ArevaEPRDCPEm Resource

From: Hearn, Peter
Sent: Friday, March 21, 2014 3:55 PM
To: ArevaEPRDCPEm Resource
Cc: Makar, Gregory
Subject: FW: Advanced Response: US EPR DC FINAL RAI 610, Chapter 10, Balance of Plant
Attachments: RAI 610 Advanced Response US EPR DC.pdf

From: GUCWA Len (EXTERNAL AREVA) [mailto:Len.Gucwa.ext@areva.com]
Sent: Friday, March 14, 2014 6:00 PM
To: Hearn, Peter
Cc: Wunder, George; HOTTLE Nathan (AREVA); GUCWA Len (EXTERNAL AREVA); UYEDA Graydon (AREVA); SEALS Jeff (AREVA); RANSOM Jim (AREVA); LEIGHLITER John (AREVA); WILLIFORD Dennis (AREVA); RYAN Tom (AREVA); ROMINE Judy (AREVA); DELANO Karen (AREVA); WILLS Tiffany (AREVA); BALLARD Bob (AREVA); KOWALSKI David (AREVA); MUSGRAVE Jennifer (AREVA)
Subject: Advanced Response: US EPR DC FINAL RAI 610, Chapter 10, Balance of Plant

Pete,

To support a final response date of May 15, 2014, an Advanced Response for RAI No. 610, Questions 10.04.08-5 through 10.04.08-8 and 10.04.08-10 are provided in the attached file, "RAI 610 Advanced Response US EPR DC.pdf."

To keep our commitment to send a final response to these questions by the final response date, we need to receive all NRC staff feedback and comments no later than **April 14, 2014**.

AREVA requires additional time to address Question 10.04.08-9. The new schedule for this question is provided below. The schedule for the remaining questions is unchanged.

Question #	Advanced Response Date	NRC Comment Request Date	Final Response Date
RAI 610 — 10.04.08-5	March 14, 2014	April 14, 2014	May 15, 2014
RAI 610 — 10.04.08-6	March 14, 2014	April 14, 2014	May 15, 2014
RAI 610 — 10.04.08-7	March 14, 2014	April 14, 2014	May 15, 2014
RAI 610 — 10.04.08-8	March 14, 2014	April 14, 2014	May 15, 2014
RAI 610 — 10.04.08-9	**March 27, 2014**	**April 28, 2014**	**May 29, 2014**
RAI 610 — 10.04.08-10	March 14, 2014	April 14, 2014	May 15, 2014

Please let me know if NRC staff has any questions or if this response can be sent as final.

Sincerely,

Len Gucwa, P.E.
404-673-2739 cell

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Advanced Response to

Request for Additional Information No. 610

11/06/2013
U.S. EPR Standard Design Certification
AREVA Inc.
Docket No. 52-020
SRP Section: 10.04.08 - Steam Generator Blowdown System
SRSB Branch

Question 10.04.08-5:

FSAR Rev. 5 introduces piping and valves to connect the steam generator blowdown system (SGBS) lines of SG1 to those of SG2, and the lines of SG 3 to those of SG 4. Provide the classification information for the piping required for this design change and identify where it is documented in the application. FSAR Tier 2, Table 3.2.2-1, provides this information for valves but not for piping.

Response to Question 10.04.08-5:

U.S. EPR FSAR Tier 2, Table 3.2.2-1—Classification Summary will be revised to include classification information for the SGBS piping, which connects the SGBS for SG1 to the SGBS for SG2, and also, for piping that connects the SGBS for SG3 to the SGBS for SG4.

FSAR Impact:

U.S. EPR FSAR Tier 2, Table 3.2.2-1 will be revised as described in the response and indicated on the enclosed markup.

Question 10.04.08-6:

The staff observed that RG 1.143 was deleted from the Comments section in FSAR Rev. 5, Tier 2, Table 3.2.2-1 for "All LCQ Piping and Valves in 4UJH Downstream of Outer Containment Isolation Valve." Explain the basis for the change and the use of ANSI/ASME B16.34 and RG 1.29 rather than RG 1.143.

Response to Question 10.04.08-6:

The classification information that is specified for a line item in U.S. EPR FSAR Tier 2, Table 3.2.2-1—Classification Summary dictates the commercial codes that are listed for the line item. Regulatory Guide (RG) 1.29 is applied for Seismic II over Seismic I considerations; therefore, pertinent portions of Appendix B to 10 CFR Part 50 apply to the steam generator blowdown system (SGBS). As such, the Seismic Category II portions of the SGBS are designed to withstand safe shutdown earthquake (SSE) seismic loads.

RG 1.143 provides guidance for the design of structures, systems and components (SSCs) used in radioactive waste management and SGBS to establish the minimum acceptable criteria to verify that these systems will perform their intended functions. In accordance with guidance in Table 2 of RG 1.143, Radwaste Seismic SSCs in the U.S. EPR design are designed for up to one-half SSE. As a result, the design considerations for the seismic load on Seismic Category II SSCs are more robust than those for Radwaste Seismic SSCs. The application of Seismic Category II is an enhancement to plant safety. The above considerations are the bases for the change from RG 1.143 to RG 1.29.

Also note that U.S. EPR FSAR Tier 2, Table 3.2.2-1 was revised in Revision 5 to reflect the implementation of a design change that added ANSI/ASME B16.34 to the LCQ line item, since these are considered Quality Group D components.

For consistency purposes, the entries in U.S. EPR FSAR Tier 2, Table 3.2.2-1 under SGBS have been reviewed. This review identified the need for the following corrections that were made to the table:

- For one of the line items, ANSI/ASME B31.3 is listed incorrectly and should be ANSI/ASME B31.1 per RG 1.26 for Quality Group classification. In addition, U.S. EPR FSAR Tier 2, Section 10.4.8.1 will be revised to address this line item and include clarification.
- For another line item, ASME VIII is listed incorrectly and should be ANSI/ASME B31.3 per Table 1 of RG 1.143.

Editorial changes will also be made to U.S. EPR FSAR Tier 2, Section 10.4.8.4 so that it is consistent with U.S. EPR FSAR Tier 2, Section 10.4.8.1.

FSAR Impact:

U.S. EPR FSAR Tier 2, Table 3.2.2-1 and Sections 10.4.8.1 and 10.4.8.4 will be revised as described in the response and indicated on the enclosed markup.

Question 10.04.08-7:

FSAR Rev. 5, Tier 2, Section 10.4.8.1 introduces a design basis stating that radiation monitors R-46 through R-48 are designed to isolate the SGBS on high activity coupled with a partial cooldown signal. Provide the following information about this design feature:

a) Discuss your plans for revising the FSAR to include monitor R-49 in this paragraph or provide the basis for excluding it. In Tier 1, Section 2.8.7, this design feature applies to monitors R-46 through R-49.

b) This design feature appears to conflict with FSAR Tier 2 Section 10.4.8.3.3, which does not include these monitors in the description of accident conditions that actuate the blowdown isolation valves. Similarly, the last sentence of Section 10.4.8.3.2 appears to be inconsistent with the information in Section 10.4.8.3.3. Provide an explanation for these apparent inconsistencies and your plans for revising the FSAR.

Response to Question 10.04.08-7:

a) Radiation monitoring point R-49 is one of the four radiation monitors designed to isolate the SGBS on high blowdown activity coupled with a partial cooldown signal. These radiation monitors are described in U.S. EPR FSAR Tier 2, Table 11.5-1–Radiation Monitor Detector Parameters.

   U.S. EPR FSAR Tier 2, Section 10.4.8.1 will be revised to delete references to specific radiation monitoring points in the design basis description concerning the isolation of the SGBS on high blowdown activity coupled with a partial cooldown signal. Instead, references to the applicable section and table in U.S. EPR FSAR Tier 2, Chapter 11 will be added, which provide design information for the radiation monitor detectors. U.S. EPR FSAR Tier 1, Section 2.8.7 and U.S. EPR FSAR Tier 2, Section 10.4.8.6 will also be revised to be consistent with this approach.

b) To clarify the function of the steam generator blowdown system (SGBS) and eliminate inconsistency in the U.S. EPR FSAR design, the following revisions will be made:

   – The last design basis description in U.S. EPR FSAR Tier 2, Section 10.4.8.1 will be revised to include an additional sentence.

   – The last two sentences of U.S. EPR FSAR Tier 2, Section 10.4.8.3.2 will be revised.

   – The last sentence of U.S. EPR FSAR Tier 2, Section 10.4.8.3.3 will be revised.

   – U.S. EPR FSAR, Tier 1 Section 2.8.7 and Table 2.8.7-3–Steam Generator Blowdown System ITAAC, Item 4.4, will be updated to clarify SGBS function.

FSAR Impact:

U.S. EPR FSAR Tier 1, Section 2.8.7 and Table 2.8.7-3; and U.S. EPR FSAR Tier 2, Sections 10.4.8.1, 10.4.8.3.2, 10.4.8.3.3, 10.4.8.6 will be revised as described in the response and indicated on the enclosed markup.

Question 10.04.08-8:

The design change introducing the SGBS transfer lines includes safety-related components but does not appear to be discussed in FSAR Rev. 5, Tier 2, Section 10.4.8.4, “Safety Evaluation.” Discuss your plans for revising the FSAR to address the design change. For example, address whether the single failure criterion is applied to the safety-related SGBS transfer valves, as it is for the containment isolation valves and steam generator blowdown isolation valves (i.e., last paragraph of Section 10.4.8.4).

Response to Question 10.04.08-8:

The piping and components associated with the steam generator blowdown system (SGBS) transfer lines are safety-related. Therefore, the information provided in U.S. EPR FSAR Tier 2, Section 10.4.8.4 that pertains to the “safety-related portion of the SGBS,” is applicable.

U.S. EPR FSAR Tier 2, Section 10.4.8.4 will be revised to clarify that the single failure criterion applies to the SGBS 1&2 transfer valves and SGBS 3&4 transfer valves. This section will also be revised to reference U.S. EPR FSAR Tier 2, Section 8.3.1.2.11, which discusses the application of the single failure criterion to manually controlled, electrically operated valves (Branch Technical Position 8-4). This position establishes the acceptability of disconnecting power to electrical components of a fluid system as one means of designing against a single failure that might cause an undesirable component action.

FSAR Impact:

U.S. EPR FSAR Tier 2, Section 10.4.8.4 will be revised as described in the response and indicated on the enclosed markup.

Question 10.04.08-10:

FSAR Rev. 5, Tier 1, Tables 2.8.7-1 and 2.8.7-2 do not appear to include all of the transfer valves. These tables only list, "SG1 & w Blowdown Transfer Valve 1" and "SG1 & w Blowdown Transfer Valve 2." What is the "w" and why is SG1 the only steam generator included in these tables? Please provide any FSAR revisions planned to address this issue.

Response to Question 10.04.08-10:

U.S. EPR FSAR Tier 1, Table 2.8.7-1—SGBS Equipment Mechanical Design and Table 2.8.7-2—SGBS Equipment I&C and Electrical Design will be revised to include the steam generator blowdown system (SGBS) 1&2 transfer valves and SGBS 3&4 transfer valves.

FSAR Impact:

U.S. EPR FSAR Tier 1, Table 2.8.7-1 and Table 2.8.7-2 will be revised as described in the response and indicated on the enclosed markup.

U.S. EPR Final Safety Analysis Report Markups

2.8.7 Steam Generator Blowdown System

Design Description

1.0 System Description

The steam generator blowdown system (SGBS) is a non-safety-related system with safety-related portions. It assists in maintaining the chemical characteristics of the secondary water within permissible limits. The SGBS is safety related from its connections to the steam generators to the outer containment isolation valves, including the SG transfer lines. The remaining portion of the blowdown system downstream of the outer containment isolation valves is non-safety-related.

The SGBS provides the following safety-related functions:

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- Containment isolation.
- SG blowdown isolation, including isolation of the SG transfer lines (emergency feedwater (EFW) actuation signal, or high main steam activity signal from radiation monitors with a partial cooldown signal, or high SG water level signal with a partial cooldown signal).
- Interconnection of steam generators.

The SGBS provides the following non-safety-related functions:

- SG blowdown isolation on high blowdown radioactivity signal from radiation monitors ~~(R-46, R-47, R-48, R-49)~~ with a partial cooldown signal.
- SG blowdown isolation on a high temperature downstream of the blowdown coolers.

2.0 Arrangement

2.1 The functional arrangement of the SGBS is as described in the Design Description of Section 2.8.7, Tables 2.8.7-1— SGBS Equipment Mechanical Design and 2.8.7-2— SGBS Equipment I&C and Electrical Design, and as shown on Figure 2.8.7-1—SGBS Functional Arrangement.

2.2 Deleted.

3.0 Mechanical Design Features

3.1 Valves listed in Table 2.8.7-1 will be functionally designed and qualified such that each valve is capable of performing its intended function under the full range of fluid flow, differential pressure, electrical conditions, and temperature conditions up to and including design basis accident conditions.

3.2 Equipment identified as RW-IIc in Table 2.8.7-1 can withstand design basis loads listed in Regulatory Guide 1.143 without a loss of structural integrity.

3.3 Equipment identified as Seismic Category I in Table 2.8.7-1 can withstand seismic design basis loads without a loss of safety function(s).

3.4 ASME Code Class 2 piping systems are designed in accordance with ASME Code Section III requirements.

3.5 As-built ASME Code Class 2 components listed in Table 2.8.7-1 are reconciled with the design requirements.

3.6 Pressure-boundary welds in ASME Code Class 2 components listed in Table 2.8.7-1 meet ASME Code Section III non-destructive examination requirements.

3.7 ASME Code Class 2 components listed in Table 2.8.7-1 retain their pressure-boundary integrity at their design pressure.

3.8 ASME Code Class 2 components listed in Table 2.8.7-1 are fabricated, installed, and inspected in accordance with ASME Code Section III requirements.

3.9 Deleted.

3.10 Deleted.

3.11 Deleted.

3.12 Deleted.

3.13 Deleted.

4.0 I&C Design Features, Displays, and Controls

4.1 Displays listed in Table 2.8.7-2 are indicated on the PICS operator workstations in the MCR and the RSS.

4.2 Controls on the PICS operator workstations in the MCR and the RSS perform the function listed in Table 2.8.7-2.

4.3 Equipment listed as being controlled by a priority and actuator control system (PACS) module in Table 2.8.7-2 responds to the state requested and provides drive monitoring signals back to the PACS module. The PACS module will protect the equipment by terminating the output command upon the equipment reaching the requested state.

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4.4 Upon receipt of the following signals, the SGBS blowdown isolation valves listed in Table 2.8.7-2 close for the affected SG:

- EFW actuation signal.
- High main steam activity signal from radiation monitors with a partial cooldown signal.
- High SG water level signal with a partial cooldown signal.

- High blowdown radioactivity signal from radiation monitors ~~(R-46, R-47, R-48, R-49)~~ with a partial cooldown signal.
- High temperature signal downstream of the blowdown coolers.

5.0 Electrical Power Design Features

5.1 Equipment designated as Class 1E in Table 2.8.7-2 are powered from the Class 1E division as listed in Table 2.8.7-2 in a normal or alternate feed condition.

5.2 Deleted.

6.0 Environmental Qualifications

6.1 Equipment designated as harsh environment in Table 2.8.7-2 can perform the function listed in Table 2.8.7-1 under normal environmental conditions, containment test conditions, anticipated operational occurrences, and accident and post-accident environmental conditions.

7.0 Equipment and System Performance

7.1 Class 1E valves listed in Table 2.8.7-2 will function to change position as listed in Table 2.8.7-1 under normal operating conditions.

7.2 Deleted.

Inspections, Tests, Analyses, and Acceptance Criteria

Table 2.8.7-3 lists the SGBS ITAAC.

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Table 2.8.7-1—SGBS Equipment Mechanical Design
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Description	Tag Number(1)	Location	ASME Code Section III	Function	Seismic Category
SG 1 & 2~~w~~ Blowdown Transfer Valve 1	30LCQ10AA012	Reactor Building	Yes	Open-Close	I
SG 1 & 2~~w~~ Blowdown Transfer Valve 2	30LCQ10AA013	Reactor Building	Yes	Open-Close	I
SG 3~~1~~ & 4~~w~~ Blowdown Transfer Valve 1	30LCQ340AA012	Reactor Building	Yes	Open-Close	I
SG 3~~1~~ & 4~~w~~ Blowdown Transfer Valve 2	30LCQ340AA013	Reactor Building	Yes	Open-Close	I
SG 1 blowdown flow rate control valve	30LCQ10AA104	Reactor Building	Yes	Pressure Retaining Component	I
SG 2 blowdown flow rate control valve	30LCQ20AA104	Reactor Building	Yes	Pressure Retaining Component	I
SG 3 blowdown flow rate control valve	30LCQ30AA104	Reactor Building	Yes	Pressure Retaining Component	I
SG 4 blowdown flow rate control valve	30LCQ40AA104	Reactor Building	Yes	Pressure Retaining Component	I
Blowdown flash tank	30LCQ50BB001	Reactor Building	Yes	Pressure Retaining Component	I
Blowdown flash tank pressure relief valve	30LCQ52AA191	Reactor Building	Yes	Pressure Retaining Component	I
SG Blowdown Cooler – First Stage	30LCQ51AC001	Reactor Building	Yes	Pressure Retaining Component	I
SG Blowdown Cooler – First Stage	30LCQ51AC002	Reactor Building	Yes	Pressure Retaining Component	I
Inner containment isolation valve	30LCQ52AA001	Reactor Building	Yes	Close (Containment Isolation)	I

Table 2.8.7-2—SGBS Equipment I&C and Electrical Design
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Description	Tag Number(1)	Location	IEEE Class 1E (2)	EQ – Harsh Env.	PACS	MCR/RSS Controls
SG 4 cold leg blowdown isolation valve	30LCQ40AA002	Reactor Building	4^N 3^A	Yes	Yes	Close/Close
SG 4 common blowdown isolation valve	30LCQ40AA003	Reactor Building	2^N 1^A	Yes	Yes	Close/Close
SG 1 & 2~~w~~ Blowdown Transfer Valve 1	30LCQ10AA012	Reactor Building	1^N 2^A	Yes	Yes	Open/Close Open/Close
SG 1 & 2~~w~~ Blowdown Transfer Valve 2	30LCQ10AA013	Reactor Building	4^N 3^A	Yes	Yes	Open/Close Open/Close
SG 3~~1~~ & 4~~w~~ Blowdown Transfer Valve 1	30LCQ340AA012	Reactor Building	3^N 4^A	Yes	Yes	Open/Close Open/Close
SG 3~~1~~ & 4~~w~~ Blowdown Transfer Valve 2	30LCQ340AA013	Reactor Building	2^N 1^A	Yes	Yes	Open/Close Open/Close
Inner containment isolation valve	30LCQ52AA001	Reactor Building	1^N 2^A	Yes	Yes	Close/Close
Inner containment isolation valve	30LCQ51AA002	Reactor Building	4^N 3^A	Yes	Yes	Close/Close
First outer containment isolation valve	30LCQ52AA002	Safeguard Building 1	3^N 4^A	No	Yes	Close/Close
Second outer containment isolation valve	30LCQ52AA005	Safeguard Building 1	3^N 4^A	No	Yes	Close/Close
Outer containment isolation valve	30LCQ51AA003	Safeguard Building 4	2^N 1^A	No	Yes	Close/Close

Table 2.8.7-3—Steam Generator Blowdown System ITAAC
Sheet 4 of 6

Commitment Wording		Inspections, Tests, Analyses	Acceptance Criteria
4.2	Controls on the PICS operator workstations in the MCR and the RSS perform the function listed in Table 2.8.7-2.	a. Tests will be performed using controls on the PICS operator workstations in the MCR. b. Tests will be performed using controls on the PICS operator workstations in the RSS.	a. Controls on the PICS operator workstations in the MCR perform the function listed in Table 2.8.7-2. b. Controls on the PICS operator workstations in the RSS perform the function listed in Table 2.8.7-2.
4.3	Equipment listed as being controlled by a PACS module in Table 2.8.7-2 responds to the state requested and provides drive monitoring signals back to the PACS module. The PACS module will protect the equipment by terminating the output command upon the equipment reaching the requested state.	A test will be performed using test input signals to verify equipment controlled by a PACS module responds to the state requested and provides drive monitoring signals back to the PACS module.	Equipment listed as being controlled by a PACS module in Table 2.8.7-2 responds to the state requested and provides drive monitoring signals back to the PACS module. The PACS module will protect the equipment by terminating the output command upon the equipment reaching the requested state.
4.4	Upon receipt of the following signals, the SGBS isolation valves listed in Table 2.8.7-2 close for the affected SG: • EFW actuation signal. • High main steam activity signal from radiation monitors with a partial cooldown signal. • High SG water level signal with a partial cooldown signal. • High blowdown radioactivity signal from radiation monitors ~~(R-46, R-47, R-48, R-49)~~ with a partial cooldown signal. • High temperature signal downstream of the blowdown coolers.	A test will be performed to verify that upon receipt of the following signals, the SGBS isolation valves close for the affected SG: • EFW actuation signal. • High main steam activity signal from radiation monitors with a partial cooldown signal. • High SG water level signal with a partial cooldown signal. • High blowdown radioactivity signal from radiation monitors ~~(R-46, R-47, R-48, R-49)~~ with a partial cooldown signal. • High temperature signal downstream of the blowdown coolers.	Upon receipt of the following signals, the SGBS isolation valves listed in Table 2.8.7-2 close for the affected SG: • EFW actuation signal. • High main steam activity signal from radiation monitors with a partial cooldown signal. • High SG water level signal with a partial cooldown signal. • High blowdown radioactivity signal from radiation monitors ~~(R-46, R-47, R-48, R-49)~~ with a partial cooldown signal. • High temperature signal downstream of the blowdown coolers.

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Table 3.2.2-1—Classification Summary
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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
LCQ	**Steam Generator Blowdown System**						
LCQ	All LCQ Piping and Valves in 2UJE Downstream of Outer Containment Isolation Valve	NS-AQ	D	CS	No	2UJE	ANSI/ASME B31.3[9], ANSI/ASME B16.34[7], RG 1.143[25], RW-IIc
LCQ	All LCQ Piping and Valves in 4UJH Downstream of Outer Containment Isolation Valve	NS-AQ	D	II	Yes	4UJH	ANSI/ASME B31.1[6], ANSI/ASME B16.34[7], Safety-Related piping in close proximity RG 1.29[25]
30LCQ51 AC001/ 002	First Stage Blowdown Coolers	S	B	I	Yes	UJA	ASME Class 2[2]
30LCQ51 AA002	Inner Containment Isolation Valve	S	B	I	Yes	UJA	ASME Class 2[2]
30LCQ52 AA001	Inner Containment Isolation Valve	S	B	I	Yes	UJA	ASME Class 2[2]
30LCQ10 AA012/ 013	SG 1 & 2 Transfer Valves	S	B	I	Yes	UJA	ASME Class 2[2]
30LCQ30 AA012/ 013	SG 3 & 4 Transfer Valves	S	B	I	Yes	UJA	ASME Class 2[2]
30LCQ51 AA003	Outer Containment Isolation Valve	S	B	I	Yes	4UJH	ASME Class 2[2]

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Table 3.2.2-1—Classification Summary
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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
LCQ	UMY, UKA and UMA Piping and Valves	NS-AQ	D	CS	No	UMY, UMA, UKA	ANSI/ASME B31.3[9], ANSI/ASME B16.34[7], RG 1.143[25], RW-IIc
LCQ	All LCQ Piping Upstream of Outer Containment Isolation Valves	S	B	I	YES	UJA, 2UJE, 4UJH	ASME Class 2[2]
LA	**Feedwater System**						
LA	Balance of Feedwater System	NS	N/A	NSC	No	UMY, UMA	ANSI/ASME B31.1[6], ANSI/ASME B16.34[7], ASME VIII[8]
30LAB60/70/80/90 AA003	Check Valves Upstream of Steam Generators	S	B	I	Yes	UJA	ASME Class 2[2]
30LAB64/74/84/94 AA301/302	Differential Pressure Transmitter Isolation Valves	S	C	I	Yes	UJE	ASME Class 3[3]
30LAB60/70/80/90 CP209	Differential Pressure Transmitters Across FLCVs	NS	N/A	NSC	No	UJE	
30LAB64/74/84/94 CP701-703	Differential Pressure Transmitters Across VLLCVs	NS	N/A	NSC	No	UJE	

10.4.8 Steam Generator Blowdown System (PWR)

The Steam Generator Blowdown System (SGBS) assists in maintaining the chemical characteristics of the secondary water within permissible limits. The SGBS provides the capability for continuous hot blowdown of the secondary side of the steam generators (SG). The SGBS includes equipment for heat recovery, purification and reuse of SG blowdown.

10.4.8.1 Design Bases

The following safety-related functions are performed by the SGBS and are required to function following a design basis accident (DBA):

- Provide blowdown system isolation.
- Provide containment isolation.
- Provide capability for interconnection of SGs.

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The SGBS has the following design basis requirements and criteria:

- The safety-related portion of the SGBS is designed and fabricated to codes consistent with the quality group classification in accordance with RG 1.26 and the seismic category in accordance with RG 1.29. The design of the SGBS is Seismic Category I and Quality Group B from its connection to the SG inside primary containment up to and including the isolation valves outside containment (GDC 1). ~~The design of the safety-related portions of the SGBS is Seismic Category I and Quality Group B from its connection to the SG inside primary containment up to and including the first isolation valve outside containment (GDC 1).~~
- The non-safety related portions of the SGBS in the Safeguard Buildings Mechanical Division 4 have a seismic category in accordance with RG 1.29 position C.2 for those non-safety related portions of which failure could reduce the functioning of any safety related or Seismic Category I system components to an unacceptable safety level (GDC 1).
- The non-safety-related portion of the SGBS, downstream of the outer containment isolation valves (CIV), meets the quality standards of RG 1.143, regulatory position C.1.1 (GDC 1).
- The non-safety portions of the SGBS downstream of the outer containment isolation valves (CIVs), meets the radwaste classifications defined in RG 1.143, regulatory position C.5. This portion of the system shall be classified as RW-IIa or RW-IIc using the guidance provided in RG 1.143.
- The safety-related portion of the SGBS is designed to function and is protected from the effects of natural phenomena such as earthquakes, tornadoes, hurricanes, floods and external missiles (GDC 2).

- The blowdown system is sampled continuously to monitor its demineralization and clean up performance (GDC 13).

- The SGBS is designed to blow down up to one percent of the main steam flow rate of all four SGs or up to two percent of a single SG main steam flow rate to maintain water chemistry (GDC 14).

- Consistent with the requirements of 10 CFR 20.1406, the SGBS is designed to minimize, to the extent practicable, contamination of the facility and the environment; facilitate eventual decommissioning; and minimize, to the extent practicable, the generation of radioactive waste (See Section 12.3.6.5). Radiation monitors ~~R-46 through R-48~~ are designed to isolate SGBS on high blowdown activity coupled with a partial cooldown signal (See Section 11.5.4.3 and Table 11.5-1). For steam generator tube rupture, radiation monitors are designed to isolate SGBS on main steam high activity coupled with a partial cooldown signal or high steam generator water level above the narrow range; only the SGBS of the affected steam generator will be automatically isolated (See Section 11.5.4.1 and Table 11.5-1).

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10.4.8.2 System Description

10.4.8.2.1 General Description

Figure 10.4.8-1—Steam Generator Blowdown System Discharge and Cooling and Figure 10.4.8-2—Steam Generator Blowdown Demineralizing System Flow Diagram provide schematic diagrams of the SGBS. Each SG is equipped with its own blowdown line with the capability of blowing down the hot leg and cold leg of the SG shell side. (The hot and cold legs are blown down at low plant loads; otherwise, only the hot leg is blown down.) The blowdown is directed into a flash tank where the flashed steam is returned to the cycle via the deaerator/feedwater storage tank. The liquid portion flows to heat exchangers cooled in two stages by the main condensate system in the first stage and the component cooling system in the second stage before going to the SG blowdown demineralizer. The SGBS also conveys the water from the exit of the SG blowdown demineralizer to the main condenser. The interfaces with the main condensate system, main condenser and feedwater storage tank are addressed in Section 10.4.7.

Each SG is fitted with two nozzles on the hot leg and one nozzle on the cold leg. Piping connects the three nozzles to one blowdown line per SG.

Two secondary sampling system branches are connected to the blowdown collecting lines, one to the cold leg blowdown line and one to the common hot leg blowdown line.

Each of the four blowdown lines is routed through blowdown flow rate adjusting valves to the blowdown flash tank, located in the Reactor Building. The blowdown flow rate adjusting valves control the blowdown flow rate from each SG. The flashed

control valve malfunction leading to excessive pressure in the flash tank, the blowdown is reduced or stopped by closing the SG blowdown flow rate adjusting valves and/or SG blowdown isolation valves. Valves are closed automatically upon reaching a setpoint pressure to prevent opening the flash tank safety relief valve and subsequent loss of SG secondary inventory through the safety relief valve.

Normally, the flash tank water level control valve maintains the level in the flash tank by controlling the flow of water leaving the tank. In case of flash tank water level control valve malfunction leading to excessive high water level in the flash tank, blowdown is reduced or stopped by closing the SG blowdown flow rate adjusting valves and/or SG blowdown isolation valves. Valves are closed automatically upon reaching a setpoint water level to prevent the water hammer that could occur inside the flash tank if the water level were to reach the flash tank inlet nozzles.

Isolation valves downstream of the coolers are automatically closed to protect the SG blowdown demineralizer resin if the temperature of the blowdown water downstream of the second stage blowdown coolers reaches 131°F. The temperature limit could be exceeded if the main condensate flow or component cooling water flow (or both) is too low; or if the main condensate temperature or component cooling water temperature (or both) is too high; or if the flash tank pressure is too high. When the blowdown demineralizer isolation valves close, the flash tank water level increases and the blowdown operation is stopped by the automatic closure of the SG blowdown adjusting valves or SG blowdown isolation valves.

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In special cases, the entire SG blowdown demineralizing system can be bypassed around to the main condenser, or the blowdown can also be bypassed to the liquid waste storage system instead of to the main condenser. The blowdown can be manually discharged to the liquid waste management system if radioactivity is detected in the blowdown. Radiation monitors are designed to isolate SGBS on high blowdown activity coupled with a partial cooldown signal; only the SGBS of the affected steam generator will be automatically isolated (See Section 11.5.4.3 and Table 11.5-1).~~Steam generator blowdown high activity does not alone constitute a signal to isolate the SGBS, however, when coupled with a partial cooldown signal, the SGBS of the affected steam generator will be automatically isolated. Refer to Section 10.4.8.3.3.~~

10.4.8.3.3 Accident Conditions

The blowdown isolation valves isolate on a containment isolation signal or emergency feedwater (EFW) actuation signal, or mainsteam isolation signal with low SG pressure or high SG pressure drop. For steam generator tube rupture, radiation monitors are designed to isolate SGBS on main steam high activity coupled with a partial cooldown signal or high steam generator water level above the narrow range; only the SGBS of the affected steam generator will be automatically isolated (See Section 11.5.4.1 and Table 11.5-1).~~For steam generator tube rupture, the blowdown isolation valves on the~~

~~affected SG close on a partial cooldown signal with high mainsteam activity or high SG level above the narrow range.~~

10.4.8.4 Safety Evaluation

The design of the SGBS satisfies GDC 1 as it relates to system components being designed, fabricated, erected, and tested for quality standards.

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- The safety-related portion of the SGBS is designed and fabricated to codes consistent with the quality group classification ~~assigned by~~ in accordance with RG 1.26 and the seismic category ~~assigned by~~ in accordance with RG 1.29. The design of the SGBS is Seismic Category I and Quality Group B from its connection to the SG inside primary containment up to and including the isolation valves outside containment. Table 3.2.2-1 provides the seismic design and other design classifications for components in the SGBS.

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- The power supplies and control function necessary for the safety functions of the system are Class IE, as described in Chapter 7 and Chapter 8.

- The non-safety-related portion of the SGBS, downstream of the outer containment isolation valves (CIV), meets the quality standards of RG 1.143, regulatory position C.1.1.

The SGBS design satisfies RG 1.143, Regulatory Position C.5, as it relates to radwaste classifications so that the radiological release/quantity is met.

The design of the SGBS satisfies GDC 2 regarding protection from the effects of natural phenomena such as earthquakes, tornadoes, hurricanes, floods and external missiles per general design criterion.

- The safety-related portions of the SGBS are located in the Reactor Building and the Safeguard Buildings. These buildings are designed to withstand the effects of earthquakes, tornadoes, hurricanes, floods, external missiles and other similar natural phenomena. Sections 3.3, 3.4, 3.5, 3.7, and 3.8 provide the bases for the adequacy of the structural design of these buildings.

- The safety-related portions of the SGBS are designed to remain functional after an SSE. Sections 3.7 and 3.9 discuss the design loading conditions considered.

- The foundations and walls of structures that house the SGBS, downstream of the outer CIV, are consistent with the natural phenomena and internal and external man-induced hazards criteria in RG 1.143, positions 1.1.3 and 6.

The SGBS design satisfies GDC 13 as it relates to monitoring system variables that can affect the reactor coolant pressure boundary and maintaining them within prescribed operating ranges.

- The SGBS maintains secondary chemistry within allowable limits. The blowdown system is sampled continuously to monitor its demineralization and clean up performance. The sampling system is further described in Section 9.3.2.

The SGBS design satisfies GDC 14 as it relates to secondary water chemistry control so that SG tube material integrity is maintained. Section 5.4.2 provides information concerning SG internal design related to blowdown.

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- The SGBS maintains contaminants and minerals produced by phase separation in the steam generators within predetermined limits by a continuous blowdown of a portion of the total SG hot leg flow. Section 10.3.5 provides the description of the secondary water chemistry program and associated limits.

- Controls are provided to protect the SGBS demineralizers from high temperatures.

The single failure criterion is applied to the CIVs, SGBS isolation valves, SGBS 1&2 transfer valves, and SGBS 3&4 transfer valves. ~~and SG blowdown isolation valves.~~ Section 6.2.4 and Section 6.2.6 discuss the system containment isolation arrangement and containment leakage testing. Section 8.3.1.2.11 discusses the application of Branch Technical Position (BTP) 8-4 to the SGBS 1&2 and 3&4 transfer valves as a means of designing against a single failure.

10.4.8.5 Inspection and Testing Requirements

The SGBS components are inspected and tested during plant startup. Refer to Section 14.2 (test abstracts #067, #072, #185 and #204) for initial plant startup test program.

The design of the SGBS includes the capability for inservice testing. This includes operation of applicable portions of the protection system. Refer to Section 3.9.6 for a description of the inservice testing program.

The SGBS components are designed and located to permit preservice and inservice inspections to the extent practical. The SGBS lines within the containment and Safeguard Buildings up to and including the isolation valves outside containment are inspected at installation as required by ASME Code, Section XI (Reference 2) preservice inspection requirements. Refer to Section 6.6 for a description of the inservice inspection program.

10.4.8.6 Instrumentation Requirements

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The SGBS instrumentation is provided to facilitate automatic operation, remote control and continuous indication of system parameters.

Process radiation monitors are provided in the SG blowdown sampling system. These monitors are discussed in Section 11.5.4.3~~, Monitor R-46 through R-49~~.

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