

ArevaEPRDCDocsPEm Resource

From: RYAN Tom (AREVA) [Tom.Ryan@areva.com]
Sent: Monday, April 07, 2014 9:00 AM
To: Eudy, Michael
Cc: Wunder, George; Hearn, Peter; STACK Tim (AREVA); NOXON David (AREVA); HOTTLE Nathan (AREVA); GUCWA Len (EXTERNAL AREVA)
Subject: Mid-loop operation for Ch. 5 technical discussion - slides for today
Attachments: US EPR Design Features Addressing Mid-Loop Operation - April 7 2014.pdf

Mike – please find attached some talking point slides for the discussion during today’s public call concerning Mid-loop Operation and RAI 579. Please note these are for discussion purposes only. Please let me know if you have any questions,

Thanks,

Tom Ryan

Manager, US EPR DCD

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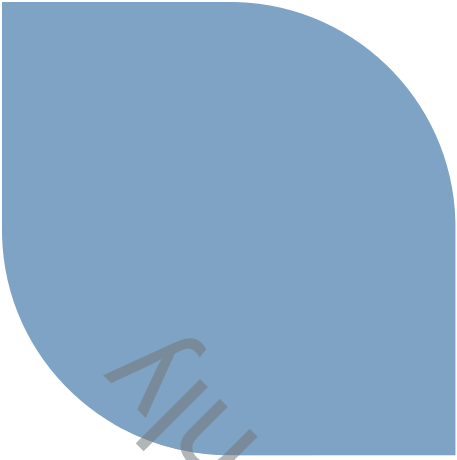
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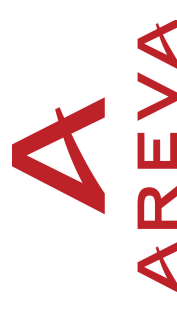


U.S. EPR Design Certification

Design Features Addressing Mid-Loop Operation

April 7, 2014

Tim Stack, Len Gucwa, David Noxon



Meeting Purpose

- ▶ Purpose of this meeting is three-fold:
 1. Present “revised” strategy for addressing mid-loop operation based on NRC feedback from March 19, 2014
 2. Discuss path forward to close DC FSAR Chapter 5 related to deterministic treatment of mid-loop operation
 3. Confirm agreement with NRC on “revised” path forward

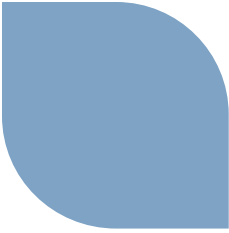
Focus of discussion will be on deterministic treatment of mid-loop operation

Background – March 19th Public Meeting

- ▶ NRC staff presented regulatory basis for their mid-loop concerns related to GDC 34 compliance and GL 88-17
- ▶ AREVA presented a strategy to address NRC mid-loop operation concerns
- ▶ NRC staff presented key issues requiring resolution to deterministically close-out mid-loop operation:
 1. If nozzle dams are used, provide an analysis that demonstrates the adequacy of venting via pressurizer manway removal.
 2. Provide a “vortexing” analysis for the RHR pumps during mid-loop.
 3. Define hot leg level setpoints needed for deterministic treatment of mid-loop. → [See Slide 4](#)
 4. Clarify the function(s) of MHSI during mid-loop operations and summarize the supporting analyses.
 5. Explain the automatic MHSI actuation feature in mid-loop with and without nozzle dam usage.

Background – Hot Leg Level Setpoints and Actions

- ◆ Elevation A – High hot leg level – PAS → Open letdown to prevent filling SG bowls
- ◆ Elevation B – Normal hot leg level – PAS → Level is automatically controlled by CVCs
- ◆ Elevation C – Low hot leg level – PAS → Full closure of letdown (most likely source of uncontrolled level drop in RCS) and CVCs and RHR isolation valves
- ◆ Elevation D - Low-Low hot leg level - auto trip of RHR pump – PAS → **Eliminates operator action required to protect RHR pumps from vortexing**
- ◆ Elevation E – Low-Low-Low hot leg level - Safety injection (SI) signal initiated – PS
 - SI automatically starts MHSI → Provides automatic means to initiate feed and bleed cooling
 - SI automatically isolates letdown on containment isolation signal → Automatically isolates most likely source of uncontrolled level drop in RCS
- ◆ Elevation F – **Minimum level to prevent vortexing and gas ingestion** → Hydraulic analysis demonstrates adequate NPSH



Mid-Loop Path Forward

- ▶ **Nozzle dam usage in Design Certification Document (DCD)**
- ▶ **Resolution of NRC key deterministic issues for mid-loop operation**
- ▶ **Chapter 5 closure for mid-loop operation**
- ▶ **RAI 579 response plan**

Nozzle Dam Usage in Mid-Loop

► Nozzle dam usage in Design Certification Document (DCD)

- ◆ Nozzle dam usage will be removed from the licensing basis of the U.S. EPR → Reactor will be defueled prior to performing maintenance that requires the RCS be maintained at mid-loop (e.g., SG maintenance, RCP seal maintenance)

Key Deterministic Issues Requiring Resolution for Mid-Loop

1. If nozzle dams are used, provide an analysis that demonstrates the adequacy of venting via pressurizer manway removal.

◆ *Resolution Approach:*

- Nozzle dams usage will be removed from U.S. EPR licensing basis.
- Therefore, venting analysis is unnecessary and will not be performed.

2. Provide a “vortexing” analysis for the RHR pumps during mid-loop.

◆ *Resolution Approach:*

- Analysis will be performed that demonstrates that RHR pumps are provided with sufficient NPSH to support decay heat removal function, are adequately protected from vortexing, and are adequately protected from air ingestion.
- Analysis will define the minimum hot leg level (Elevation F on Slide 4) that allows the RHR pumps to be reliably operated.

A

Key Deterministic Issues Requiring Resolution for Mid-Loop

3. Define hot leg level setpoints needed for deterministic treatment of mid-loop.

◆ Resolution Approach:

- Loss of RHR in Mid-Loop – GDC 34 compliance
 - In Mode 5 with loops not filled,
 - 2 of 4 RHR loops required to be operable per Technical Specification 3.4.8
- RHR pump protection provided as follows:
 - Automatic trip of operating RHR pumps by SAS on low hot leg level (Level D on Slide 4) → I&C platform changed from Slide 4 from PAS (non-safety-related) to SAS (safety-related)
 - Manual operator action to start/restart RHR pumps
 - Aligned to IRWST for ECCS/containment cooling mode
 - Aligned to hot leg (Level F on Slide 4) for RHR mode

Key Deterministic Issues Requiring Resolution for Mid-Loop

4. Clarify the function(s) of MHSI during mid-loop operations and summarize the supporting analyses.

◆ *Resolution Approach:*

- Technical Specification 3.5.8 – 2 of 4 MHSI required to be operable in Modes 5 and 6 with the refueling cavity not filled.
- MHSI functional requirements in mid-loop

Key Deterministic Issues Requiring Resolution for Mid-Loop

5. Explain the automatic MHSI actuation feature in mid-loop with and without nozzle dam usage.

◆ Resolution Approach:

- Nozzle dams usage will be removed from U.S. EPR licensing basis → Automatic MHSI actuation with nozzle dam usage is no longer relevant
- Automatic MHSI actuation will include the following:
 - SIS bypass switch will be removed from U.S. EPR design
 - In Mode 5 and 6 (with refueling cavity not filled), Technical Specification 3.5.8 governs ECCS operability:
 - 2 of 4 MHSI pumps required to be operable
 - Note allowing temporary removal of all MHSI pumps will be removed from U.S. EPR design

MHSI is automatically actuated by the Protection System. Technical Specification 3.3.2 governs Engineered Safety Features operability.

Chapter 5 Closure for Mid-Loop Operation

- ▶ Chapter 5 closure for mid-loop operation
- ◆ Focus Chapter 5 discussion on deterministic features that address GL 88-17
- ◆ Include changes to Technical Specifications and COL items (as needed) to support deterministic safety findings

Technical Specifications and COL Items

► Technical Specifications

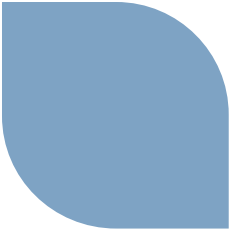
- ◆ In Technical Specification 3.5.8, remove “Note” allowing temporary removal of all MHSI pumps from service in Mode 5 and 6 (with refueling cavity not filled) → **Change assures operability of MHSI in Modes 5 and 6 (with refueling cavity not filled)**
- ◆ In Technical Specification 3.3.9, add protective trip for RHR

► COL Items

- ◆ Delete COL item 5.4-2 → **Risk assessment for RCS maintenance with fuel in the vessel is no longer required by COL applicant.**

Response Plan

- ▶ **Partial RAI 579 Response**
 - ◆ **Provide Discussion and Markup**
 - Chapter 5
 - Chapter 7
 - Chapter 16
 - COL Items in Section 1.8
 - ◆ **Provide Partial RAI 579 response by May 30, 2014 (tentative)**
- ▶ **Final RAI 579 Response**
 - ◆ **Provide Discussion and Markup**
 - Tier1, Chapter 19, Chapter 14 and any new COL items based on new PRA results, insights or conclusions.
 - ◆ **Incorporate Final RAI 579 response in Rev. 8 of FSAR**
 - ◆ **Provide Final RAI 579 response with Chapter 19 completion in 2015.**



Conclusions

1. AREVA has provided a “revised” strategy for deterministically addressing mid-loop operation based on NRC feedback from March 19, 2014
2. AREVA has provided a regulatory path forward to close DC FSAR Chapter 5 related to deterministic treatment of mid-loop operation
3. NRC concurrence on deterministic treatment of mid-loop operation is needed to close DC FSAR Chapter 5 in 2014