ArevaEPRDCPEm Resource

From:	BRYAN Martin (EXTERNAL AREVA) [Martin.Bryan.ext@areva.com]
Sent:	Friday, November 05, 2010 7:54 AM
To:	Tesfaye, Getachew
Cc:	DELANO Karen (AREVA); ROMINE Judy (AREVA); BENNETT Kathy (AREVA); GUCWA Len (EXTERNAL AREVA)
Subject:	Response to U.S. EPR Design Certification Application RAI No. 416, FSAR Ch. 6, Supplement 1
Attachments:	RAI 416 Supplement 1 Response US EPR DC.pdf

Getachew,

AREVA NP Inc. (AREVA NP) provided a schedule for a technically correct and complete response to RAI 416 on August 25, 2010. The attached file, "RAI 416 Supplement 1 Response US EPR DC.pdf" provides technically correct and complete responses to 2 of the 3 remaining questions, as committed. Appended to this file are affected pages of the U.S. EPR Final Safety Analysis Report in redline-strikeout format which support the response to RAI 416 Question 06.02.01-94.

The following table indicates the respective pages in the response document, "RAI 416 Supplement 1 Response US EPR DC.pdf," that contain AREVA NP's response to the subject questions.

Question #	Start Page	End Page
RAI 416 — 06.02.01-94	2	31
RAI 416 — 06.02.01-95	32	35

The response schedule for Question 06.03-15 is changed to provide additional opportunity to interact with the NRC staff as shown below.

Question #	Response Date
RAI 416 — 06.03-15	February 24, 2011

Sincerely,

Martin (Marty) C. Bryan
U.S. EPR Design Certification Licensing Manager
AREVA NP Inc.
Tel: (434) 832-3016
702 561-3528 cell
Martin.Bryan.ext@areva.com

From: BRYAN Martin (External RS/NB)
Sent: Wednesday, August 25, 2010 8:13 PM
To: 'Tesfaye, Getachew'
Cc: DELANO Karen (RS/NB); ROMINE Judy (RS/NB); BENNETT Kathy (RS/NB); GUCWA Len (External RS/NB)
Subject: Response to U.S. EPR Design Certification Application RAI No. 416, FSAR Ch. 6

Getachew,

Attached please find AREVA NP Inc.'s response to the subject request for additional information (RAI). The attached file, "RAI 416 Response US EPR DC.pdf" provides a schedule since a technically correct and complete response to the 3 questions cannot be provided at this time.

The following table indicates the respective pages in the response document, "RAI 416 Response US EPR DC.pdf," that contains AREVA NP's response to the subject questions.

Question #	Start Page	End Page
RAI 416 — 06.02.01-94	2	3
RAI 416 — 06.02.01-95	4	4
RAI 416 — 06.03-15	5	6

A complete answer is not provided for 3 of the 3 questions. The schedule for a technically correct and complete response to these questions is provided below.

Question #	Response Date
RAI 416 — 06.02.01-94	November 6, 2010
RAI 416 — 06.02.01-95	November 6, 2010
RAI 416 — 06.03-15	November 6, 2010

Sincerely,

Martin (Marty) C. Bryan
U.S. EPR Design Certification Licensing Manager
AREVA NP Inc.
Tel: (434) 832-3016
702 561-3528 cell
Martin.Bryan.ext@areva.com

From: Tesfaye, Getachew [mailto:Getachew.Tesfaye@nrc.gov]
Sent: Monday, July 26, 2010 6:52 AM
To: ZZ-DL-A-USEPR-DL
Cc: Peng, Shie-Jeng; Jackson, Christopher; McKirgan, John; Ashley, Clinton; Lu, Shanlai; Donoghue, Joseph; Carneal, Jason; Colaccino, Joseph
Subject: U.S. EPR Design Certification Application RAI No. 416(4767,4749),FSAR Ch. 6

Attached please find the subject requests for additional information (RAI). A draft of the RAI was provided to you on June 6, and discussed with your staff on June 30, 2010. No change is made to the draft RAI as a result of that discussion. The schedule we have established for review of your application assumes technically correct and complete responses within 30 days of receipt of RAIs. For any RAIs that cannot be answered within 30 days, it is expected that a date for receipt of this information will be provided to the staff within the 30 day period so that the staff can assess how this information will impact the published schedule.

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

Hearing Identifier: AREVA_EPR_DC_RAIs
Email Number: 2235

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Subject: Response to U.S. EPR Design Certification Application RAI No. 416, FSAR Ch. 6, Supplement 1
Sent Date: 11/5/2010 7:53:40 AM
Received Date: 11/5/2010 7:54:44 AM
From: BRYAN Martin (EXTERNAL AREVA)

Created By: Martin.Bryan.ext@areva.com

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Tracking Status: None

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MESSAGE	3873	11/5/2010 7:54:44 AM
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Options
Priority: Standard
Return Notification: No
Reply Requested: No
Sensitivity: Normal
Expiration Date:
Recipients Received:

Response to

Request for Additional Information No. 416(4767, 4749), Revision 1
Supplement 1

6/8/2010

U.S. EPR Standard Design Certification
AREVA NP Inc.
Docket No. 52-020
SRP Section: 06.02.01 - Containment Functional Design
SRP Section: 06.03 - Emergency Core Cooling System

Application Section: FSAR Chapter 6

QUESTIONS for Containment and Ventilation Branch 1 (AP1000/EPR Projects) (SPCV)
QUESTIONS for Reactor System, Nuclear Performance and Code Review (SRSB)

Question 06.02.01-94:

Follow-up to RAI 368, Question 06.02.01-75:

a. The CONVECT system is a new design. The mixing dampers, rupture foils and convection foils are safety-related components of the system. The safety evaluation of U.S. EPR design with respect to the compliance with GDC 16 and GDC 38 depends on the availability of performance information of the dampers, rupture and convection foils. Experimental evidence is needed to demonstrate that (1) the foils and dampers will perform their intended function as is described in the U.S. EPR FSAR, and (2) the design parameters of the foils are properly modeled in the containment safety analysis.

The intended functions of the foils are:

1. The foils will rupture when a pre-determined pressure differential is applied on them,
2. The foils will rupture in either direction,
3. The foils will rupture within a relatively narrow band around the predetermined pressure differential, thus rupture of some of the foils will not prevent rupture of the rest of the foils,
4. When the foils rupture, they will not create debris that could interfere with the operation of the heat removal systems,
5. The rupture foils will have sufficient flow area to fulfill the system's function,
6. The convection foils will drop down by gravity with some delay, when a predetermined temperature is reached,
7. The convection foils will drop down even against a specified pressure differential.

The intended functions of the mixing dampers are:

1. To open within the time assumed in the safety analysis against the loads generated by LOCA and MSLB.
2. To provide a path for water carried over into and condensed within the accessible space to return to the IRWST following LOCA events.
3. To continue to maintain operability status throughout the live of the plant.

The following design parameters enter into the containment safety evaluation:

1. Rupture pressure differential of foils in both the upward and downward direction
2. Uncertainty band of the rupture pressure differential
3. Open flow area of the foils after rupture
4. Activation temperature of the convection foils
5. Delay time associated with the convection foils opening
6. Uncertainty associated with operation of the convection foils
7. Pressure differential against which the convection foils are designed to function.
8. Opening time for the dampers upon receiving an actuation signal.

9. The curb height over which water within the accessible space must rise before flowing into the IRWST.

Provide a justification that the CONVECT system will function as described in the safety analysis under the full range of conditions relied upon in the safety analysis.

b. FSAR Rev. 2 interim Section 6.2.1 describes the design feature and evaluation for the CONVECT system. The performance information for CONVECT system is scattered in all of subsections. At most, Table 6.2.1-25 provides some information on the cause and timing for foil opening. Provide a comprehensive summary of CONVECT system (foils and dampers) performance information (type of foil or damper, location, opening mechanism, timing, opening area) as assumed or credited in the safety analyses of all LOCAs (LBLOCA, SBLOCA, MSLB and any other accident/transient that will lead to breaks in the containment) as, for example, those listed in Tables 6.2.1-1 and 6.2.1-25. This summary combined with the experimental evidence provided in response to the previous question will facilitate the review of CONVECT system design.

Response to Question 06.02.01-94:

Part a:

Experimental evidence of test results is vendor-specific. AREVA NP has not committed to a specific vendor for the components of the combustible gas control system (CGCS). To address the NRC concerns about CONVECT components, U.S. EPR FSAR Tier 2, Section 6.2.5.2.1 will be revised to include performance criteria for their intended functions under normal conditions and the full range of conditions relied upon in the safety analyses. The components of the CONVECT system are safety-related items and therefore are included in the equipment qualification program as described in U.S. EPR FSAR Tier 2, Appendix 3D.

The scenario for the opening of the convection foils against a specified differential pressure is theoretical. A theoretical approach was used because in case of an accident with release of mass and energy the pressure and temperature increase simultaneously, but the weight of the lower convection foil frame does allow opening against a pressure differential between the service and equipment rooms. In case the convection foils can not open by gravity, the increasing pressure will cause the burst elements to open at approximately 0.5 psid, which is the lower limit of the burst pressure (0.7 psid $\pm$ 30% nominal actuation pressure differential). At this time, pressure relief occurs and the convection foils open by gravity. The temperature opening mechanism is a redundancy feature of the convection foils.

Openings exist at several wall locations approximately four inches above floor level to provide a flow path to return water and condensate from the accessible space to the in-containment refueling water storage tank (IRWST). The mixing dampers are located at least three feet above the floor level and their openings are not used to return water to the IRWST. The mixing dampers are not affected by the flooding because the water level remains below three feet in the annular area.

Components are designed for plant lifetime, including wear, maintenance, and replacement of dedicated parts. As safety-related components, the mixing dampers are included in the equipment qualification program, which considers ambient conditions for normal plant operation and design basis accidents (DBA). Refer to U.S. EPR FSAR Tier 2, Appendix 3D for information regarding the EQ program.

Table 06.02.01-94-01 lists the parameters used in the safety analyses. Uncertainties are considered by adding a margin to the design specifications as listed in U.S. EPR FSAR Tier 2, Section 6.2.5 and Table 6.2.5-1. For example, the design pressure of the burst element of the rupture foil is 0.7 psid ± 30 percent tolerance and the maximum opening pressure is 0.91 psid. For conservatism, the safety analysis assumes a slightly higher opening pressure. The same principle is applied for other set points and opening times.

Part b:

A comprehensive summary of the CONVECT system as used in the safety analyses of LOCAs and main steam line breaks (MSLB) is provided in Table 06.02.01-94-01.

FSAR Impact:

U.S. EPR FSAR Tier 2, Section 6.2.5.2.1 and Table 6.2.5-1 will be revised as described in the response and indicated on the enclosed markup.

Table 06.02.01-94-01—Summary of CONVECT System in LOCA and MSLB Scenarios

Item No.	FSAR Reference	Description	Foils/Dampers Credited[1]	Location	Opening Mechanism	Set Point	Opening Area (ft^2)	Opening Time (sec)
1	6.2.1-1 Case 1	Hot Leg DE	N/A	N/A	N/A	N/A	N/A	N/A
2	6.2.1-1 Case 2	Hot Leg DEG	N/A	N/A	N/A	N/A	N/A	N/A
3	6.2.1-1 Case 3	Hot Leg DEG	N/A	N/A	N/A	N/A	N/A	N/A
4	6.2.1-1 Case 4	Hot Leg DEG	N/A	N/A	N/A	N/A	N/A	N/A
5	6.2.1-1 Case 5	Hot Leg DEG	N/A	N/A	N/A	N/A	N/A	N/A
6	6.2.1-1 Case 6	Hot Leg DEG	N/A	N/A	N/A	N/A	N/A	N/A
7	6.2.1-1 Case 7	Hot Leg Split Break	N/A	N/A	N/A	N/A	N/A	N/A
8	6.2.1-1 Case 7A	Hot Leg DEG	N/A	N/A	N/A	N/A	N/A	N/A
9	6.2.1-1 Case 7C	Hot Leg Split Break	N/A	N/A	N/A	N/A	N/A	N/A
10	6.2.1-1 Case 8	Cold Leg Pump Suction DEG	N/A	N/A	N/A	N/A	N/A	N/A
11	6.2.1-1 Case 9	Cold Leg Pump Suction DEG	N/A	N/A	N/A	N/A	N/A	N/A

Table 06.02.01-94-01—Summary of CONVECT System in LOCA and MSLB Scenarios

Item No.	FSAR Reference	Description	Foils/Dampers Credited[1]	Location	Opening Mechanism	Set Point	Opening Area (ft²)	Opening Time (sec)
12	6.2.1-1 Case 10	Cold Leg Pump Suction DEG	N/A	N/A	N/A	N/A	N/A	N/A
13	6.2.1-1 Case 10B	Cold Leg Pump Suction DEG	N/A	N/A	N/A	N/A	N/A	N/A
14	6.2.1-1 Case 11	Cold Leg Pump Suction DEG	N/A	N/A	N/A	N/A	N/A	N/A
15	6.2.1-1 Case 12	Cold Leg Pump Suction DEG	N/A	N/A	N/A	N/A	N/A	N/A
16	6.2.1-1 Case 13	Cold Leg Pump Suction DEG	N/A	N/A	N/A	N/A	N/A	N/A
17	6.2.1-1 Case 14	Cold Leg Pump Suction Split Break	N/A	N/A	N/A	N/A	N/A	N/A
18	6.2.1-1 Case 14B	Cold Leg Pump Suction Split Break	N/A	N/A	N/A	N/A	N/A	N/A

Table 06.02.01-94-01—Summary of CONVECT System in LOCA and MSLB Scenarios

Item No.	FSAR Reference	Description	Foils/Dampers Credited[1]	Location	Opening Mechanism	Set Point	Opening Area (ft²)	Opening Time (sec)
19	6.2.1-1 Case 14C	Cold Leg Pump Suction Split Break	N/A	N/A	N/A	N/A	N/A	N/A
20	6.2.1-1 Case 14D	Cold Leg Pump Suction Split Break	N/A	N/A	N/A	N/A	N/A	N/A
21	6.2.1-1 Case 14E	Cold Leg Pump Suction Split Break	N/A	N/A	N/A	N/A	N/A	N/A
22	6.2.1-1 Case 15	Cold Leg Pump Discharge DEG	N/A	N/A	N/A	N/A	N/A	N/A
23	6.2.1-1 Case 16	Cold Leg Pump Discharge DEG	N/A	N/A	N/A	N/A	N/A	N/A
24	6.2.1-1 Case 17	Cold Leg Pump Discharge DEG	N/A	N/A	N/A	N/A	N/A	N/A
25	6.2.1-1 Case 18	Cold Leg Pump Discharge DEG	N/A	N/A	N/A	N/A	N/A	N/A

Table 06.02.01-94-01—Summary of CONVECT System in LOCA and MSLB Scenarios

Item No.	FSAR Reference	Description	Foils/Dampers Credited[1]	Location	Opening Mechanism	Set Point	Opening Area (ft²)	Opening Time (sec)
26	6.2.1-1 Case 19	Cold Leg Pump Discharge DEG	N/A	N/A	N/A	N/A	N/A	N/A
27	6.2.1-1 Case 20	Cold Leg Pump Discharge DEG	N/A	N/A	N/A	N/A	N/A	N/A
28	6.2.1-1 Case 21	Cold Leg Pump Discharge DEG	N/A	N/A	N/A	N/A	N/A	N/A
29	6.2.1-1 Case 22	Cold Leg Pump Discharge Split Break	N/A	N/A	N/A	N/A	N/A	N/A
30	6.2.1-1 Case 23	Cold Leg Pump Discharge Split Break	N/A	N/A	N/A	N/A	N/A	N/A
31	6.2.1-1 Case 24	Cold Leg Pump Discharge DEG	N/A	N/A	N/A	N/A	N/A	N/A
32	6.2.1-1 Case 25	Cold Leg Pump Discharge Split Break	N/A	N/A	N/A	N/A	N/A	N/A

Table 06.02.01-94-01—Summary of CONVECT System in LOCA and MSLB Scenarios

Item No.	FSAR Reference	Description	Foils/Dampers Credited[1]	Location	Opening Mechanism	Set Point	Opening Area (ft^2)	Opening Time (sec)
33	6.2.1-1 Case 26	Cold Leg Pump Discharge Split Break	N/A	N/A	N/A	N/A	N/A	N/A
34	6.2.1-1 Case 27	Cold Leg Pump Discharge Split Break	N/A	N/A	N/A	N/A	N/A	N/A
35	6.2.1-1 Case 28	Cold Leg Pump Discharge Split Break	N/A	N/A	N/A	N/A	N/A	N/A
36	6.2.1-1 Case 29	Cold Leg Pump Discharge Split Break	N/A	N/A	N/A	N/A	N/A	N/A
37	6.2.1-1 Case 30	Cold Leg Pump Discharge Split Break	N/A	N/A	N/A	N/A	N/A	N/A
38	6.2.1-1 Case 31	Cold Leg Pump Discharge Split Break	N/A	N/A	N/A	N/A	N/A	N/A
39	6.2.1-1 Case 32	Hot Leg DEG	Damper L1&2	From IRWST to L1&2 Lower Annulus	Pressure	0.66 psi	32.16	18.18
			Damper L3&4	From IRWST to L3&4 Lower Annulus	Pressure	0.66 psi	32.16	18.07

Table 06.02.01-94-01—Summary of CONVECT System in LOCA and MSLB Scenarios

Item No.	FSAR Reference	Description	Foils/Dampers Credited[1]	Location	Opening Mechanism	Set Point	Opening Area (ft²)	Opening Time (sec)
			Rupture foil L1&2	From L1&2 Upper Equipment Room to Dome	Pressure	0.943 psi	187.66	0.18
			Rupture foil L3&4	From L3&4 Upper Equipment Room to Dome	Pressure	0.943 psi	187.66	0.08
			Convection foil L1&2	From L1&2 Upper Equipment Room to Dome	Gas Temperature	185.9 °F	240.26	0.18
			Convection foil L3&4	From L3&4 Upper Equipment Room to Dome	Gas Temperature	185.9 °F	240.26	0.08
40	6.2.1-1 Case 33	Cold Leg Pump Suction DEG	Damper L1&2	From IRWST to L1&2 Lower Annulus	Pressure	0.66 psi	32.16	18.19
			Damper L3&4	From IRWST to L3&4 Lower Annulus	Pressure	0.66 psi	32.16	18.08
			Rupture foil L1&2	From L1&2 Upper Equipment Room to Dome	Pressure	0.943 psi	187.66	0.20
			Rupture foil L3&4	From L3&4 Upper Equipment Room to Dome	Pressure	0.943 psi	187.66	0.09
			Convection foil L1&2	From L1&2 Upper Equipment Room to Dome	Gas Temperature	185.9 °F	240.26	0.20
			Convection foil L3&4	From L3&4 Upper Equipment Room to Dome	Gas Temperature	185.9 °F	240.26	0.09
41	6.2.1-1 Case 34	Cold Leg Pump Suction DEG	Damper L1&2	From IRWST to L1&2 Lower Annulus	Pressure	0.66 psi	32.16	18.19
			Damper L3&4	From IRWST to L3&4 Lower Annulus	Pressure	0.66 psi	32.16	18.08
			Rupture foil L1&2	From L1&2 Upper Equipment Room to Dome	Pressure	0.943 psi	187.66	0.20
			Rupture foil L3&4	From L3&4 Upper Equipment Room to Dome	Pressure	0.943 psi	187.66	0.09

Table 06.02.01-94-01—Summary of CONVECT System in LOCA and MSLB Scenarios

Item No.	FSAR Reference	Description	Foils/Dampers Credited[1]	Location	Opening Mechanism	Set Point	Opening Area (ft²)	Opening Time (sec)
			Convection foil L1&2	From L1&2 Upper Equipment Room to Dome	Gas Temperature	185.9 °F	240.26	0.20
			Convection foil L3&4	From L3&4 Upper Equipment Room to Dome	Gas Temperature	185.9 °F	240.26	0.09
42	6.2.1-1 Case 36	Cold Leg Pump Suction DEG	Damper L1&2	From IRWST to L1&2 Lower Annulus	Pressure	0.66 psi	32.16	18.19
			Damper L3&4	From IRWST to L3&4 Lower Annulus	Pressure	0.66 psi	32.16	18.08
			Rupture foil L1&2	From L1&2 Upper Equipment Room to Dome	Pressure	0.943 psi	187.66	0.20
			Rupture foil L3&4	From L3&4 Upper Equipment Room to Dome	Pressure	0.943 psi	187.66	0.09
			Convection foil L1&2	From L1&2 Upper Equipment Room to Dome	Gas Temperature	185.9 °F	240.26	0.20
			Convection foil L3&4	From L3&4 Upper Equipment Room to Dome	Gas Temperature	185.9 °F	240.26	0.09
43	6.2.1-1 Case 37	Cold Leg Pump Suction DEG	Damper L1&2	From IRWST to L1&2 Lower Annulus	Pressure	0.66 psi	32.16	18.19
			Damper L3&4	From IRWST to L3&4 Lower Annulus	Pressure	0.66 psi	32.16	18.08
			Rupture foil L1&2	From L1&2 Upper Equipment Room to Dome	Pressure	0.943 psi	187.66	0.20
			Rupture foil L3&4	From L3&4 Upper Equipment Room to Dome	Pressure	0.943 psi	187.66	0.09
			Convection foil L1&2	From L1&2 Upper Equipment Room to Dome	Gas Temperature	185.9 °F	240.26	0.20
			Convection foil L3&4	From L3&4 Upper Equipment Room to Dome	Gas Temperature	185.9 °F	240.26	0.09

Table 06.02.01-94-01—Summary of CONVECT System in LOCA and MSLB Scenarios

Item No.	FSAR Reference	Description	Foils/Dampers Credited[1]	Location	Opening Mechanism	Set Point	Opening Area (ft^2)	Opening Time (sec)
44	6.2.1-1 Case 38	Cold Leg Pump Suction DEG	Damper L1&2	From IRWST to L1&2 Lower Annulus	Pressure	0.66 psi	32.16	18.19
			Damper L3&4	From IRWST to L3&4 Lower Annulus	Pressure	0.66 psi	32.16	18.08
			Rupture foil L1&2	From L1&2 Upper Equipment Room to Dome	Pressure	0.943 psi	187.66	0.20
			Rupture foil L3&4	From L3&4 Upper Equipment Room to Dome	Pressure	0.943 psi	187.66	0.09
			Convection foil L1&2	From L1&2 Upper Equipment Room to Dome	Gas Temperature	185.9 °F	240.26	0.20
			Convection foil L3&4	From L3&4 Upper Equipment Room to Dome	Gas Temperature	185.9 °F	240.26	0.09
45	6.2.1-1 Case 39	Cold Leg Pump Suction DEG	Damper L1&2	From IRWST to L1&2 Lower Annulus	Pressure	0.66 psi	32.16	18.19
			Damper L3&4	From IRWST to L3&4 Lower Annulus	Pressure	0.66 psi	32.16	18.08
			Rupture foil L1&2	From L1&2 Upper Equipment Room to Dome	Pressure	0.943 psi	187.66	0.20
			Rupture foil L3&4	From L3&4 Upper Equipment Room to Dome	Pressure	0.943 psi	187.66	0.09
			Convection foil L1&2	From L1&2 Upper Equipment Room to Dome	Gas Temperature	185.9 °F	240.26	0.20
			Convection foil L3&4	From L3&4 Upper Equipment Room to Dome	Gas Temperature	185.9 °F	240.26	0.09
46	6.2.1-1 Case 40	Cold Leg Pump Suction DEG	Damper L1&2	From IRWST to L1&2 Lower Annulus	Pressure	0.66 psi	32.16	18.20
			Damper L3&4	From IRWST to L3&4 Lower Annulus	Pressure	0.66 psi	32.16	18.08

Table 06.02.01-94-01—Summary of CONVECT System in LOCA and MSLB Scenarios

Item No.	FSAR Reference	Description	Foils/Dampers Credited[1]	Location	Opening Mechanism	Set Point	Opening Area (ft²)	Opening Time (sec)
			Rupture foil L1&2	From L1&2 Upper Equipment Room to Dome	Pressure	0.943 psi	187.66	0.20
			Rupture foil L3&4	From L3&4 Upper Equipment Room to Dome	Pressure	0.943 psi	187.66	0.08
			Convection foil L1&2	From L1&2 Upper Equipment Room to Dome	Gas Temperature	185.9 °F	240.26	0.20
			Convection foil L3&4	From L3&4 Upper Equipment Room to Dome	Gas Temperature	185.9 °F	240.26	0.08
47	6.2.1-1 Case 41	Cold Leg Pump Discharge DEG	Damper L1&2	From IRWST to L1&2 Lower Annulus	Pressure	0.66 psi	32.16	18.19
			Damper L3&4	From IRWST to L3&4 Lower Annulus	Pressure	0.66 psi	32.16	18.08
			Rupture foil L1&2	From L1&2 Upper Equipment Room to Dome	Pressure	0.943 psi	187.66	0.19
			Rupture foil L3&4	From L3&4 Upper Equipment Room to Dome	Pressure	0.943 psi	187.66	0.09
			Convection foil L1&2	From L1&2 Upper Equipment Room to Dome	Gas Temperature	185.9 °F	240.26	0.19
			Convection foil L3&4	From L3&4 Upper Equipment Room to Dome	Gas Temperature	185.9 °F	240.26	0.09
48	6.2.1-1 Case 42	Cold Leg Pump Discharge 0.5 ft² (9 in) Split Break	Damper L1&2	From IRWST to L1&2 Lower Annulus	Pressure	0.66 psi	32.16	18.28
			Damper L3&4	From IRWST to L3&4 Lower Annulus	Pressure	0.66 psi	32.16	18.12
			Rupture foil L1&2	From L1&2 Upper Equipment Room to Dome	Pressure	0.943 psi	187.66	0.34
			Rupture foil L3&4	From L3&4 Upper Equipment Room to Dome	Pressure	0.943 psi	187.66	0.13

Table 06.02.01-94-01—Summary of CONVECT System in LOCA and MSLB Scenarios

Item No.	FSAR Reference	Description	Foils/Dampers Credited[1]	Location	Opening Mechanism	Set Point	Opening Area (ft^2)	Opening Time (sec)
			Convection foil L1&2	From L1&2 Upper Equipment Room to Dome	Gas Temperature	185.9 °F	240.26	0.34
			Convection foil L3&4	From L3&4 Upper Equipment Room to Dome	Gas Temperature	185.9 °F	240.26	0.13
49	6.2.1-1 Case 43	Cold Leg Pump Discharge 0.1963 ft^2 (6 in) Split Break	Damper L1&2	From IRWST to L1&2 Lower Annulus	Pressure	0.66 psi	32.16	18.36
			Damper L3&4	From IRWST to L3&4 Lower Annulus	Pressure	0.66 psi	32.16	18.15
			Rupture foil L1&2	From L1&2 Upper Equipment Room to Dome	Pressure	0.943 psi	187.66	0.45
			Rupture foil L3&4	From L3&4 Upper Equipment Room to Dome	Pressure	0.943 psi	187.66	0.32
			Convection foil L1&2	From L1&2 Upper Equipment Room to Dome	Gas Temperature	185.9 °F	240.26	0.45
			Convection foil L3&4	From L3&4 Upper Equipment Room to Dome	Gas Temperature	185.9 °F	240.26	0.32
50	6.2.1-1 Case 44	Cold Leg Pump Discharge 0.0491 ft^2 (3 in) Split Break	Damper L1&2	From IRWST to L1&2 Lower Annulus	Pressure	0.66 psi	32.16	18.96
			Damper L3&4	From IRWST to L3&4 Lower Annulus	Pressure	0.66 psi	32.16	18.87
			Rupture foil L1&2	From L1&2 Upper Equipment Room to Dome	Pressure	0.943 psi	187.66	1.35
			Rupture foil L3&4	From L3&4 Upper Equipment Room to Dome	Pressure	0.943 psi	187.66	1.31
			Convection foil L1&2	From L1&2 Upper Equipment Room to Dome	Gas Temperature	185.9 °F	240.26	1.35
			Convection foil L3&4	From L3&4 Upper Equipment Room to Dome	Gas Temperature	185.9 °F	240.26	1.31

Table 06.02.01-94-01—Summary of CONVECT System in LOCA and MSLB Scenarios

Item No.	FSAR Reference	Description	Foils/Dampers Credited[1]	Location	Opening Mechanism	Set Point	Opening Area (ft^2)	Opening Time (sec)
51	6.2.1-1 Case 45	Hot Leg 0.0491 ft^2 (3 in) Split Break	Damper L1&2	From IRWST to L1&2 Lower Annulus	Pressure	0.66 psi	32.16	19.00
			Damper L3&4	From IRWST to L3&4 Lower Annulus	Pressure	0.66 psi	32.16	18.98
			Rupture foil L1&2	From L1&2 Upper Equipment Room to Dome	Pressure	0.943 psi	187.66	1.45
			Rupture foil L3&4	From L3&4 Upper Equipment Room to Dome	Pressure	0.943 psi	187.66	1.39
			Convection foil L1&2	From L1&2 Upper Equipment Room to Dome	Gas Temperature	185.9 °F	240.26	1.45
			Convection foil L3&4	From L3&4 Upper Equipment Room to Dome	Gas Temperature	185.9 °F	240.26	1.39
52	6.2.1-1 Case 46	Hot Leg 0.0491 ft^2 (3 in) Split Break	Damper L1&2	From IRWST to L1&2 Lower Annulus	Pressure	0.66 psi	32.16	19.00
			Damper L3&4	From IRWST to L3&4 Lower Annulus	Pressure	0.66 psi	32.16	18.97
			Convection foil L1&2	From L1&2 Upper Equipment Room to Dome	Gas Temperature	185.9 °F	240.26	523.27
			Convection foil L3&4	From L3&4 Upper Equipment Room to Dome	Gas Temperature	185.9 °F	240.26	108.16
53	6.2.1-2 Case 1	MSLB 100% Power DEG	Damper L1&2	From IRWST to L1&2 Lower Annulus	Pressure	0.66 psi	32.16	18.01
			Damper L3&4	From IRWST to L3&4 Lower Annulus	Pressure	0.66 psi	32.16	18.23
			Rupture foil L1&2	From L1&2 Upper Equipment Room to Dome	Pressure	0.943 psi	187.66	0.01
			Rupture foil L3&4	From L3&4 Upper Equipment Room to Dome	Pressure	0.943 psi	187.66	0.26

Table 06.02.01-94-01—Summary of CONVECT System in LOCA and MSLB Scenarios

Item No.	FSAR Reference	Description	Foils/Dampers Credited[1]	Location	Opening Mechanism	Set Point	Opening Area (ft^2)	Opening Time (sec)
			Convection foil L1&2	From L1&2 Upper Equipment Room to Dome	Gas Temperature	185.9 °F	240.26	0.01
			Convection foil L3&4	From L3&4 Upper Equipment Room to Dome	Gas Temperature	185.9 °F	240.26	0.26
54	6.2.1-2 Case 2	MSLB 100%	Damper L1&2	From IRWST to L1&2 Lower Annulus	Pressure	0.66 psi	32.16	18.02
		Power 1.0 ft^2 Split	Damper L3&4	From IRWST to L3&4 Lower Annulus	Pressure	0.66 psi	32.16	18.43
		Break	Rupture foil L1&2	From L1&2 Upper Equipment Room to Dome	Pressure	0.943 psi	187.66	0.02
			Convection foil L1&2	From L1&2 Upper Equipment Room to Dome	Gas Temperature	185.9 °F	240.26	0.02
			Convection foil L3&4	From L3&4 Upper Equipment Room to Dome	Gas Temperature	185.9 °F	240.26	50.68
55	6.2.1-2 Case 3	MSLB 100%	Damper L1&2	From IRWST to L1&2 Lower Annulus	Pressure	0.66 psi	32.16	18.02
		Power 0.7 ft^2 Split	Damper L3&4	From IRWST to L3&4 Lower Annulus	Pressure	0.66 psi	32.16	22.57
		Break	Rupture foil L1&2	From L1&2 Upper Equipment Room to Dome	Pressure	0.943 psi	187.66	0.04
			Convection foil L1&2	From L1&2 Upper Equipment Room to Dome	Gas Temperature	185.9 °F	240.26	0.04
			Convection foil L3&4	From L3&4 Upper Equipment Room to Dome	Gas Temperature	185.9 °F	240.26	60.38
56	6.2.1-2 Case 4	MSLB 100%	Damper L1&2	From IRWST to L1&2 Lower Annulus	Pressure	0.66 psi	32.16	18.04
		Power 0.52 ft^2 Split	Damper L3&4	From IRWST to L3&4 Lower Annulus	Pressure	0.66 psi	32.16	18.42

Table 06.02.01-94-01—Summary of CONVECT System in LOCA and MSLB Scenarios

Item No.	FSAR Reference	Description	Foils/Dampers Credited[1]	Location	Opening Mechanism	Set Point	Opening Area (ft^2)	Opening Time (sec)
		Break	Rupture foil L1&2	From L1&2 Upper Equipment Room to Dome	Pressure	0.943 psi	187.66	0.23
			Convection foil L1&2	From L1&2 Upper Equipment Room to Dome	Gas Temperature	185.9 °F	240.26	0.23
			Convection foil L3&4	From L3&4 Upper Equipment Room to Dome	Gas Temperature	185.9 °F	240.26	70.88
57	6.2.1-2 Case 5	MSLB 100%	Damper L1&2	From IRWST to L1&2 Lower Annulus	Pressure	0.66 psi	32.16	18.64
		Power 0.3 ft^2 Split	Damper L3&4	From IRWST to L3&4 Lower Annulus	Pressure	0.66 psi	32.16	18.65
		Break	Rupture foil L1&2	From L1&2 Upper Equipment Room to Dome	Pressure	0.943 psi	187.66	0.91
			Convection foil L1&2	From L1&2 Upper Equipment Room to Dome	Gas Temperature	185.9 °F	240.26	0.91
			Convection foil L3&4	From L3&4 Upper Equipment Room to Dome	Gas Temperature	185.9 °F	240.26	324.37
58	6.2.1-2 Case 6	MSLB 80% Power DEG	Damper L1&2	From IRWST to L1&2 Lower Annulus	Pressure	0.66 psi	32.16	18.01
			Damper L3&4	From IRWST to L3&4 Lower Annulus	Pressure	0.66 psi	32.16	18.24
			Rupture foil L1&2	From L1&2 Upper Equipment Room to Dome	Pressure	0.943 psi	187.66	0.01
			Rupture foil L3&4	From L3&4 Upper Equipment Room to Dome	Pressure	0.943 psi	187.66	0.28
			Convection foil L1&2	From L1&2 Upper Equipment Room to Dome	Gas Temperature	185.9 °F	240.26	0.01
			Convection foil L3&4	From L3&4 Upper Equipment Room to Dome	Gas Temperature	185.9 °F	240.26	0.28

Table 06.02.01-94-01—Summary of CONVECT System in LOCA and MSLB Scenarios

Item No.	FSAR Reference	Description	Foils/Dampers Credited[1]	Location	Opening Mechanism	Set Point	Opening Area (ft²)	Opening Time (sec)
59	6.2.1-2 Case 7	MSLB 80% Power 1.0 ft² Split Break	Damper L1&2	From IRWST to L1&2 Lower Annulus	Pressure	0.66 psi	32.16	18.02
			Damper L3&4	From IRWST to L3&4 Lower Annulus	Pressure	0.66 psi	32.16	21.46
			Rupture foil L1&2	From L1&2 Upper Equipment Room to Dome	Pressure	0.943 psi	187.66	0.03
			Convection foil L1&2	From L1&2 Upper Equipment Room to Dome	Gas Temperature	185.9 °F	240.26	0.03
			Convection foil L3&4	From L3&4 Upper Equipment Room to Dome	Gas Temperature	185.9 °F	240.26	51.32
60	6.2.1-2 Case 8	MSLB 80% Power 0.7 ft² Split Break	Damper L1&2	From IRWST to L1&2 Lower Annulus	Pressure	0.66 psi	32.16	18.03
			Damper L3&4	From IRWST to L3&4 Lower Annulus	Pressure	0.66 psi	32.16	22.76
			Rupture foil L1&2	From L1&2 Upper Equipment Room to Dome	Pressure	0.943 psi	187.66	0.04
			Convection foil L1&2	From L1&2 Upper Equipment Room to Dome	Gas Temperature	185.9 °F	240.26	0.04
			Convection foil L3&4	From L3&4 Upper Equipment Room to Dome	Gas Temperature	185.9 °F	240.26	61.49
61	6.2.1-2 Case 9	MSLB 80% Power 0.52 ft² Split Break	Damper L1&2	From IRWST to L1&2 Lower Annulus	Pressure	0.66 psi	32.16	18.05
			Damper L3&4	From IRWST to L3&4 Lower Annulus	Pressure	0.66 psi	32.16	18.42
			Rupture foil L1&2	From L1&2 Upper Equipment Room to Dome	Pressure	0.943 psi	187.66	0.24
			Convection foil L1&2	From L1&2 Upper Equipment Room to Dome	Gas Temperature	185.9 °F	240.26	0.24

Table 06.02.01-94-01—Summary of CONVECT System in LOCA and MSLB Scenarios

Item No.	FSAR Reference	Description	Foils/Dampers Credited[1]	Location	Opening Mechanism	Set Point	Opening Area (ft²)	Opening Time (sec)
			Convection foil L3&4	From L3&4 Upper Equipment Room to Dome	Gas Temperature	185.9 °F	240.26	72.08
62	6.2.1-2 Case 10	MSLB 80% Power 0.3 ft² Split Break	Damper L1&2	From IRWST to L1&2 Lower Annulus	Pressure	0.66 psi	32.16	18.63
			Damper L3&4	From IRWST to L3&4 Lower Annulus	Pressure	0.66 psi	32.16	18.64
			Rupture foil L1&2	From L1&2 Upper Equipment Room to Dome	Pressure	0.943 psi	187.66	0.90
			Convection foil L1&2	From L1&2 Upper Equipment Room to Dome	Gas Temperature	185.9 °F	240.26	0.90
			Convection foil L3&4	From L3&4 Upper Equipment Room to Dome	Gas Temperature	185.9 °F	240.26	333.11
63	6.2.1-2 Case 11	MSLB 60% Power DEG	Damper L1&2	From IRWST to L1&2 Lower Annulus	Pressure	0.66 psi	32.16	18.01
			Damper L3&4	From IRWST to L3&4 Lower Annulus	Pressure	0.66 psi	32.16	18.24
			Rupture foil L1&2	From L1&2 Upper Equipment Room to Dome	Pressure	0.943 psi	187.66	0.01
			Rupture foil L3&4	From L3&4 Upper Equipment Room to Dome	Pressure	0.943 psi	187.66	0.27
			Convection foil L1&2	From L1&2 Upper Equipment Room to Dome	Gas Temperature	185.9 °F	240.26	0.01
			Convection foil L3&4	From L3&4 Upper Equipment Room to Dome	Gas Temperature	185.9 °F	240.26	0.27
64	6.2.1-2 Case 12	MSLB 60% Power 1.0 ft² Split Break	Damper L1&2	From IRWST to L1&2 Lower Annulus	Pressure	0.66 psi	32.16	18.02
			Damper L3&4	From IRWST to L3&4 Lower Annulus	Pressure	0.66 psi	32.16	21.33

Table 06.02.01-94-01—Summary of CONVECT System in LOCA and MSLB Scenarios

Item No.	FSAR Reference	Description	Foils/Dampers Credited[1]	Location	Opening Mechanism	Set Point	Opening Area (ft²)	Opening Time (sec)
			Rupture foil L1&2	From L1&2 Upper Equipment Room to Dome	Pressure	0.943 psi	187.66	0.03
			Convection foil L1&2	From L1&2 Upper Equipment Room to Dome	Gas Temperature	185.9 °F	240.26	0.03
			Convection foil L3&4	From L3&4 Upper Equipment Room to Dome	Gas Temperature	185.9 °F	240.26	50.71
65	6.2.1-2 Case 13	MSLB 60% Power 0.7 ft² Split Break	Damper L1&2	From IRWST to L1&2 Lower Annulus	Pressure	0.66 psi	32.16	18.03
			Damper L3&4	From IRWST to L3&4 Lower Annulus	Pressure	0.66 psi	32.16	22.63
			Rupture foil L1&2	From L1&2 Upper Equipment Room to Dome	Pressure	0.943 psi	187.66	0.04
			Convection foil L1&2	From L1&2 Upper Equipment Room to Dome	Gas Temperature	185.9 °F	240.26	0.04
			Convection foil L3&4	From L3&4 Upper Equipment Room to Dome	Gas Temperature	185.9 °F	240.26	60.70
66	6.2.1-2 Case 14	MSLB 60% Power 0.52 ft² Split Break	Damper L1&2	From IRWST to L1&2 Lower Annulus	Pressure	0.66 psi	32.16	18.04
			Damper L3&4	From IRWST to L3&4 Lower Annulus	Pressure	0.66 psi	32.16	18.41
			Rupture foil L1&2	From L1&2 Upper Equipment Room to Dome	Pressure	0.943 psi	187.66	0.23
			Convection foil L1&2	From L1&2 Upper Equipment Room to Dome	Gas Temperature	185.9 °F	240.26	0.23
			Convection foil L3&4	From L3&4 Upper Equipment Room to Dome	Gas Temperature	185.9 °F	240.26	72.79

Table 06.02.01-94-01—Summary of CONVECT System in LOCA and MSLB Scenarios

Item No.	FSAR Reference	Description	Foils/Dampers Credited[1]	Location	Opening Mechanism	Set Point	Opening Area (ft^2)	Opening Time (sec)
67	6.2.1-2 Case 15	MSLB 60% Power 0.3 ft^2 Split Break	Damper L1&2	From IRWST to L1&2 Lower Annulus	Pressure	0.66 psi	32.16	18.61
			Damper L3&4	From IRWST to L3&4 Lower Annulus	Pressure	0.66 psi	32.16	18.56
			Rupture foil L1&2	From L1&2 Upper Equipment Room to Dome	Pressure	0.943 psi	187.66	0.84
			Convection foil L1&2	From L1&2 Upper Equipment Room to Dome	Gas Temperature	185.9 °F	240.26	0.84
			Convection foil L3&4	From L3&4 Upper Equipment Room to Dome	Gas Temperature	185.9 °F	240.26	343.78
68	6.2.1-2 Case 16	MSLB 50% Power DEG	Damper L1&2	From IRWST to L1&2 Lower Annulus	Pressure	0.66 psi	32.16	18.01
			Damper L3&4	From IRWST to L3&4 Lower Annulus	Pressure	0.66 psi	32.16	18.24
			Rupture foil L1&2	From L1&2 Upper Equipment Room to Dome	Pressure	0.943 psi	187.66	0.01
			Rupture foil L3&4	From L3&4 Upper Equipment Room to Dome	Pressure	0.943 psi	187.66	0.27
			Convection foil L1&2	From L1&2 Upper Equipment Room to Dome	Gas Temperature	185.9 °F	240.26	0.01
			Convection foil L3&4	From L3&4 Upper Equipment Room to Dome	Gas Temperature	185.9 °F	240.26	0.27
69	6.2.1-2 Case 17	MSLB 50% Power 1.0 ft^2 Split Break	Damper L1&2	From IRWST to L1&2 Lower Annulus	Pressure	0.66 psi	32.16	18.02
			Damper L3&4	From IRWST to L3&4 Lower Annulus	Pressure	0.66 psi	32.16	21.32
			Rupture foil L1&2	From L1&2 Upper Equipment Room to Dome	Pressure	0.943 psi	187.66	0.03

Table 06.02.01-94-01—Summary of CONVECT System in LOCA and MSLB Scenarios

Item No.	FSAR Reference	Description	Foils/Dampers Credited[1]	Location	Opening Mechanism	Set Point	Opening Area (ft²)	Opening Time (sec)
			Convection foil L1&2	From L1&2 Upper Equipment Room to Dome	Gas Temperature	185.9 °F	240.26	0.03
			Convection foil L3&4	From L3&4 Upper Equipment Room to Dome	Gas Temperature	185.9 °F	240.26	50.15
70	6.2.1-2 Case 18	MSLB 50% Power 0.7 ft² Split Break	Damper L1&2	From IRWST to L1&2 Lower Annulus	Pressure	0.66 psi	32.16	18.03
			Damper L3&4	From IRWST to L3&4 Lower Annulus	Pressure	0.66 psi	32.16	22.63
			Rupture foil L1&2	From L1&2 Upper Equipment Room to Dome	Pressure	0.943 psi	187.66	0.04
			Convection foil L1&2	From L1&2 Upper Equipment Room to Dome	Gas Temperature	185.9 °F	240.26	0.04
			Convection foil L3&4	From L3&4 Upper Equipment Room to Dome	Gas Temperature	185.9 °F	240.26	60.21
71	6.2.1-2 Case 19	MSLB 50% Power 0.52 ft² Split Break	Damper L1&2	From IRWST to L1&2 Lower Annulus	Pressure	0.66 psi	32.16	18.04
			Damper L3&4	From IRWST to L3&4 Lower Annulus	Pressure	0.66 psi	32.16	18.41
			Rupture foil L1&2	From L1&2 Upper Equipment Room to Dome	Pressure	0.943 psi	187.66	0.23
			Convection foil L1&2	From L1&2 Upper Equipment Room to Dome	Gas Temperature	185.9 °F	240.26	0.23
			Convection foil L3&4	From L3&4 Upper Equipment Room to Dome	Gas Temperature	185.9 °F	240.26	74.04
72	6.2.1-2 Case 20	MSLB 50% Power 0.3 ft² Split Break	Damper L1&2	From IRWST to L1&2 Lower Annulus	Pressure	0.66 psi	32.16	18.61
			Damper L3&4	From IRWST to L3&4 Lower Annulus	Pressure	0.66 psi	32.16	18.56

Table 06.02.01-94-01—Summary of CONVECT System in LOCA and MSLB Scenarios

Item No.	FSAR Reference	Description	Foils/Dampers Credited[1]	Location	Opening Mechanism	Set Point	Opening Area (ft²)	Opening Time (sec)
			Rupture foil L1&2	From L1&2 Upper Equipment Room to Dome	Pressure	0.943 psi	187.66	0.83
			Convection foil L1&2	From L1&2 Upper Equipment Room to Dome	Gas Temperature	185.9 °F	240.26	0.83
			Convection foil L3&4	From L3&4 Upper Equipment Room to Dome	Gas Temperature	185.9 °F	240.26	343.87
73	6.2.1-2 Case 21	MSLB 40% Power DEG	Damper L1&2	From IRWST to L1&2 Lower Annulus	Pressure	0.66 psi	32.16	18.01
			Damper L3&4	From IRWST to L3&4 Lower Annulus	Pressure	0.66 psi	32.16	18.24
			Rupture foil L1&2	From L1&2 Upper Equipment Room to Dome	Pressure	0.943 psi	187.66	0.01
			Rupture foil L3&4	From L3&4 Upper Equipment Room to Dome	Pressure	0.943 psi	187.66	0.27
			Convection foil L1&2	From L1&2 Upper Equipment Room to Dome	Gas Temperature	185.9 °F	240.26	0.01
			Convection foil L3&4	From L3&4 Upper Equipment Room to Dome	Gas Temperature	185.9 °F	240.26	0.27
74	6.2.1-2 Case 22	MSLB 40% Power 1.0 ft² Split Break	Damper L1&2	From IRWST to L1&2 Lower Annulus	Pressure	0.66 psi	32.16	18.02
			Damper L3&4	From IRWST to L3&4 Lower Annulus	Pressure	0.66 psi	32.16	21.34
			Rupture foil L1&2	From L1&2 Upper Equipment Room to Dome	Pressure	0.943 psi	187.66	0.03
			Convection foil L1&2	From L1&2 Upper Equipment Room to Dome	Gas Temperature	185.9 °F	240.26	0.03
			Convection foil L3&4	From L3&4 Upper Equipment Room to Dome	Gas Temperature	185.9 °F	240.26	49.80

Table 06.02.01-94-01—Summary of CONVECT System in LOCA and MSLB Scenarios

Item No.	FSAR Reference	Description	Foils/Dampers Credited[1]	Location	Opening Mechanism	Set Point	Opening Area (ft²)	Opening Time (sec)
75	6.2.1-2 Case 23	MSLB 40% Power 0.7 ft² Split Break	Damper L1&2	From IRWST to L1&2 Lower Annulus	Pressure	0.66 psi	32.16	18.03
			Damper L3&4	From IRWST to L3&4 Lower Annulus	Pressure	0.66 psi	32.16	22.68
			Rupture foil L1&2	From L1&2 Upper Equipment Room to Dome	Pressure	0.943 psi	187.66	0.04
			Convection foil L1&2	From L1&2 Upper Equipment Room to Dome	Gas Temperature	185.9 °F	240.26	0.04
			Convection foil L3&4	From L3&4 Upper Equipment Room to Dome	Gas Temperature	185.9 °F	240.26	60.90
76	6.2.1-2 Case 24	MSLB 40% Power 0.52 ft² Split Break	Damper L1&2	From IRWST to L1&2 Lower Annulus	Pressure	0.66 psi	32.16	18.04
			Damper L3&4	From IRWST to L3&4 Lower Annulus	Pressure	0.66 psi	32.16	18.41
			Rupture foil L1&2	From L1&2 Upper Equipment Room to Dome	Pressure	0.943 psi	187.66	0.23
			Convection foil L1&2	From L1&2 Upper Equipment Room to Dome	Gas Temperature	185.9 °F	240.26	0.23
			Convection foil L3&4	From L3&4 Upper Equipment Room to Dome	Gas Temperature	185.9 °F	240.26	72.94
77	6.2.1-2 Case 25	MSLB 40% Power 0.3 ft² Split Break	Damper L1&2	From IRWST to L1&2 Lower Annulus	Pressure	0.66 psi	32.16	18.61
			Damper L3&4	From IRWST to L3&4 Lower Annulus	Pressure	0.66 psi	32.16	18.56
			Rupture foil L1&2	From L1&2 Upper Equipment Room to Dome	Pressure	0.943 psi	187.66	0.84
			Convection foil L1&2	From L1&2 Upper Equipment Room to Dome	Gas Temperature	185.9 °F	240.26	0.84

Table 06.02.01-94-01—Summary of CONVECT System in LOCA and MSLB Scenarios

Item No.	FSAR Reference	Description	Foils/Dampers Credited[1]	Location	Opening Mechanism	Set Point	Opening Area (ft^2)	Opening Time (sec)
			Convection foil L3&4	From L3&4 Upper Equipment Room to Dome	Gas Temperature	185.9 °F	240.26	346.89
78	6.2.1-2 Case 26	MSLB 20% Power DEG	Damper L1&2	From IRWST to L1&2 Lower Annulus	Pressure	0.66 psi	32.16	18.01
			Damper L3&4	From IRWST to L3&4 Lower Annulus	Pressure	0.66 psi	32.16	18.24
			Rupture foil L1&2	From L1&2 Upper Equipment Room to Dome	Pressure	0.943 psi	187.66	0.01
			Rupture foil L3&4	From L3&4 Upper Equipment Room to Dome	Pressure	0.943 psi	187.66	0.27
			Convection foil L1&2	From L1&2 Upper Equipment Room to Dome	Gas Temperature	185.9 °F	240.26	0.01
			Convection foil L3&4	From L3&4 Upper Equipment Room to Dome	Gas Temperature	185.9 °F	240.26	0.27
79	6.2.1-2 Case 26A	MSLB 20% Power DEG	Damper L1&2	From IRWST to L1&2 Lower Annulus	Pressure	0.66 psi	32.16	18.01
			Damper L3&4	From IRWST to L3&4 Lower Annulus	Pressure	0.66 psi	32.16	18.24
			Rupture foil L1&2	From L1&2 Upper Equipment Room to Dome	Pressure	0.943 psi	187.66	0.01
			Rupture foil L3&4	From L3&4 Upper Equipment Room to Dome	Pressure	0.943 psi	187.66	0.27
			Convection foil L1&2	From L1&2 Upper Equipment Room to Dome	Gas Temperature	185.9 °F	240.26	0.01
			Convection foil L3&4	From L3&4 Upper Equipment Room to Dome	Gas Temperature	185.9 °F	240.26	0.27
80	6.2.1-2 Case 26B	MSLB 20% Power DEG	Damper L1&2	From IRWST to L1&2 Lower Annulus	Pressure	0.66 psi	32.16	18.22

Table 06.02.01-94-01—Summary of CONVECT System in LOCA and MSLB Scenarios

Item No.	FSAR Reference	Description	Foils/Dampers Credited[1]	Location	Opening Mechanism	Set Point	Opening Area (ft^2)	Opening Time (sec)
			Damper L3&4	From IRWST to L3&4 Lower Annulus	Pressure	0.66 psi	32.16	18.15
			Convection foil L1&2	From L1&2 Upper Equipment Room to Dome	Gas Temperature	185.9 °F	240.26	49.47
			Convection foil L3&4	From L3&4 Upper Equipment Room to Dome	Gas Temperature	185.9 °F	240.26	49.43
81	6.2.1-2 Case 27	MSLB 20% Power 1.0 ft^2 Split Break	Damper L1&2	From IRWST to L1&2 Lower Annulus	Pressure	0.66 psi	32.16	18.02
			Damper L3&4	From IRWST to L3&4 Lower Annulus	Pressure	0.66 psi	32.16	18.46
			Rupture foil L1&2	From L1&2 Upper Equipment Room to Dome	Pressure	0.943 psi	187.66	0.02
			Convection foil L1&2	From L1&2 Upper Equipment Room to Dome	Gas Temperature	185.9 °F	240.26	0.02
			Convection foil L3&4	From L3&4 Upper Equipment Room to Dome	Gas Temperature	185.9 °F	240.26	49.15
82	6.2.1-2 Case 28	MSLB 20% Power 0.7 ft^2 Split Break	Damper L1&2	From IRWST to L1&2 Lower Annulus	Pressure	0.66 psi	32.16	18.03
			Damper L3&4	From IRWST to L3&4 Lower Annulus	Pressure	0.66 psi	32.16	22.64
			Rupture foil L1&2	From L1&2 Upper Equipment Room to Dome	Pressure	0.943 psi	187.66	0.04
			Convection foil L1&2	From L1&2 Upper Equipment Room to Dome	Gas Temperature	185.9 °F	240.26	0.04
			Convection foil L3&4	From L3&4 Upper Equipment Room to Dome	Gas Temperature	185.9 °F	240.26	58.90

Table 06.02.01-94-01—Summary of CONVECT System in LOCA and MSLB Scenarios

Item No.	FSAR Reference	Description	Foils/Dampers Credited[1]	Location	Opening Mechanism	Set Point	Opening Area (ft^2)	Opening Time (sec)
83	6.2.1-2 Case 29	MSLB 20% Power 0.52 ft² Split Break	Damper L1&2	From IRWST to L1&2 Lower Annulus	Pressure	0.66 psi	32.16	18.04
			Damper L3&4	From IRWST to L3&4 Lower Annulus	Pressure	0.66 psi	32.16	18.41
			Rupture foil L1&2	From L1&2 Upper Equipment Room to Dome	Pressure	0.943 psi	187.66	0.22
			Convection foil L1&2	From L1&2 Upper Equipment Room to Dome	Gas Temperature	185.9 °F	240.26	0.22
			Convection foil L3&4	From L3&4 Upper Equipment Room to Dome	Gas Temperature	185.9 °F	240.26	77.32
84	6.2.1-2 Case 30	MSLB 20% Power 0.3 ft² Split Break	Damper L1&2	From IRWST to L1&2 Lower Annulus	Pressure	0.66 psi	32.16	18.60
			Damper L3&4	From IRWST to L3&4 Lower Annulus	Pressure	0.66 psi	32.16	18.54
			Rupture foil L1&2	From L1&2 Upper Equipment Room to Dome	Pressure	0.943 psi	187.66	0.82
			Convection foil L1&2	From L1&2 Upper Equipment Room to Dome	Gas Temperature	185.9	240.26	0.82
			Convection foil L3&4	From L3&4 Upper Equipment Room to Dome	Gas Temperature	185.9	240.26	348.81
85	6.2.1-2 Case 31	MSLB 0% Power DEG	Damper L1&2	From IRWST to L1&2 Lower Annulus	Pressure	0.66 psi	32.16	18.01
			Damper L3&4	From IRWST to L3&4 Lower Annulus	Pressure	0.66 psi	32.16	18.24
			Rupture foil L1&2	From L1&2 Upper Equipment Room to Dome	Pressure	0.943 psi	187.66	0.01
			Rupture foil L3&4	From L3&4 Upper Equipment Room to Dome	Pressure	0.943 psi	187.66	0.27

Table 06.02.01-94-01—Summary of CONVECT System in LOCA and MSLB Scenarios

Item No.	FSAR Reference	Description	Foils/Dampers Credited[1]	Location	Opening Mechanism	Set Point	Opening Area (ft²)	Opening Time (sec)
			Convection foil L1&2	From L1&2 Upper Equipment Room to Dome	Gas Temperature	185.9 °F	240.26	0.01
			Convection foil L3&4	From L3&4 Upper Equipment Room to Dome	Gas Temperature	185.9 °F	240.26	0.27
86	6.2.1-2 Case 32	MSLB 0% Power 1.0 ft² Split Break	Damper L1&2	From IRWST to L1&2 Lower Annulus	Pressure	0.66 psi	32.16	18.02
			Damper L3&4	From IRWST to L3&4 Lower Annulus	Pressure	0.66 psi	32.16	18.46
			Rupture foil L1&2	From L1&2 Upper Equipment Room to Dome	Pressure	0.943 psi	187.66	0.02
			Convection foil L1&2	From L1&2 Upper Equipment Room to Dome	Gas Temperature	185.9 °F	240.26	0.02
			Convection foil L3&4	From L3&4 Upper Equipment Room to Dome	Gas Temperature	185.9 °F	240.26	45.18
87	6.2.1-2 Case 33	MSLB 0% Power 0.7 ft² Split Break	Damper L1&2	From IRWST to L1&2 Lower Annulus	Pressure	0.66 psi	32.16	18.03
			Damper L3&4	From IRWST to L3&4 Lower Annulus	Pressure	0.66 psi	32.16	22.65
			Rupture foil L1&2	From L1&2 Upper Equipment Room to Dome	Pressure	0.943 psi	187.66	0.04
			Convection foil L1&2	From L1&2 Upper Equipment Room to Dome	Gas Temperature	185.9 °F	240.26	0.04
			Convection foil L3&4	From L3&4 Upper Equipment Room to Dome	Gas Temperature	185.9 °F	240.26	53.06
88	6.2.1-2 Case 34	MSLB 0% Power 0.52 ft² Split Break	Damper L1&2	From IRWST to L1&2 Lower Annulus	Pressure	0.66 psi	32.16	18.04
			Damper L3&4	From IRWST to L3&4 Lower Annulus	Pressure	0.66 psi	32.16	18.41

Table 06.02.01-94-01—Summary of CONVECT System in LOCA and MSLB Scenarios

Item No.	FSAR Reference	Description	Foils/Dampers Credited[1]	Location	Opening Mechanism	Set Point	Opening Area (ft²)	Opening Time (sec)
			Rupture foil L1&2	From L1&2 Upper Equipment Room to Dome	Pressure	0.943 psi	187.66	0.22
			Convection foil L1&2	From L1&2 Upper Equipment Room to Dome	Gas Temperature	185.9 °F	240.26	0.22
			Convection foil L3&4	From L3&4 Upper Equipment Room to Dome	Gas Temperature	185.9 °F	240.26	61.80
89	6.2.1-2 Case 35	MSLB 0% Power 0.3 ft² Split Break	Damper L1&2	From IRWST to L1&2 Lower Annulus	Pressure	0.66 psi	32.16	18.60
			Damper L3&4	From IRWST to L3&4 Lower Annulus	Pressure	0.66 psi	32.16	18.54
			Rupture foil L1&2	From L1&2 Upper Equipment Room to Dome	Pressure	0.943 psi	187.66	0.82
			Convection foil L1&2	From L1&2 Upper Equipment Room to Dome	Gas Temperature	185.9 °F	240.26	0.82
			Convection foil L3&4	From L3&4 Upper Equipment Room to Dome	Gas Temperature	185.9 °F	240.26	349.56
90	6.2.1-2 Case 35A	MSLB 0% Power 0.3 ft² Split Break	Damper L1&2	From IRWST to L1&2 Lower Annulus	Pressure	0.66 psi	32.16	20.75
			Damper L3&4	From IRWST to L3&4 Lower Annulus	Pressure	0.66 psi	32.16	20.75
			Convection foil L1&2	From L1&2 Upper Equipment Room to Dome	Gas Temperature	185.9 °F	240.26	357.35
			Convection foil L3&4	From L3&4 Upper Equipment Room to Dome	Gas Temperature	185.9 °F	240.26	335.17
91	6.2.1-2 Case 36	MSLB 0% Power 0.2 ft² Split Break	Damper L1&2	From IRWST to L1&2 Lower Annulus	Pressure	0.66 psi	32.16	18.89
			Damper L3&4	From IRWST to L3&4 Lower Annulus	Pressure	0.66 psi	32.16	19.00

Table 06.02.01-94-01—Summary of CONVECT System in LOCA and MSLB Scenarios

Item No.	FSAR Reference	Description	Foils/Dampers Credited[1]	Location	Opening Mechanism	Set Point	Opening Area (ft^2)	Opening Time (sec)
			Rupture foil L1&2	From L1&2 Upper Equipment Room to Dome	Pressure	0.943 psi	187.66	1.37
			Convection foil L1&2	From L1&2 Upper Equipment Room to Dome	Gas Temperature	185.9 °F	240.26	1.37
			Convection foil L3&4	From L3&4 Upper Equipment Room to Dome	Gas Temperature	185.9 °F	240.26	368.37
92	6.2.1-2 Case 37	MSLB 0% Power 0.15 ft^2 Split Break	Damper L1&2	From IRWST to L1&2 Lower Annulus	Pressure	0.66 psi	32.16	19.32
			Damper L3&4	From IRWST to L3&4 Lower Annulus	Pressure	0.66 psi	32.16	19.32
			Rupture foil L1&2	From L1&2 Upper Equipment Room to Dome	Pressure	0.943 psi	187.66	1.88
			Convection foil L1&2	From L1&2 Upper Equipment Room to Dome	Gas Temperature	185.9 °F	240.26	1.88
			Convection foil L3&4	From L3&4 Upper Equipment Room to Dome	Gas Temperature	185.9 °F	240.26	386.86
93	6.2.1-2 Case 38	MSLB 0% Power 0.1 ft^2 Split Break	Damper L1&2	From IRWST to L1&2 Lower Annulus	Pressure	0.66 psi	32.16	19.99
			Damper L3&4	From IRWST to L3&4 Lower Annulus	Pressure	0.66 psi	32.16	20.01
			Rupture foil L1&2	From L1&2 Upper Equipment Room to Dome	Pressure	0.943 psi	187.66	2.83
			Convection foil L1&2	From L1&2 Upper Equipment Room to Dome	Gas Temperature	185.9 °F	240.26	2.83
			Convection foil L3&4	From L3&4 Upper Equipment Room to Dome	Gas Temperature	185.9 °F	240.26	427.81

Table 06.02.01-94-01—Summary of CONVECT System in LOCA and MSLB Scenarios

Item No.	FSAR Reference	Description	Foils/Dampers Credited[1]	Location	Opening Mechanism	Set Point	Opening Area (ft²)	Opening Time (sec)
94	6.2.1-2 Case 39	MSLB 0% Power 0.01 ft² Split Break	Damper L1&2	From IRWST to L1&2 Lower Annulus	Pressure	0.66 psi	32.16	34.42
			Damper L3&4	From IRWST to L3&4 Lower Annulus	Pressure	0.66 psi	32.16	34.48
			Rupture foil L1&2	From L1&2 Upper Equipment Room to Dome	Pressure	0.943 psi	187.66	24.49
			Convection foil L1&2	From L1&2 Upper Equipment Room to Dome	Gas Temperature	185.9 °F	240.26	24.49
95	6.2.1-2 Case 40	MSLB 0% Power 0.005 ft² Split Break	Damper L1&2	From IRWST to L1&2 Lower Annulus	Pressure	0.66 psi	32.16	45.33
			Damper L3&4	From IRWST to L3&4 Lower Annulus	Pressure	0.66 psi	32.16	45.39
			Rupture foil L1&2	From L1&2 Upper Equipment Room to Dome	Pressure	0.943 psi	187.66	41.99
			Convection foil L1&2	From L1&2 Upper Equipment Room to Dome	Gas Temperature	185.9 °F	240.26	41.99

Question 06.02.01-95

Follow-up to RAI 266, Question 06.02.01-47

In letter dated 12/10/2009 in response to RAI No. 266 Supplement 2, the applicant provided Gothic input decks. In a review of the GOTHIC input tables (Thermal Conductors) generated at the NRC from file "clps_np_s_sd2, Oct/27/2009", it was noted that containment liner wall areas between cells v21 and v22 showed significant skewing (12280 vs. 15067.8 ft^2). Please verify that this skewed set of liner areas are currently being used in AVEVA Chapter 6 calculations. Discuss the reason for the skewing and whether these area values are correct. If not correct, provide a corrected set of v21/v22 liner areas and discuss the impact this error may have on containment pressure, local (v21 and v22) gas and liner temperatures.

Response to Question 06.02.01-95:

A U.S. EPR COCOSYS database was used as the source of geometry inputs for nodal volumes, flow paths, and heat sinks in the U.S. EPR GOTHIC containment model.

Control volume 21 represents the loop 1 and 2 middle annulus region on the west side of the containment, and control volume 22 represents the loop 3 and 4 middle annulus region on the east side. These two nodes have symmetric geometry; therefore, the containment wall liner areas of control volumes 21 and 22 should be equivalent. The distribution of liner areas in the model, however, is skewed to a larger control volume 22 (15067.8 ft^2 or 1399.8 m^2) relative to control volume 21 (12280 ft^2 or 1140.81 m^2).

The skewing of the above liner areas is traced back to a wall heat structure being mislabeled in the COCOSYS database. As a result, the section of wall surrounding room UJA15014, which is lumped into control volume 21, was incorrectly associated in the model with control volume 22.

In the COCOSYS database nomenclature, “primary wall” # 346 is mislabeled as belonging to room UJA15015, which results in this room having twice the wall area. By logical sequencing of the primary walls listing around “primary wall” # 346, this wall should have been labeled as belonging to room UJA15014.

This mislabeled wall is responsible for skewing the surface area value of 130.42 m^2 (“primary wall” # 346). Therefore, correcting the liner areas yields:

- Corrected node v21 liner area = 1140.81 + 130.42 = 1271.23 m^2 (13683.85 ft^2).
- Corrected node v22 liner area = 1399.8 - 130.42 = 1269.38 m^2 (13663.94 ft^2).

The above corrected wall areas confirm the symmetry of the containment walls at the elevation of control volumes 21 and 22, similar to the symmetry obtained for the walls below this elevation (control volumes 19 and 20 liner areas at 1628 ft^2 each) and above this elevation (control volumes 23 and 24 liner areas at 3559.1 ft^2 each).

While the distribution of liner heat sink areas is skewed at the elevation of middle annulus control volumes 21 and 22, the total heat sink area, including liner surface area, is preserved. Because containment pressure response to LOCA and MSLB is strongly dependent on integral parameters (e.g., free volume, amount of non-condensables, and total heat sink surface areas) it follows the prediction that containment pressure is un-impacted by the local difference in heat sink areas at this one location because the total surface area is accurately modeled.

Figures 06.02.01-95-1 and 06.02.01-95-2 show, for the limiting CLPS LOCA and MSLB, respectively, the skewed heat sink surface areas have an insignificant impact on the local temperature response of the affected nodes. There will be an insignificant impact on the surface temperatures of the affected liners (GOTHIC heat structures #3 and #4) because they are exposed to similar magnitude gas temperatures, as shown in Figures 06.02.01-95-1 and 06.02.01-95-2.

FSAR Impact:

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

Figure 06.02.01-95-1—Local Vapor Temperatures in Affected Nodes for Limiting CLPS LOCA

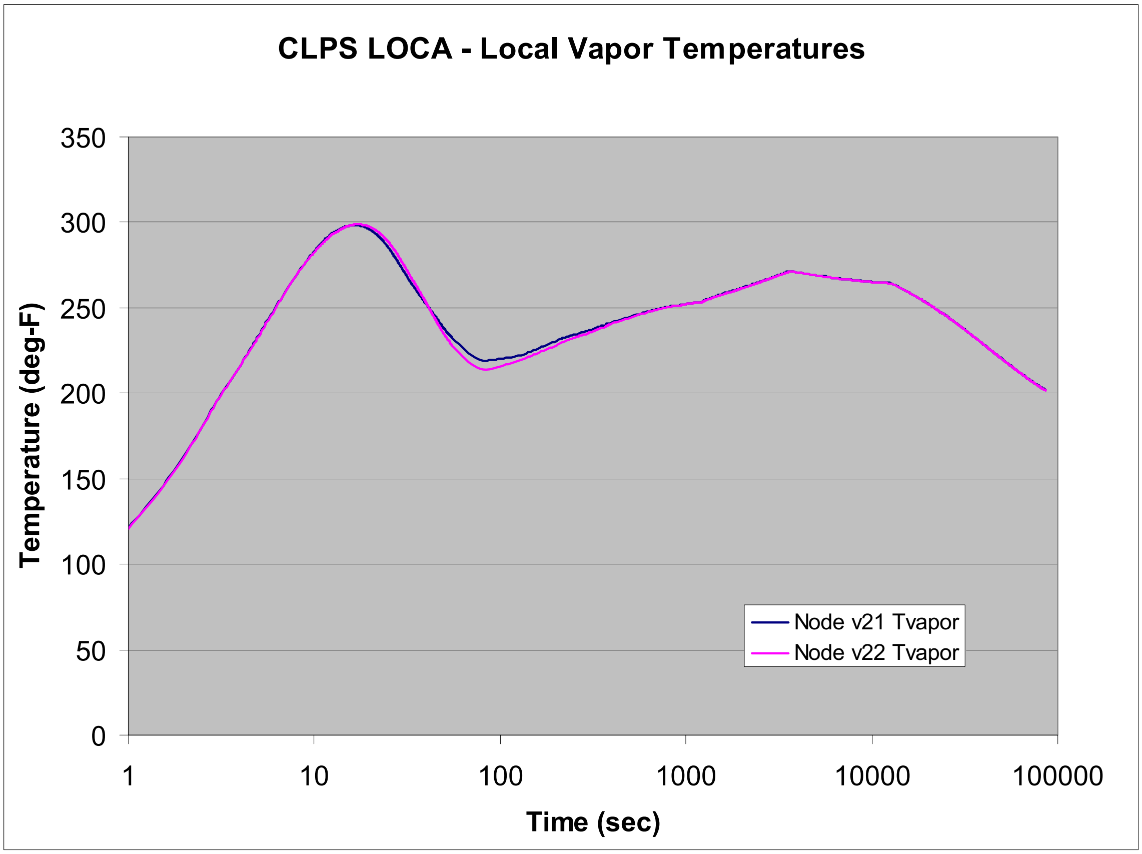
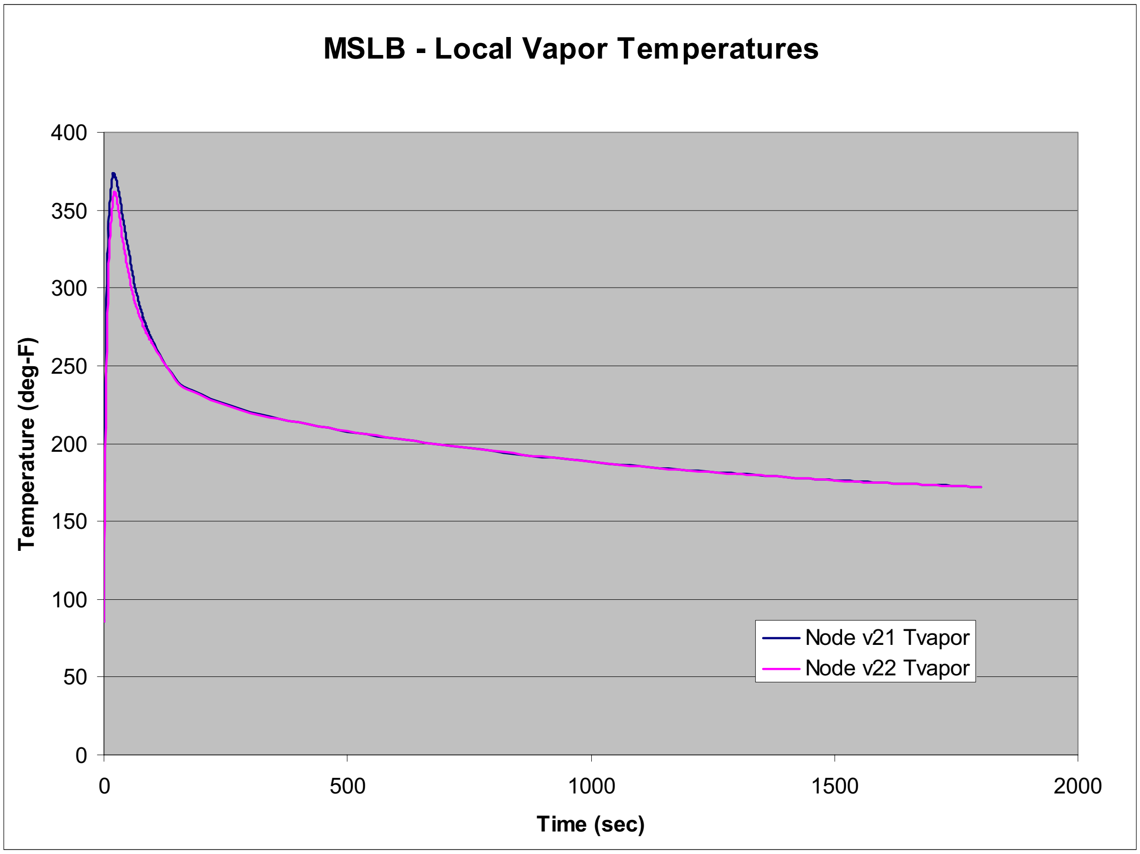


Figure 06.02.01-95-2—Local Vapor Temperatures in Affected Nodes for Limiting MSLB



U.S. EPR Final Safety Analysis Report Markups

- The CGCS maintains containment structural integrity following an accident that releases hydrogen generated from 100 percent fuel clad-coolant reaction accompanied by hydrogen burning (10 CFR 50.44(c)(5), GDC 41).
- The CGCS and HMS are not shared among multiple units (GDC 5).
- The CGCS is designed to permit periodic inspection and testing to confirm the integrity and operability of the systems (GDC 42, GDC 43).
- The CGCS and HMS conform to RG 1.7 to meet the requirements of 10 CFR 50.44.

Refer to Section 3.2 for the seismic and system quality group classifications of the CGCS and HMS.

6.2.5.2 System Description

Global convection reduces the likelihood of combustible gas buildup under accident conditions. This is aided by the containment geometry, which provides open-ended compartments and a large total volume (as shown in Figures 3.8-2 through 3.8-13). The CGCS enables the convection of gas mixtures from the lower elevations of the IRWST to the containment dome. This space includes the entire containment volume.

Additionally, the rupture disks of the pressurizer relief tank discharge to the equipment compartments in the lower containment (Section 5.4.11). The release of hydrogen and steam into the lower compartments of the containment drives an upward convection current that promotes mixing of combustible gases.

6.2.5.2.1 Combustible Gas Control System

The CGCS provides for a mixed and homogeneous gas atmosphere in the containment and controls the concentration of combustible gases following an accident that results in a release of hydrogen to the containment atmosphere. The design and performance parameters are listed in Table 6.2.5-1—CGCS Design and Performance Parameters. The CGCS consists of the following components:

- Rupture foils installed in the steel framework above the steam generators open passively on pressure differential to promote global convection and containment atmosphere mixing.
- Convection foils installed with the rupture foils open passively on pressure differential or temperature differential to promote global convection and containment atmosphere mixing.
- Hydrogen mixing dampers installed between the in-containment refueling water storage tank (IRWST) and the annular compartments within containment open passively on receiving a differential or absolute pressure signal~~pressure differential~~ or loss of power to promote global convection and mixing. In addition, the mixing dampers can be opened by manual operator action.

- PARs distributed throughout containment recombine hydrogen and oxygen to reduce hydrogen concentrations. The PARs also promote natural convection within the containment.

06.02.01-94

Rupture and Convection Foils

During normal operation, the rupture and convection foils form a pressure equalization ceiling in each steam generator compartment. A pressure differential less than 1 psi is sufficient to burst the rupture and convection foils. Fusible links in the steel frames of the convection foils passively open the flow path at an elevated temperature.During normal operation, the rupture and convection foils form a pressure equalization ceiling in each steam generator compartment. The rupture foils consist of a rupture foil frame and burst element. The burst element is designed to open in either direction at a pressure differential of 0.7 psi ± 30 percent. The passive opening of the rupture foil releases no debris that could interfere with the operation of the heat removal system or cause clogging of the sump strainers.

The convection foils consist of two frames connected by hinges on the rear side, and a fusible link mounted on the front. The upper frame of the convection foil is installed at the pressure equalization ceiling framework. The lower frame contains the burst element, which is the same as the rupture foil enclosure. For this reason, the bi-directional opening behavior and burst pressure is identical to the rupture foils. The second opening mechanism is the fusible link. It verifies a failsafe and passive opening of the lower frame by gravity. The fusible link design allows a fast opening at a temperature of 176-185°F, within a few seconds. The weight of the lower convection foil frame opens against a slight pressure differential if the ambient temperature exceeds the fusible link opening temperature.

The rupture and convection foils are both safety-related items and are included in the equipment qualification program.

Multiple passive actuation mechanisms fulfill requirements for flow areas and opening times under different loss of coolant accident (LOCA) scenarios. Following a large break LOCA, rupture foils open on differential pressure very early in the accident to create a large free flow area and limit the peak pressure differential in the containment. For a small break LOCA, the mass and energy release may be enough to open only a few rupture foils. However, the large free flow area required for sufficient atmospheric mixing is provided by the convection foils, which open due to the increased temperature.

Apart from breaks in the reactor coolant pressure boundary, hydrogen and steam can be released into containment via the pressurizer relief tank following intentional reactor coolant system depressurization. In this case, a rupture disk opens a path from the tank to the bottom rooms of the steam generator compartments. Reflection of the gas jet on the heavy floor generates a broad plume moving upward in the central part of the containment driven by a density gradient. The resultant opening of the rupture foils enables and promotes global containment convection flows.

06.02.01-94

Mixing Dampers

~~Mixing dampers separate the air space of the IRWST and the lower part of the annular rooms in containment. Each spring-loaded mixing damper is held closed during normal operation by a solenoid-operated actuator. The mixing dampers open automatically if the differential pressure between operational and equipment rooms is exceeded or if the containment pressure increases slightly above atmospheric pressure. The mixing dampers also open on loss of power to the solenoid-operated actuators and can be opened manually by the operator.~~Mixing dampers consist of a spring loaded actuator that is held closed during normal operation by an energized solenoid. The second part of the mixing damper is the flap with a horizontal opening axis, similar to a butterfly valve. This design allows the mixing damper to open against a pressure differential. The flap separates the air space of the IRWST and the lower part of the annular rooms in containment. The mixing dampers open if the differential pressure between operational and equipment rooms exceed 0.5 psi; or if the containment pressure exceeds 17.4 psia. The mixing dampers open fail-safe on a loss of power to the solenoid-operated actuators and can be manually opened by the operator.

The mixing dampers are safety-related items and are included in the equipment qualification program.

Passive Autocatalytic Recombiners

The PARs are part of the combustible gas control system. Unlike the rupture foils, convection foils, and mixing dampers, they are not safety-related components; instead, they are designed for severe accident condition applications.

Large and small PARs are arranged in containment to support global convection, homogenize the containment atmosphere, and reduce local and global peak hydrogen concentrations. The location of the PARs is shown in Figure 6.2.5-1—Arrangement and Location of the Passive Autocatalytic Recombiners.

A PAR consists of a metal housing with a gas inlet at the bottom and a lateral gas outlet at the top to promote convection. Numerous parallel plates with a catalytically active coating are arranged vertically in the bottom of the housing. Gas mixtures containing hydrogen are recombined upon contact with the catalyst, with the recombination rate depending primarily on the concentration of hydrogen at the PAR. In the presence of oxygen, the PARs will start automatically if the threshold hydrogen concentration is reached at the catalytic surfaces. The heat released from the catalyst helps drive gas flow through the PARs, resulting in high recombination efficiency.

Table 6.2.5-1—CGCS Design and Performance Parameters

06.02.01-94

Parameter	Value
Large PARs	
• Number of units	41
• Nominal hydrogen reduction rate (per PAR)	11.8 lb_m/hr
• Catalyst	Pt / Pd coating
Small PARs	
• Number of units	6
• Nominal hydrogen reduction rate (per PAR)	2.6 ~~lb^m~~ lb_m/hr
• Catalyst	Pt / Pd coating
Hydrogen mixing dampers	
• Number of units	8
• Approximate opening cross section (total)	64 ft^2
• Nominal actuation pressure	0.5 psid or 17.4 psia
Rupture foils	
• Approximate opening cross section (total)	~~375~~420 ft^2
• Nominal actuation pressure	0.7 psid ± 30%
Convection foils	
• Approximate opening cross section (total)	~~480~~450 ft^2
• Nominal actuation pressure	0.7 psid ± 30%
• Nominal actuation temperature	180.5°F