ArevaEPRDCPEm Resource

From: BRYAN Martin (EXTERNAL AREVA) [Martin.Bryan.ext@areva.com]
Sent: Sunday, August 22, 2010 11:53 AM
To: Tesfaye, Getachew
Cc: Hearn, Peter; KOWALSKI David (AREVA)
Subject: FW: DRAFT RESPONSES FOR FSAR Chapter 9 Weekly NRC Telecon
Attachments: Blank Bkgrd.gif; DRAFT RESPONSE RAI 417 Q.09.02.02-120.pdf; DRAFT RESPONSE RAI 375 Q.09.02.02-105.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 375 and 417 questions. These responses will be discussed at Tuesday's (8/24/10) FSAR Chapter 9 Weekly Telecon/GoToMeeting with the NRC.

Attached are the following DRAFT response(s):

- Response to RAI 375 - Question 09.02.02-105.
- Response to RAI 417 - Question 09.02.02-120.

Note that these DRAFT responses have not been through the final Licensing review/approval process; nor do they reflect technical editing.

Please call me if you have any questions. Thanks.

David J. Kowalski, P.E.
Principal Engineer
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Request for Additional Information No. 417(4741), Revision 0

6/8/2010

U. S. EPR Standard Design Certification
AREVA NP Inc.
Docket No. 52-020
SRP Section: 09.02.02 - Reactor Auxiliary Cooling Water Systems
Application Section: 9.2.2

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

09.02.02-120

Follow-up to RAI 334, Question 9.2.2-75 and RAI 174, Question 9.2.2-29:

Part (c)- In Part (c) of follow-up RAI 9.2.2-75 to RAI 9.2.2-29 the staff asked the applicant to add a discussion to FSAR Tier 2 Section 9.2.2 relative to the intended use of common header manual isolation valves (e.g. 20/30KAA30 AA013 and AA014 for 1b and 2b common header). The staff also requested the applicant to include a discussion in the RAI response of potential Technical Specifications that may apply if these valves must be closed during power operation. In response to RAI 334 Supplement 1, the applicant stated that these valves were provided only for maintenance isolation purpose to provide the capability for isolation of a common headers (1b or 2b) while still maintaining flow to the Safety Chilled Water System (SCWS).

However, the staff review noted that the applicant's response did not address the potential applicability of Technical Specifications (TS) when the valves are closed (e.g. note A-1 of TS 3.7.7) and no FSAR text markup of Section 9.2.2 was included. The staff noted that closure of these valves would prevent automatic train switchover of the 1b or 2b headers to the opposite pump and the plant would then be forced to shutdown since the 1b or 2b header would be isolated to the reactor coolant pumps for two pumps. Accordingly, the staff considers the capability provided by these valves of sufficient importance to warrant a description in the FSAR Tier 2 Section 9.2.2. The staff also requests that the applicant explain what is meant by the portion of the response that states "This configuration confirms the availability of the safety chillers during normal plant operation when only two CCWS trains are operating."

In summary, the applicant should address the following:

a. The applicant should address the meaning of: "This configuration confirms the availability of the safety chillers during normal plant operation when only two CCWS trains are operating."
b. Since credit is taken for these manual valves to isolate either the 1b or 2b header and provide CCWS flow to the SCWS to maintain operability, this should be discussed in the FSAR in Section 9.2.2.
c. For manual valves 20/30KAA30 AA013 and AA014 for the 1b and 2b common headers, which are required to be manually closed (for example, during maintenance conditions) to maintain system operability, testing should be included that these valves are able to be closed and provide proper isolation.

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d. The applicant should include a discussion of potential Technical Specifications that may apply if these valves must be closed in the applicable TS modes.
e. The applicant should explain (from RAI 9.2.2-29) the equalizing of runtimes of each CCWS pumpby the closing of these maintenance valves.

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Response to Question 09.02.02-120:

a. Valves KAA20/30 AA013 and AA014 are manual isolation valves that are normally open in all CCWS operating modes. These valves are intended for use only when the common header requires isolation for maintenance and the water cooled Safety Chilled Water System Divisions 2 and 3 are required for operation. Closing these manual isolation valves for common header maintenance allows the operator the option of supplying CCWS flow to division 2 of the SCWS via the CCWS train 2 pump and division 3 of the SCWS via the CCWS train 3 pump. Note that divisions 1 and 4 of the SCWS are air cooled while divisions 2 and 3 are water cooled with the supply provided from the Common "B" portions of each CCWS common header. For division 2 or 3 of the SCWS to require CCWS flow while the CCWS common header is isolated for maintenance, both of the air cooled divisions of SCWS would also have to be out of service. Valves KAA20/30 AA013/014 are only closed during plant shutdown (for example Modes 5 and 6) for maintenance activities on the 1B or 2B headers where the water cooled divisions of the Safety Chilled Water System are needed.

   These manual isolation valves do not confirm the availability of the safety chillers during normal plant operation when only two CCWS trains are operating. If only two CCWS trains are operating and those two trains supply the same common header, these manual isolation valves give the operator the option of supplying the SCWS division from one of the two available CCWS trains. In all normal operations, the SCWS is supplied from the Common "B" header along with all other common loads. These manual isolation valves only provide the operator an additional option to isolate and supply all of the common "B" header from one train and supply the SCWS water cooled division from the other available CCWS train.

   Due to the limited use of these valves, they will be added to FSAR table 3.9.6-2 for exercise testing in five year intervals.

b. The information in Part "a" will be added to the FSAR in section 9.2.2

c. These valves are not required to maintain CCWS operability. These valves are intended to provide the operators the option to provide CCWS cooling to the water cooled divisions of the SCWS in the event that a CCWS common header is isolated for maintenance and both of the air cooled divisions of SCWS are out of service.

d. If one train of CCWS is inoperable the operators have a completion time of 120 days to restore that train to operable status per Tech Spec 3.7.7 Required Action A.2. These manual isolation valves would not be closed in this operating mode as the remaining train would provide cooling to the entire common header, while the other two CCWS trains would be available for cooling of the other common header.

   If two CCWS trains are inoperable the operators have a completion time of 72 hours to restore one CCWS train to operable status per Tech Spec 3.7.7 Required Action B.1. In this scenario if it is assumed that both operable CCWS trains supply the same common header these manual isolation valves would not be closed. The valves would remain open and the water cooled SCWS division associated with that common header would receive CCWS cooling along with the other common header users. If during the 72 LCO, the operators had a need to run the CCWS train 2 or 3

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pump, these manual isolation valves could be closed to provide cooling to the water cooled division of the SCWS from that particular CCWS train while the remainder of the common header is cooled by the other operable CCWS train.

e. Refer to the Response to Part “a” and “d” above.

FSAR Impact:

U.S. EPR FSAR Tier 2 Section 9.2.2 and Table 3.9.6-2 will be revised as described in the response and indicated on the enclosed markup.

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- Isolation valves to separate the safety-related train from the common load set.

Each CCWS safety-related train supplies cooling to its respective CCWS and medium head safety injection (MHSI) pumps and motors and associated LHSI/RHR HXs, and trains 2 and 3 cool their respective LHSI pumps and motors. The LHSI pumps and motors of trains 1 and 4 are cooled by the SCWS.

The SCWS chillers for divisions 2 and 3 are supplied by CCWS trains 1 or 2, and 3 or 4, respectively. This enables continuous availability of the safety chillers during testing or maintenance activity and allows for equitable distribution of operating time for each of the CCWS safety-related trains. The CCWS safety-related trains are shown in Figure 9.2.2-1—Component Cooling Water System Trains 1 through 4.

The non-safety-related operational loads are supplied by two separate isolable headers designated common 1 and common 2. Common 1 may be aligned for service from either safety-related trains 1 or 2, and common 2 may be aligned to safety-related trains 3 or 4. Each common header branches into subheaders further designated "a" and "b" (i.e., common 1.a, 1.b, 2.a, and 2.b). Headers 1.a and 2.a, which cool FPCS trains 1 and 2, respectively, are separate from the other operational loads to provide continued cooling of the spent fuel. Headers 1.b and 2.b cool the remaining operational CCWS loads. Each of the common b-loops is isolable from the associated safety train by two fast-acting hydraulic valves, one installed in each train supply line and the other in the return line.

Common 1.b or 2.b headers cools multiple loads throughout the plant. The loads for each (b) header are summarized in Table 9.2.2-3—CCWS Common Header Users. ~~RB CCWS loads through two branches. One branch cools RCP 1, RCP 2, and CVCS high pressure (HP) cooler 1. The other branch cools heating ventilation and air conditioning (HVAC) coolers 1, 2, 3, and 4 and the RCDT cooler. Common 1.b also cools CVCS charging pump 1 and sampling system coolers in the FB, and the first chiller of both OCWS subsystems in the NAB.~~

~~Common 2.b cools RCP 3, RCP 4, and CVCS HP cooler 2 in the RB; CVCS charging pump 2 and sampling system coolers in the FB; and the second chiller of both OCWS subsystem, liquid, waste, coolant treatment, and boron recycle system users in the NAB and RWB.~~

RCP 1, 2, 3 and 4 thermal barriers are capable of being cooled from either common header.

~~To maintain CCWS train separation for the RCP thermal barrier cooling, an interlocking function is required. Either CCWS Common 1b or 2b headers can provide cooling to the thermal barriers. To maintain strict separation, the containment isolation valves on the RCP thermal barrier cooling path on the supply and return side of CCWS Common 1b cannot be opened unless the CIVs on both the~~

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Table 3.9.6-2—Inservice Valve Testing Program Requirements
Sheet 48 of 97

Valve Identification Number[1]	Description/ Valve Function	Valve Type[2]	Valve Actuator[3]	ASME Code Class[4]	ASME OM Code Category[5]	Active / Passive[6]	Safety Position[7]	Test Required[8,10]	Test Frequency[9]	Comments
30KAA40AA032	Quick Closing Valve for KAA40 to Common2A	BF	HO	3	A	A	O/C	ET ST LT PI	Q Q 2Y 2Y	
30KAA40AA033	Quick Closing Valve for Common2A to KAA40	BF	HO	3	A	A	O/C	ET ST LT PI	Q Q 2Y 2Y	
30KAA40AA112	Bypass Control Valve for KAA40 AC001	BF	MO	3	A	A	O/C	ET ST LT PI	Q Q 2Y 2Y	
30KAA42AA005	CCW Isolation Valve for LHSI HX 4	BF	MO	3	A	A	O	ET ST LT PI	Q Q 2Y 2Y	
30KAA42AA012	Check Valve Downstream LHSI HX 40	CK	SA	3	C	A	O	ET	Q	
30KAB10AA192	RV Downstream Common 1B	RV	SA	3	C	A	O/C	ET LT	10Y 10Y	
30KAB80AA015	Supply Isolation Operational Chilled Water Users	BF	HO	3	A	A	C	ET ST LT PI	Q Q 2Y 2Y	

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RAI 417, Q 9.2.2-120 Insert 'A'

Valve Identification Number	Description/Valve Function	Valve Type	Valve Actuator	ASME Code Class	ASME OM Code Category	Active / Passive	Safety Position	Test Required	Te Frequ
30KAA20AA013	Common 1.B Supply Manual Isolation Valve	BF	MA	3	B	A	O/C	ET	5
30KAA20AA014	Common 1.B Return Manual Isolation Valve	BF	MA	3	B	A	O/C	ET	5
30KAA30AA013	Common 2.B Supply Manual Isolation Valve	BF	MA	3	B	A	O/C	ET	5
30KAA30AA014	Common 2.B Return Manual Isolation Valve	BF	MA	3	B	A	O/C	ET	5

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Response to

Request for Additional Information No. 375(4402), Supplement 4

4/27/2010

U.S. EPR Standard Design Certification
AREVA NP Inc.
Docket No. 52-020
SRP Section: 09.02.02 - Reactor Auxiliary Cooling Water Systems
SRP Section: 09.05.01 - Fire Protection Program

Application Section: FSAR Chapter 9

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

DRAFT

Question 09.02.02-105:

FSAR Tier 2 Section 10.2.2.4, "Excitation System," states that the turbine building closed cooling water system (TBCCWS) provides cooling water to the brushgear air-to-water heat exchangers. However, the TBCCWS is not described in the FSAR.

FSAR Tier 2 Section 10.2.2.1.2, "TG Accessories," lists many TG accessories systems such as stator cooling, seal oil, bearing lubrication oil; however, the cooling system for these accessories is not described in the FSAR. Verify whether this cooling system is the same as TBCCWS.

FSAR Tier 2 Section 10.4.2.2.1, "General Description," for the main condenser evacuation system states that a closed cooling water type system cools the heat exchanger for this system. This cooling water system is not described in the FSAR. Verify whether this cooling system is the same as TBCCWS.

In accordance with 10 CFR52.47 (a)(24), the applicant should either provide a full description of the TBCCWS in Chapters 9 and 10 of the FSAR or revise FSAR Section 1.8, "Interfaces with Standard Designs and Early Site Permits," to indicate that the TBCCWS is outside the scope of the EPR standard design and provide a conceptual design of the TBCCWS and the TBCCWS heat sink in Chapter 9 of the FSAR.

The FSAR should specifically address the TBCCWS components that require cooling, such as various heat exchangers, chillers, sample racks, oil coolers, seals, air compressors, and pumps, such as condensate and feedwater. In addition, portions of NUREG-0800 Standard Review Plan (SRP) Section 9.2.2, "Reactor Auxiliary Cooling Water System," that pertain to the non-safety cooling water systems need to be fully addressed. This includes, General Design Criteria (GDC) 2, 10 CFR 20.1406, and Inspection, Testing, Analyses and Acceptance (ITAAC) requirements should to be discussed as applicable which includes interface requirements for conceptual design portions.

Response to Question 09.02.02-105:

a. "FSAR Tier 2 Section 10.2.2.4, "Excitation System," states that the turbine building closed cooling water system (TBCCWS) provides cooling water to the brushgear air-to-water heat exchangers. However, the TBCCWS is not described in the FSAR."

   U.S. EPR FSAR Tier 2, Chapter 9 will be revised to include a new Section 9.2.10, which provides a description of the TBCCWS. The following U.S. EPR FSAR sections will be revised to reflect the addition of the TBCCWS:

   - Tier 1, Section 2.7.13 (new section).
   - Tier 2, Table 1.1-1–U.S. EPR FSAR Acronyms and Descriptions.
   - Tier 2, Table 3.2.2-1–Classification Summary.
   - Tier 2, Section 10.2.2.4.
   - Tier 2, Section 10.4.2.2.1.

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b. "FSAR Tier 2 Section 10.2.2.1.2, "TG Accessories," lists many TG accessories systems such as stator cooling, seal oil, bearing lubrication oil; however, the cooling system for these accessories is not described in the FSAR. Verify whether this cooling system is the same as TBCCWS."

   The cooling system for these accessories is the TBCCWS.

c. "FSAR Tier 2 Section 10.4.2.2.1, "General Description," for the main condenser evacuation system states that a closed cooling water type system cools the heat exchanger for this system. This cooling water system is not described in the FSAR. Verify whether this cooling system is the same as TBCCWS."

   The cooling system cited in U.S. EPR FSAR Tier 2, Section 10.4.2.2.1 is the TBCCWS.

FSAR Impact:

U.S. EPR FSAR Tier 1, Section 2.7; and Tier 2, Table 1.1-1, Table 3.2.2-1, Chapter 9, Section 10.2.2.4 and 10.4.2.2.1 will be revised as described in the response and indicated on the enclosed markup.

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FSAR Insert for Response to Question 09.02.02-105

New U.S. EPR FSAR Section 9.2.10

9.2.10 Turbine Building Closed Cooling Water System

The turbine building closed cooling water system (TBCCWS) is a closed loop system, which provides water to non-safety-related secondary side Conventional Island (CI) equipment coolers and heat exchangers (HX). The TBCCWS removes heat generated by components in the conventional part of the plant and transfers it to the non-safety-related auxiliary cooling water system (ACWS) for rejection to the normal heat sink.

9.2.10.1 Design Bases

The TBCCWS performs no safety function and has no safety design basis. The system is not required to operate during or after a design basis event (DBE).

9.2.10.2 System Description

9.2.10.2.1 General Description

The TBCCWS provides cooling to several secondary side CI power generation components. The system has adequate margin in its heat removal capacity to accommodate the highest user heat loads with the maximum expected cooling water temperature in the ACWS.

The TBCCWS includes three 50 percent capacity pumps supplying a common header, which in turn, supplies three 50 percent capacity TBCCWS cooled HXs and one bypass line, which supply a common piping system that delivers cooling flow to various component coolers throughout the CI and returns the heated water to the common suction of the TBCCWS pumps. An expansion tank connected to the pump suction header maintains the system filled, thereby providing protection against cavitation and water hammer. During cold weather or low load operations, the TBCCWS minimum temperature is maintained through HX bypass flow control by a temperature-controlled bypass line flow control valve. Components and piping in the system are designed for ambient conditions in the TB.

9.2.10.2.2 Component Description

Refer to Table 3.2.2-1 for the quality group classification of the TBCCWS system, structures and components (SSC).

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Turbine Building Closed Cooling Water Pump

The TBCCWS pumps provide the motive circulation force for the system. During normal operation, any two of the three 50 percent capacity cooling water pumps discharge water to any two of the three 50 percent TBCCWS HXs.

Turbine Building Closed Cooling Water Heat Exchanger

Two of three 50 percent capacity TBCCWS HXs operate under plant normal load conditions to remove heat from secondary side component coolers and HXs. The heat sink for the HXs is the ACWS. The heat exchangers are ASME Section VIII pressure vessels that are supplied with a relief valve sized for thermal expansion.

Turbine Building Closed Cooling Water Expansion Tank

The TBCCWS expansion tank provides volumetric and pressure control for the TBCCWS during normal operation. The expansion tank is sized to accommodate level change based on expected pump suction conditions and thermal expansion and contraction. The expansion tank also provides pump net positive suction head (NPSH) protection by maintaining an elevated system pressure using nitrogen on one side of a diaphragm within the tank.

9.2.10.3 System Operation

During normal full load operation, two TBCCWS pumps and two HXs are in service to provide cooling to CI heat loads. In the event of a failure of one TBCCWS pump, the standby pump automatically starts. In the event of a failure of a TBCCWS HX, the standby HX is placed in service. High temperatures of the cooled components may require a load reduction or potential TG shutdown. The following loads are serviced by the TBCCWS:

- Turbine lube oil coolers and other turbine equipment, as required.
- Generator, excitation system and bus duct coolers.
- Condensate and feedwater system equipment coolers.
- Main condensate evacuation system coolers.
- Auxiliary boiler equipment coolers, as required.
- CI process auxiliary equipment coolers, as required.
- Turbine Island (TI) operational chilled water system coolers.

A connection from the demineralized water distribution system (DWDS) to the suction header accommodates system fill and makeup. There is also a connection on the suction header to accommodate injection of chemicals for TBCCWS water

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chemistry control, which is monitored through an additional connection from the sampling system. A safety valve on the suction header protects the system from overpressure.

9.2.10.4 Safety Evaluation

The TBCCWS does not perform any safety function and it does not interface with any safety-related system. The system is not important to safety and is not required to operate during or after a DBE. Therefore, the requirements of GDC 4, 44, 45 and 46 do not apply.

The TBCCWS complies with GDC 2 by adhering to the guidance of Regulatory Position C.2 of RG 1.29 for confirming that failures of the TBCCWS during seismic events will not affect the performance of any safety-related systems or components. The TBCCWS equipment is located entirely within the TB. Cooling loads are primarily in the TB. As required, cooling loads in non-safety-related outdoor areas and in the Electric Switchgear Building may be served. No safety-related equipment is located in the Turbine Building or in non-safety-related outdoor areas. Since the system is physically separated from the NI by multiple structural barriers, a malfunction of the TBCCWS does not adversely affect the safe shutdown of the plant or impact the performance of any required safety function. Therefore, the failure of the non-seismic TBCCWS (including the effects of jet impingement and flooding) cannot lead to the failure of any safety-related systems, structures and components. Flooding of the TB due to failure of the TBCCWS is bounded by the failure of the site-specific circulating water system (CWS). Refer to U.S. EPR Combined License Information Item No. 10.4-5.

The TBCCWS has no connection to systems having the potential for containing radioactive materials.

The TBCCWS is designed for a single unit and is not shared with other units.

9.2.10.5 Inspection and Testing Requirements

System components are designed to permit appropriate preservice and startup testing in conformance with conventional good operating practices and component supplier recommendations. The pressure relief valves will be tested and maintained in accordance with the manufacturer's recommendation.

9.2.10.6 Instrumentation Requirements

Installed instrumentation provides adequate information, displayed locally and in the main control room (MCR), for determination of system status.

Specific system setpoint logic is based on system or component functions and conditions. One TBCCWS pump is normally in standby and automatically starts on the trip of an operating pump without interrupting normal plant operation.

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2.7.~~12~~ 13 ~~Compressed Air~~ Turbine Building Closed Cooling Water System

There are no Tier 1 entries for this system.

Create NEW Tier 1, Section 2.7.13

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RAI 375 Q.09.02.02-105

TBCCWS Turbine Building Closed Cooling Water System

Table 1.1-1—U.S. EPR FSAR Acronyms and Descriptions
Sheet 18 of 20

Acronym	Description
SPDS	Safety Parameter Display System
SPND	Self-Powered Neutron Detector
SQDP	Seismic Qualification Data Package
SRI	Stanford Research Institute
SRM	Staff Requirement Memorandum
SRO	Senior Reactor Operator
SRP	Standard Review Plan
SRSS	Square Root of the Sum of the Squares
SS	Shift Supervisor
SSC	Structures, Systems and Components
SSE	Safe Shutdown Earthquake
SSI	Soil-Structure Interaction
S SLOCA	Seismic Small Loss of Coolant Accident
SSS	Startup and Shutdown System
SSSI	Structure-Soil-Structure Interaction
SSSS	Standstill Seal System
STA	Shift Technical Advisor
SU	Service Unit
SWBVS	Switchgear Building Ventilation System, Turbine Island
SWCCF	Software Common Cause Failure
SWMS	Solid Waste Management System
SWSC	Service Water System (Conventional)
SWYD	Switchyard
T_{AVG}	Temperature (Average)
TA	Task Analysis
TAF	Top of Active Fuel
TB	Turbine Building
TBPD	Turbine Building Plant Drainage
TBS	Turbine Bypass System
TBVS	Turbine Building Ventilation System
TCV	Turbine Control Valve
TD	Theoretical Density
TG	Turbine Generator

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RAI 375 Q.09.02.02-105

Table 3.2.2-1—Classification Summary
Sheet 151 of 182

KKS System or Component Code	SSC Description	Safety Classification (Note 15)	Quality Group Classification	Seismic Category (Note 16)	10 CFR 50 Appendix B Program (Note 5)	Location (Note 17)	Comments/ Commercial Code
PA	Circulating Water Supply System	NS	E	NSC	No	UMA, UZT	
STRUCTURES							
UFA, UJA, UJB, UJH, UJK, UJE, JM	Nuclear Island Structural System (Fuel, Reactor, Safeguard Buildings)	S	N/A	I	Yes	UFA, UJA, UJB, UJH, UJK, UJE, JM	
JMK	Piping Containment Penetrations	S	B	I	Yes	UJA, UJB	ASME Class 2[2]
JML	Cable Containment Penetrations	S	B	I	Yes	UJA, UJB	ASME Class 2[2]
UBP	Emergency Power Generating Buildings	S	N/A	I	Yes	UBP	
URB	Essential Service Water Cooling Tower Structures	S	N/A	I	Yes	URB	
UQB	Essential Service Water Pump Buildings	S	N/A	I	Yes	UQB	
UKA	Nuclear Auxiliary Building	NS-AQ	N/A	RS, II	Yes	UKA	
PG	Turbine Building Closed Cooling Water System	NS	E	NSC	No	UMA, UZT	ASME B31.1[6] ASME VIII[8]

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RAI 375 Q.09.02.02-105

The turbine shaft seals and the main steam valve glands are fitted with connections to the gland steam system.

10.2.2.4 Excitation System

The excitation system is static with a solid-state voltage regulator. Excitation power is obtained from dry type, indoor excitation transformers, which are directly connected to the main generator IPB. The brushgear includes the enclosure with coolers, filters, moisture control, brush holders and brushes; and the slip rings mounted on a generator shaft extension. The exciter rectifiers are arranged in a full-wave bridge configuration and protected by a series-connected fuse. The Turbine Building closed cooling water system provides cooling water to the brushgear air-to-water heat exchangers. The TBCCWS is addressed in Section 9.2.10.
(TBCCWS)

10.2.2.5 TG Control System

The TG control system is a fault-tolerant control system with the following features:

- Triple processors and two-out-of-three trip logic.
- Automatic synchronizing capabilities.
- Automatic TG startup and shutdown control system functions as well as separate automatic startup and shutdown functions for each individual auxiliary system. These automatic functions are separate and independent of each other.
- Automatic and manual controls in the control room to preheat the turbines, start and load the unit from no load to full load, adjust load during continuous operation, perform all normal (periodic) test functions, and unload the unit for shutdown. Automatic controls are based, in part, on thermal ramp rate, acceleration through critical speeds, rotor stress and heat soak (temperature gradient minimization) of cylinders, shells and rotors.
- Redundant communication paths between processors within the turbine control system.
- Digital speed governor.
- On-line redundancy in a hot standby arrangement for turbine governor processors.
- Redundant power supplies for processors, chassis, input/output (I/O) modules, and field devices with alarm notification of any malfunction.
- Two redundant communication paths for each turbine-generator package from the TG control system main control cabinet to the operator workstation.
- Two redundant communication paths within the TG control system connecting to the plant PAS.

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Initial filling of the seal water reservoirs of the exhauster and make-up water supply to the units is provided from the sealing and cooling drains system. Excess process water, produced primarily by condensation of the steam extracted during operation, is discharged into the building drain system.

The liquid ring in the vacuum pumps is maintained and cooled by a process water circuit. Process water is extracted from the moisture separators, passed to the vacuum pumps via the heat exchangers and returned to the moisture separators. Heat dissipated by the vacuum pumps and the heat of condensation from the steam component, which is absorbed by the process water circuit, is removed by the heat exchangers. The heat exchangers are supplied with cooling water from ~~a~~ the turbine building closed cooling water ~~type~~ system. (TBCCWS). The TBCCWS is addressed in Section 9.2.10.

Seal water from the sealing and cooling drains system is admitted to the stems of the isolation valves in the air removal lines from each condenser shell, the isolation valves in the air removal header and the air intake isolation valves.

10.4.2.2.2 Component Description

The major components of the MCES are described below. Table 3.2.2-1 provides the quality group and seismic design classification of components and equipment in the MCES. Individual codes and standards applicable to each component are also listed below. Section 3.2 describes how the guidance of RG 1.26 is implemented for the U.S. EPR.

Mechanical Vacuum Pumps

The mechanical vacuum pumps remove air and other non-condensable gases from the condensers. The capacity is in accordance with the Heat Exchanger Institute (HEI) Standards for Steam Surface Condensers (Reference 1) and is adequate to maintain condenser backpressure with one holding exhauster in operation, under normal conditions. An additional holding exhauster per condenser and one hogging exhauster for all condensers is installed for the hogging mode. The purpose of these exhausters is to assist in removing air from the turbine, moisture separator reheaters, condensers, feedwater heaters and associated piping, prior to startup of the turbine. The mechanical exhausters are electric motor-driven, two stage, liquid ring seal vacuum pumps. Each is a complete self-contained package consisting of a unit motor, heat exchanger, combination separator and seal water reservoir, exhauster silencer–moisture separator, and control and monitoring instrumentation. Materials are suitable for the specified service and conditions.

Seal Water Heat Exchangers

The vacuum pump heat exchangers will be either shell-and-tube or plate type. Materials will suitable for the specified service and conditions.

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