspeed Protection System Schematic.
- U.S. EPR FSAR Tier 2, Figure 10.2-3—Turbine Trip Block Schematic.

FSAR Impact:

U.S. EPR FSAR Tier 1, Section 2.8.1 and Table 2.8.1-3, and U.S. EPR FSAR Tier 2, Section 10.2.2.9 will be revised as described in the response and indicated on the enclosed markup.

U.S. EPR Final Safety Analysis Report Markups

3.0 Instrumentation and Controls (I&C) Design Features, Displays, and Controls

~~3.0~~3.1 Controls exist in the main control room (MCR) to trip the turbine-generator.

~~3.1 Overspeed protection systems are listed in Table 2.8.1-2—Turbine-Generator System Equipment I&C and Electrical Design.~~

3.2 The turbine generator has overspeed protection.

4.0 Electrical Power Design Features

10.2-7

~~4.0~~4.1 Turbine stop valves and turbine control valves as listed in Table 2.8.1-1 fail closed on loss of power.

5.0 Inspections, Tests, Analyses, and Acceptance Criteria

Table 2.8.1-3 lists the turbine-generator system ITAAC.

Table 2.8.1-3—Turbine-Generator System ITAAC (2 Sheets)

Commitment Wording		Inspections, Tests, Analyses	Acceptance Criteria
2.4	Turbine disk integrity is provided through the combined use of selected materials with suitable toughness, analyses, design, testing, and inspections.	An analysis of turbine rotor material property data, turbine rotor and blade design, and pre-service inspection and testing requirements will be conducted. This information will be available for review greater than one year before loading the fuel.	An analysis exists and concludes that the turbine disk integrity meets the requirements of the manufacturer's turbine missile probability analysis: (1) turbine material property data, rotor and blade design analyses (including loading combinations, assumptions and warm-up time) demonstrating sufficient safety margin to withstand loadings from overspeed events, and (2) the requirements for pre-service testing and inspection information.
2.5	The probability of turbine material and overspeed related failures resulting in external turbine missiles is < $1x10^{-4}$ per turbine year.	A material and overspeed failures analysis will be performed on the as-built turbine design.	An analysis exists and concludes that the probability of turbine material and overspeed related failures resulting in external turbine missiles is < 1x10-4 per turbine year.
3.1	Controls exist in the MCR to trip the turbine-generator.	Tests will be performed for the existence of control signals from the MCR.	Controls exist in the MCR to trip the turbine-generator.
~~3.2~~	~~Overspeed protection systems for the turbine-generator system are listed in Table 2.8.1-2.~~	~~Tests will be performed for operation of the overspeed and backup overspeed protection systems listed in Table 2.8.1-2.~~	~~Overspeed and backup overspeed turbine trips occur within the design limits.~~
3.2	The turbine generator has overspeed protection	a) Analyses will be performed on the overspeed protection system. b) Tests will be performed for operation of the overspeed and backup overspeed protection systems listed in Table 2.8.1-2.	a) A report exists and concludes that the turbine overspeed protection systems are diverse. b) Overspeed and backup overspeed turbine trips occur within the design limits.

10.2-7

The turbine control valves are positioned by electro-hydraulic servo actuators in response to signals from their respective flow control unit. The flow control unit signal positions the control valves for wide-range speed control through the normal turbine operating range and for load control after the TG unit is synchronized.

The reheat stop and intercept valves, located in the hot reheat lines at the inlet of the IP turbines, control steam flow to the IP turbines. During normal operation of the turbine, the reheat stop and intercept valves are fully open. The intercept valve flow control unit positions the valve during startup and normal operation and closes the valve rapidly on loss of turbine load. The reheat stop valves close completely on turbine overspeed and turbine trip.

10.2.2.9 Overspeed Protection

A protective trip system is provided to quickly close the main stop, control, reheat stop and intercept valves in the event of an unsafe condition or to provide overspeed protection. The system is designed to minimize false and spurious trips during normal operation and allow testing of the trip system during operation. A power load imbalance function is provided, which compares turbine and generator load and initiates an appropriate momentary control valve closure when the turbine load exceeds the generator load by a specified amount.

~~Two independent electrical overspeed trip devices are provided. Each independent electrical overspeed trip system is designed and manufactured by a different vendor. There are no common components or process inputs between the two systems. Each system will be installed in a separate cubicle and with separate power sources.~~The steam turbine has two redundant and diverse electrical overspeed systems that meet the single failure criterion. The two overspeed protection systems are redundant from the speed probes to the turbine trip relays. Both overspeed protection systems have three independent speed probes and processing modules acting on one of three electronic tripping channels. Each independent electrical overspeed trip system is designed and manufactured by a different vendor. Each vendor directly manufactures their system components (e.g., motherboards, sensors) and develops the software to transform the analog speed sensor signal into a digital signal. There are no common components or process inputs between the two systems. Each system will be installed in a separate cubicle with separate power sources. Figure 10.2-2—Overspeed Protection System Schematic shows the separate source of power supply to each system and how the sensors are treated by independent mothercards.

10.2-7

The trip block provides an interface between the electrical and hydraulic systems and consists of three trip solenoid valves. The three independent electronic channels energize three fail safe solenoid valves (trip by loss of power). Each solenoid valve acts on two hydraulic relays of the trip block in order to perform the hydraulic two-out-of-three trip voting. The turbine will be tripped when a least two solenoid valves are de-

energized. An interruption and discharge of the fluid supply by the trip block will cause the high pressure and intermediate pressure valves to close by spring action. Figure 10.2-3—Turbine Trip Block Schematic provides a schematic of the trip block. Failure of the hydraulic tubing between the trip block and the valve actuator, or between the hydraulic fluid tank and the valve actuator will cause a loss of fluid pressure, which closes the valves. Thus, the trip block is designed fail safe, due to the fact that any failure (e.g., loss of power, loss of safety fluid pressure, fluid leak) will cause a steam turbine trip.

The primary electrical overspeed trip system fully closes the valves at about 110 percent of rated speed. An independent and redundant backup electrical overspeed trip circuit is provided to fully close these valves at about 111 percent of rated speed. The TG rotor is designed to withstand 120 percent of rated speed.

The actuation of the turbine protection system does not rely on components in the electro-hydraulic control system. Conversely, turbine trip initiation devices are not used for normal control of the unit.

Provisions for online testing of the emergency trip system, including individual trip devices, are provided.

After receipt of a trip signal, the hydraulic controllers for the main stop, control, reheat stop and intercept valves close off these valves quickly to preclude an unsafe turbine overspeed. The response of the controllers considers the residual steam in the piping between the valves and the turbine.

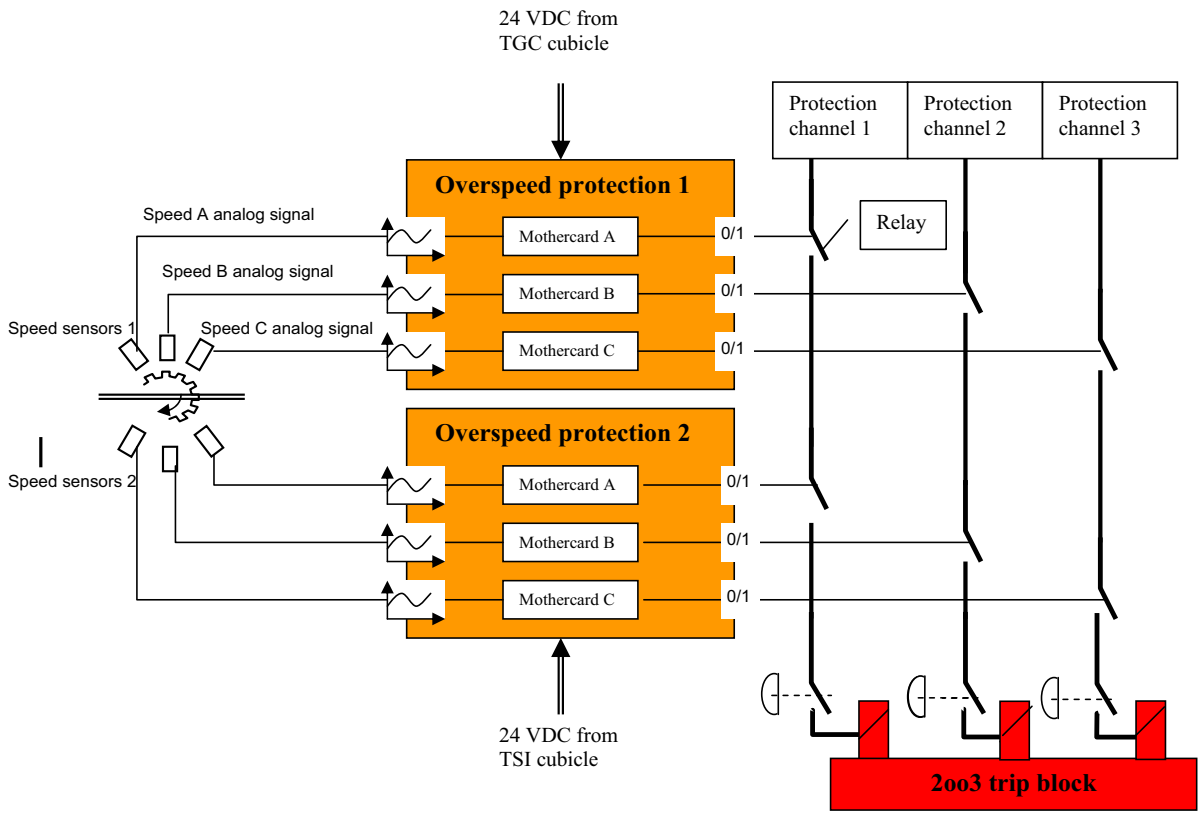
10.2.2.10 Turbine Supervisory Instrumentation

TSI monitors thermal, hydraulic and electrical parameters; controls equipment components; and initiates automatic alarms and automatic shutdown of the TG in the event of an unsafe condition. Monitoring instrumentation interfaces with the plant PAS. The following conditions initiate a turbine trip:

- Low bearing oil pressure.
- Low control oil (hydraulic fluid) pressure.
- High condenser back pressure.
- Turbine overspeed.
- Thrust bearing excessive wear.
- Remote trip (includes manual and reactor trips).
- Excessive 'Time of Operation above No Flow Load' (initiated by generator reverse power relay after time delay specified by turbine designer).

10.2-7

Figure 10.2-2—Overspeed Protection System Schematic



EPR8000 T2

Next File

10.2-7

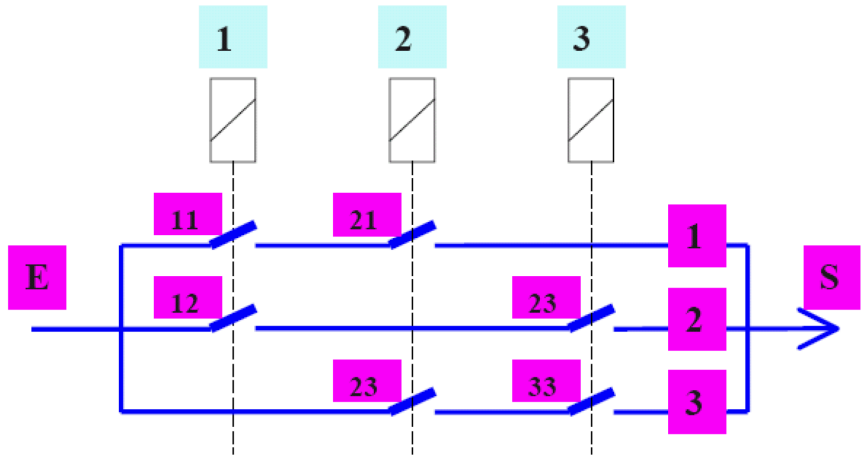



Figure 10.2-3—Turbine Trip Block Schematic