ArevaEPRDCPEm Resource

From: BRYAN Martin (EXT) [Martin.Bryan.ext@areva.com]
Sent: Wednesday, June 09, 2010 5:42 PM
To: Tesfaye, Getachew
Cc: DELANO Karen V (AREVA NP INC); ROMINE Judy (AREVA NP INC); BENNETT Kathy A (OFR) (AREVA NP INC); GUCWA Len T (EXT)
Subject: Response to U.S. EPR Design Certification Application RAI No. 368, FSAR Ch 6, Supplement 1, Part 2 of 5
Attachments: RAI 368 Supplement 1 US EPR DC Part 2 of 5.pdf

Getachew,

AREVA NP Inc. (AREVA NP) provided responses to 3 of the 23 questions in RAI No. 368 on April 19, 2010. Because of the file size, AREVA NP is providing a technically correct and complete response to 6 of the remaining 20 questions in 5 parts. The 5 files are designated as "RAI 368 Supplement 1 US EPR DC Part X of 5.pdf," where "X" is one of the five parts. The first file, part 1 of 5, contains the response to 5 of the 6 questions, and the remaining question 06.02.01-77 is transmitted in parts 2 through 5.

Attached is file, "RAI 368 Supplement 1 US EPR DC Part 2 of 5.pdf."

The following table indicates the respective pages in the response document, "RAI 368 Supplement 1 Response US EPR DC Part 2 of 5.pdf," that contain AREVA NP's response to the subject questions.

Question #	Start Page	End Page
RAI 368 — 06.02.01-77	18	62

The schedule for a technically correct and complete response to the remaining questions is unchanged and is provided below:

Question #	Response Date
RAI 368 — 06.02.01-61	July 8, 2010
RAI 368 — 06.02.01-62	August 5, 2010
RAI 368 — 06.02.01-63	July 8, 2010
RAI 368 — 06.02.01-66	August 5, 2010
RAI 368 — 06.02.01-67	August 5, 2010
RAI 368 — 06.02.01-68	August 5, 2010
RAI 368 — 06.02.01-69	August 5, 2010
RAI 368 — 06.02.01-70	July 8, 2010
RAI 368 — 06.02.01-71	July 8, 2010
RAI 368 — 06.02.01-73	July 8, 2010
RAI 368 — 06.02.01-76	July 8, 2010
RAI 368 — 06.02.01-78	July 8, 2010
RAI 368 — 06.02.01-80	July 8, 2010
RAI 368 — 06.02.01-81	July 8, 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: BRYAN Martin (EXT)
Sent: Wednesday, June 09, 2010 5:32 PM
To: 'Tesfaye, Getachew'
Cc: DELANO Karen V (AREVA NP INC); ROMINE Judy (AREVA NP INC); BENNETT Kathy A (OFR) (AREVA NP INC); GUCWA Len T (EXT)
Subject: Response to U.S. EPR Design Certification Application RAI No. 368, FSAR Ch 6, Supplement 1, Part 1 of 5

Getachew,

AREVA NP Inc. (AREVA NP) provided responses to 3 of the 23 questions in RAI No. 368 on April 19, 2010. Because of the file size, AREVA NP is providing a technically correct and complete response to 6 of the remaining 20 questions in 5 parts. The 5 files are designated as "RAI 368 Supplement 1 US EPR DC Part X of 5.pdf," where "X" is one of the five parts. The first file, part 1 of 5, contains the response to 5 of the 6 questions, and the remaining question 06.02.01-77 is transmitted in parts 2 through 5.

Attached is file, "RAI 368 Supplement 1 US EPR DC Part 1 of 5.pdf."

The following table indicates the respective pages in the response document, "RAI 368 Supplement 1 Response US EPR DC Part 1 of 5.pdf," that contain AREVA NP's response to the subject questions.

Question #	Start Page	End Page
RAI 368 — 06.02.01-58	2	9
RAI 368 — 06.02.01-59	10	13
RAI 368 — 06.02.01-60	14	14
RAI 368 — 06.02.01-64	15	15
RAI 368 — 06.02.01-65	16	17

The schedule for a technically correct and complete response to the remaining questions is unchanged and is provided below:

Question #	Response Date
RAI 368 — 06.02.01-61	July 8, 2010
RAI 368 — 06.02.01-62	August 5, 2010
RAI 368 — 06.02.01-63	July 8, 2010
RAI 368 — 06.02.01-66	August 5, 2010
RAI 368 — 06.02.01-67	August 5, 2010
RAI 368 — 06.02.01-68	August 5, 2010
RAI 368 — 06.02.01-69	August 5, 2010
RAI 368 — 06.02.01-70	July 8, 2010
RAI 368 — 06.02.01-71	July 8, 2010
RAI 368 — 06.02.01-73	July 8, 2010

RAI 368 — 06.02.01-76	July 8, 2010
RAI 368 — 06.02.01-78	July 8, 2010
RAI 368 — 06.02.01-80	July 8, 2010
RAI 368 — 06.02.01-81	July 8, 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: WELLS Russell D (AREVA NP INC)
Sent: Monday, April 19, 2010 6:17 PM
To: 'Getachew Tesfaye'
Cc: BRYAN Martin (EXT); BENNETT Kathy A (OFR) (AREVA NP INC); DELANO Karen V (AREVA NP INC)
Subject: Response to U.S. EPR Design Certification Application RAI No. 368, FSAR Ch 6

Getachew,

Attached please find AREVA NP Inc.'s response to the subject request for additional information (RAI). The attached file, "RAI 368 Response US EPR DC.pdf," provides technically correct and complete responses to 3 of the 23 questions.

The following table indicates the respective pages in the response document, "RAI 368 Response US EPR DC.pdf," that contain AREVA NP's response to the subject questions.

Question #	Start Page	End Page
RAI 368 — 06.02.01-58	2	2
RAI 368 — 06.02.01-59	3	3
RAI 368 — 06.02.01-60	4	4
RAI 368 — 06.02.01-61	5	5
RAI 368 — 06.02.01-62	6	6
RAI 368 — 06.02.01-63	7	7
RAI 368 — 06.02.01-64	8	8
RAI 368 — 06.02.01-65	9	9
RAI 368 — 06.02.01-66	10	10
RAI 368 — 06.02.01-67	11	11
RAI 368 — 06.02.01-68	12	12
RAI 368 — 06.02.01-69	13	13
RAI 368 — 06.02.01-70	14	14
RAI 368 — 06.02.01-71	15	15
RAI 368 — 06.02.01-72	16	17
RAI 368 — 06.02.01-73	18	18
RAI 368 — 06.02.01-74	19	19
RAI 368 — 06.02.01-75	20	20
RAI 368 — 06.02.01-76	21	21
RAI 368 — 06.02.01-77	22	22
RAI 368 — 06.02.01-78	23	23

RAI 368 — 06.02.01-80	24	24
RAI 368 — 06.02.01-81	25	25

A complete answer is not provided for 20 of the 23 questions. The schedule for a technically correct and complete response to these questions is provided below. Some of the response dates are subject to change based on anticipated feedback from the NRC staff regarding prioritization of responses. AREVA NP plans to discuss the response schedule with the NRC staff during an April 30, 2010, meeting.

Question #	Response Date
RAI 368 — 06.02.01-58	June 9, 2010
RAI 368 — 06.02.01-59	June 9, 2010
RAI 368 — 06.02.01-60	June 9, 2010
RAI 368 — 06.02.01-61	July 8, 2010
RAI 368 — 06.02.01-62	August 5, 2010
RAI 368 — 06.02.01-63	July 8, 2010
RAI 368 — 06.02.01-64	July 8, 2010
RAI 368 — 06.02.01-65	June 9, 2010
RAI 368 — 06.02.01-66	August 5, 2010
RAI 368 — 06.02.01-67	August 5, 2010
RAI 368 — 06.02.01-68	August 5, 2010
RAI 368 — 06.02.01-69	August 5, 2010
RAI 368 — 06.02.01-70	July 8, 2010
RAI 368 — 06.02.01-71	July 8, 2010
RAI 368 — 06.02.01-73	July 8, 2010
RAI 368 — 06.02.01-76	July 8, 2010
RAI 368 — 06.02.01-77	June 9, 2010
RAI 368 — 06.02.01-78	July 8, 2010
RAI 368 — 06.02.01-80	July 8, 2010
RAI 368 — 06.02.01-81	July 8, 2010

Sincerely,

(Russ Wells on behalf of)
Martin (Marty) C. Bryan
Licensing Advisory Engineer
AREVA NP Inc.
Tel: (434) 832-3016
Martin.Bryan.ext@areva.com

From: Tesfaye, Getachew [mailto:Getachew.Tesfaye@nrc.gov]
Sent: Friday, March 19, 2010 4:08 PM
To: ZZ-DL-A-USEPR-DL
Cc: Jensen, Walton; Jackson, Christopher; Snodderly, Michael; Carneal, Jason; Colaccino, Joseph; ArevaEPRDCPEm Resource
Subject: U.S. EPR Design Certification Application RAI No. 368 (4344), FSARCh. 6

Attached please find the subject requests for additional information (RAI). A draft of the RAI was provided to you on February 9, 2010, and discussed with your staff on March 4, 2010. Drat RAI Question 06.02.01-79 was deleted, and Draft RAI Questions 06.02.01-61, 06.02.01-72, 06.02.01-73, and 06.02.01-78 were modified 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: 1526

Mail Envelope Properties (BC417D9255991046A37DD56CF597DB7106765E51)

Subject: Response to U.S. EPR Design Certification Application RAI No. 368, FSAR Ch 6, Supplement 1, Part 2 of 5
Sent Date: 6/9/2010 5:41:41 PM
Received Date: 6/9/2010 5:49:10 PM
From: BRYAN Martin (EXT)

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

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Tracking Status: None
"BENNETT Kathy A (OFR) (AREVA NP INC)" <Kathy.Bennett@areva.com>
Tracking Status: None
"GUCWA Len T (EXT)" <Len.Gucwa.ext@areva.com>
Tracking Status: None
"Tesfaye, Getachew" <Getachew.Tesfaye@nrc.gov>
Tracking Status: None

Post Office: AUSLYNCMX02.adom.ad.corp

Files	**Size**	**Date & Time**
MESSAGE	8594	6/9/2010 5:49:10 PM
RAI 368 Supplement 1 US EPR DC Part 2 of 5.pdf	6875140	

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

Question 06.02.01-77:

Provide detailed results of one of the DEG MSLB calculations in the accessible area. The results should include: pressure and temperature history, flow rates in various flow path, heat transfer to major heat sinks, concentration of non-condensable gases at selected locations. Discuss observed flow patterns, non-condensable distributions, temperature stratification, local heat transfer and energy deposition to major heat sinks.

Response to Question 06.02.01-77:

The plots in this response, Figure 06.02.01-77-1 through Figure 06.02.01-77-205, are from a double-ended guillotine (DEG) main steam line break (MSLB) analysis at 20 percent power with the break in the accessible area, and not crediting emergency feedwater (EFW). The patterns of flow circulation can be seen in Figures 06.02.01-77-1 through Figure 06.02.01-77-41. Initially, there is no flow in the equipment area of the containment. Once the in-containment refueling water storage tank (IRWST) dampers to the lower annulus rooms open 18 seconds into the transient, a spike in flow rates from the accessible areas to the equipment areas occurs. Following the rapid mass transfer from the accessible areas to equipment areas, the flow circulation reaches a steady-state condition. Figure 06.02.01-77-42 shows the flow circulation patterns during the blowdown.

Figure 06.02.01-77-43 through Figure 06.02.01-77-54 shows the temperature response in various lumped parameter cells in the model, while Figure 06.02.01-77-55 through Figure 06.02.01-77-66 provides the temperature distribution in the subdivided dome at various elevations. The temperature in the equipment area stays at the initial condition until spiking at 18 seconds before slowly decreasing for the rest of the transient. The accessible areas have a rapid increase during blowdown until reaching a peak at approximately 20 seconds. The lower part of the dome experiences thermal stratification, with higher temperatures close to the loop 1 and loop 2 upper annulus region. The upper portion of the dome is more uniform in temperatures. During blowdown, the lower part of the dome has a higher temperature than the upper part until a peak is reached, and then the upper dome experiences higher temperatures.

Figure 06.02.01-77-67 through Figure 06.02.01-77-78 provides the containment pressure response in the equipment area and the accessible space. The pressure responses are similar to the temperatures. Equipment area pressures remain at the initial condition until 18 seconds, where the accessible area pressures increase immediately until reaching a peak around 20 seconds. Figure 06.02.01-77-79 through Figure 06.02.01-77-90 represents the liquid volume fractions in the lumped parameter nodes. These figures show that the IRWST level remains relatively constant during the event.

Figure 06.02.01-77-91 through Figure 06.02.01-77-125 provides the air and steam volume fractions. In the legend for each plot, “1Rx” refers to the air volume fraction in node x and “SRx” refers to the steam volume fraction in node x. The equipment areas stay at initial conditions until the dampers open and the rapidly increase in steam volume fraction. The accessible areas immediately increase in steam volume fraction and then decrease after the IRWST dampers open at 18 seconds. In the containment dome, the initial highest concentration of steam is near the loop 1 and loop 2 upper annulus region. As the transient continues, the air eventually settles toward the bottom of the dome and lumped parameter cells, while the higher concentrations of steam are present in the upper portion of the containment dome.

Figure 06.02.01-77-126 through Figure 06.02.01-77-163 provides heat conductor surface temperatures. Figure 06.02.01-77-164 through Figure 06.02.01-77-201 provides the heat conductor heat rates for a variety of conductors spread throughout the containment. Figure 06.02.01-77-202 through Figure 06.02.01-77-205 provides the temperature profiles of the conductors in the annular walls. The temperature profiles are taken at 1 second, 200 seconds, and at 1800 seconds for the transient. The major heat sinks for energy deposition are the containment walls. The thermal conductor temperature profiles show that the B-side is at or close to ambient temperature, even at the end of the transient. The containment is not saturated and has not reached a limit of energy deposition.

FSAR Impact:

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

Figure 06.02.01-77-1—Vapor Flow from the Equipment Area to the Containment Dome via the Rupture and Convection Foils

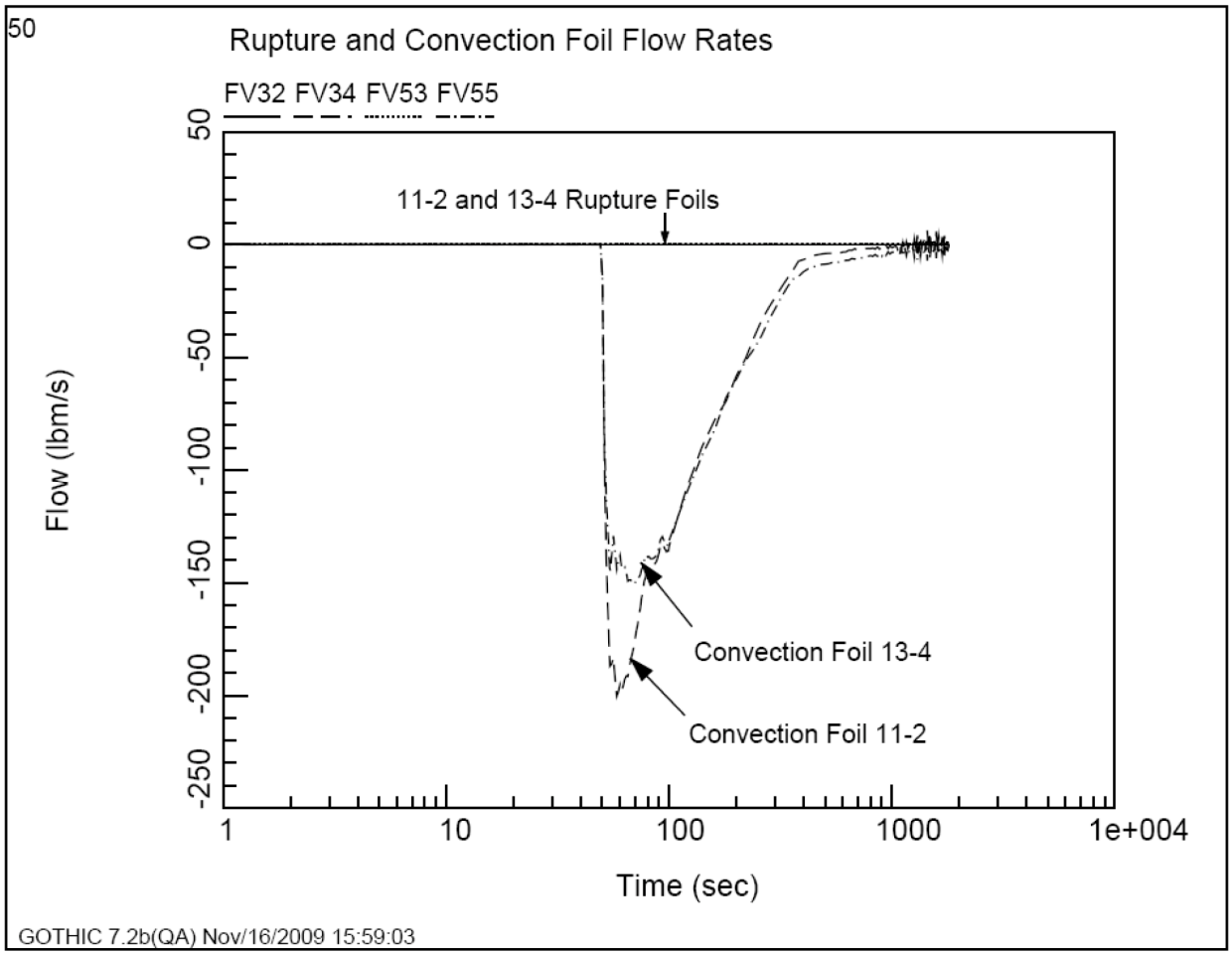

Figure 06.02.01-77-2—Vapor Flow from the Annulus Region to the Equipment Area via the Dampers

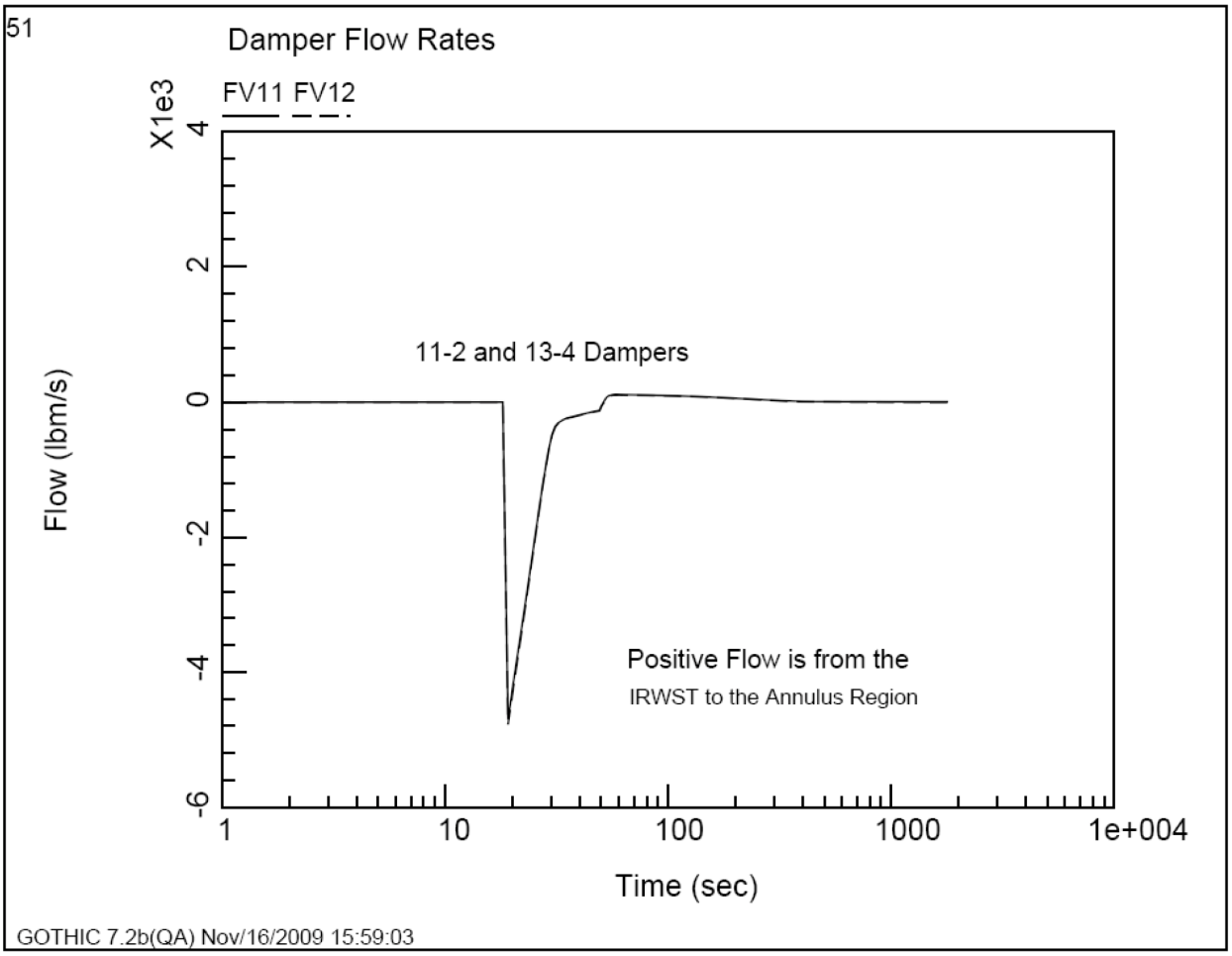

Figure 06.02.01-77-3—Flow into the Spreading Room via Drain Paths

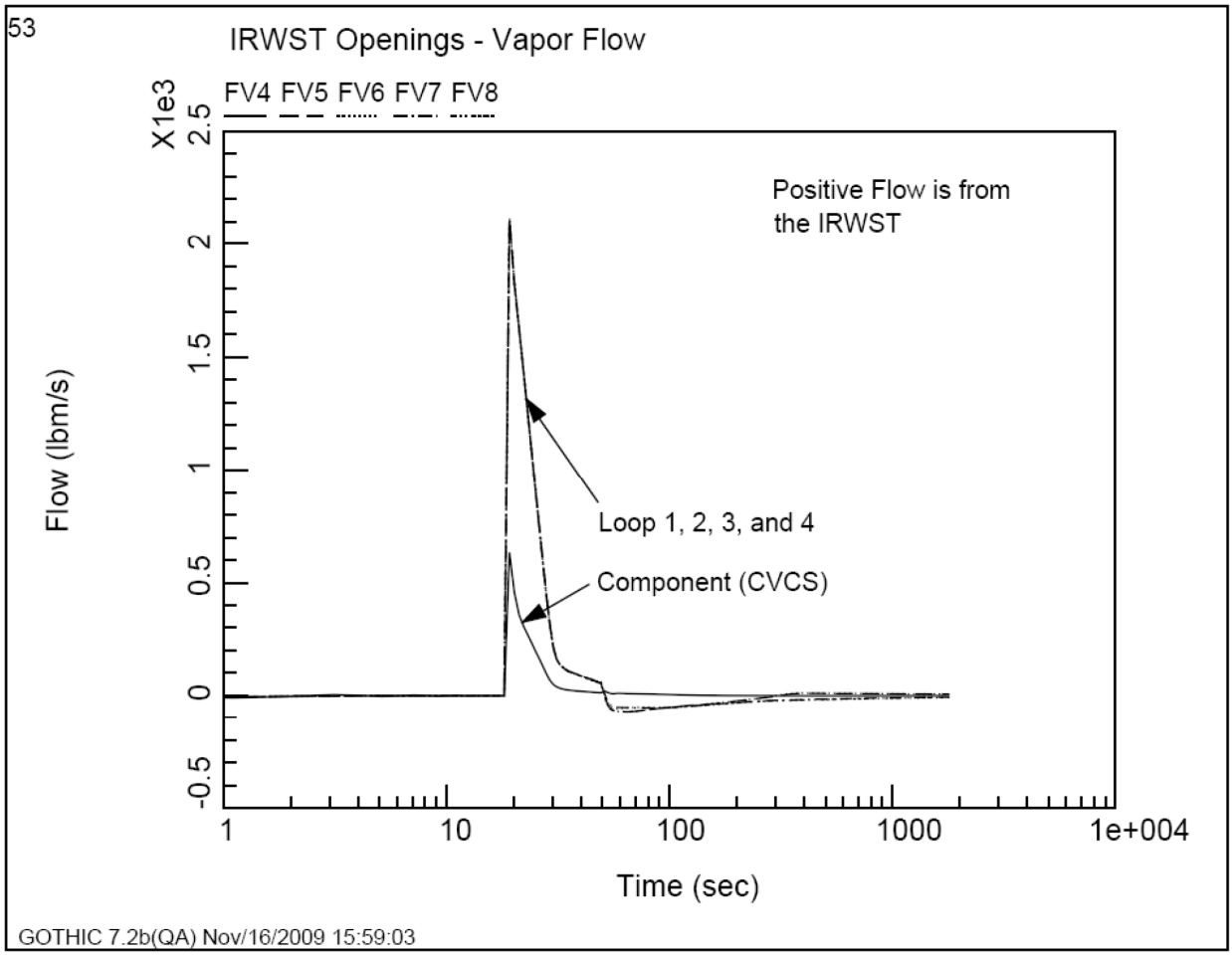

Figure 06.02-01-77-4—Vapor Flow into the IRWST via Drain Paths

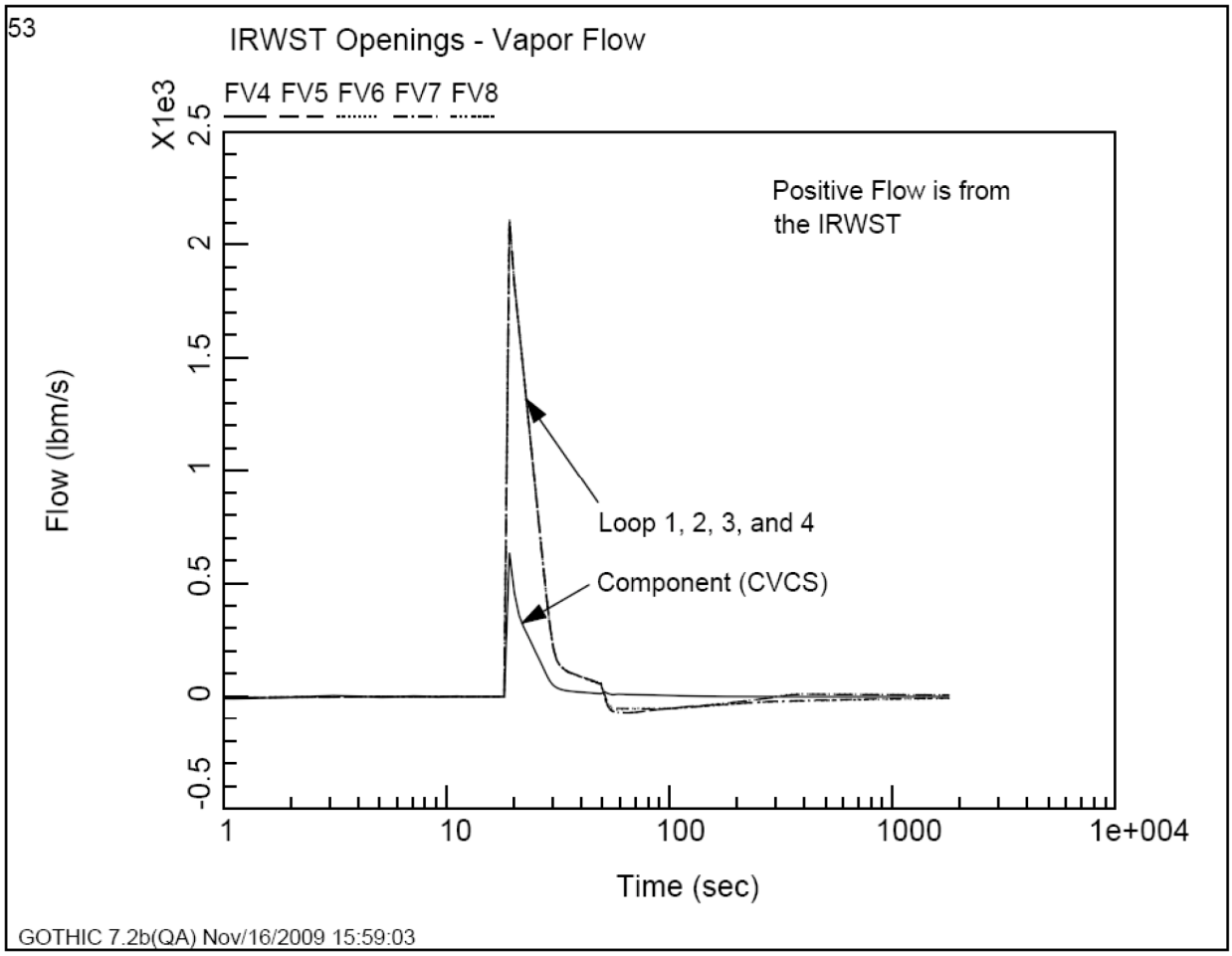

Figure 06.02.01-77-5—Vapor Flow into the IRWST via Drain Paths

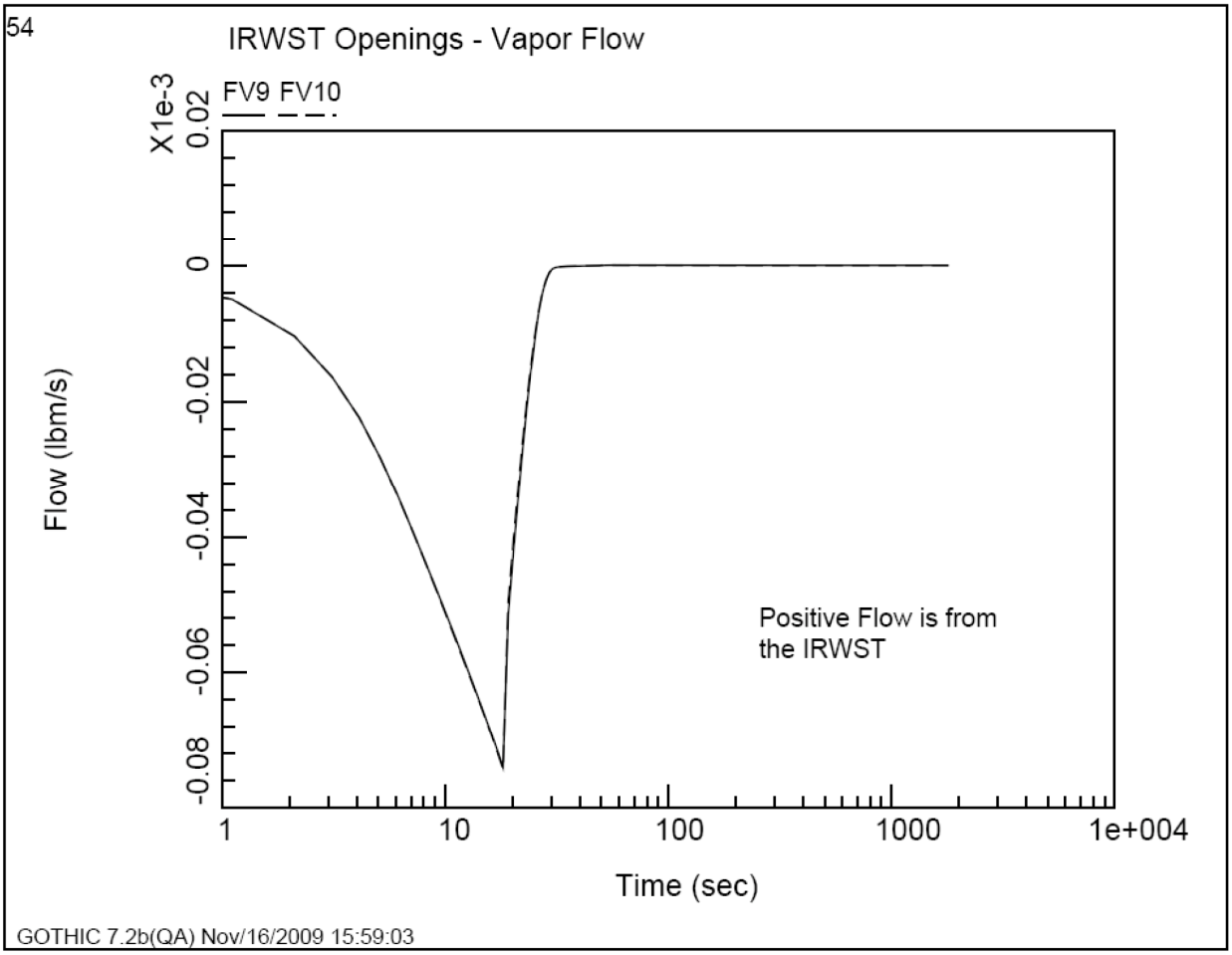

Figure 06.02.01-77-6—Water Flow into the IRWST via Drain Paths

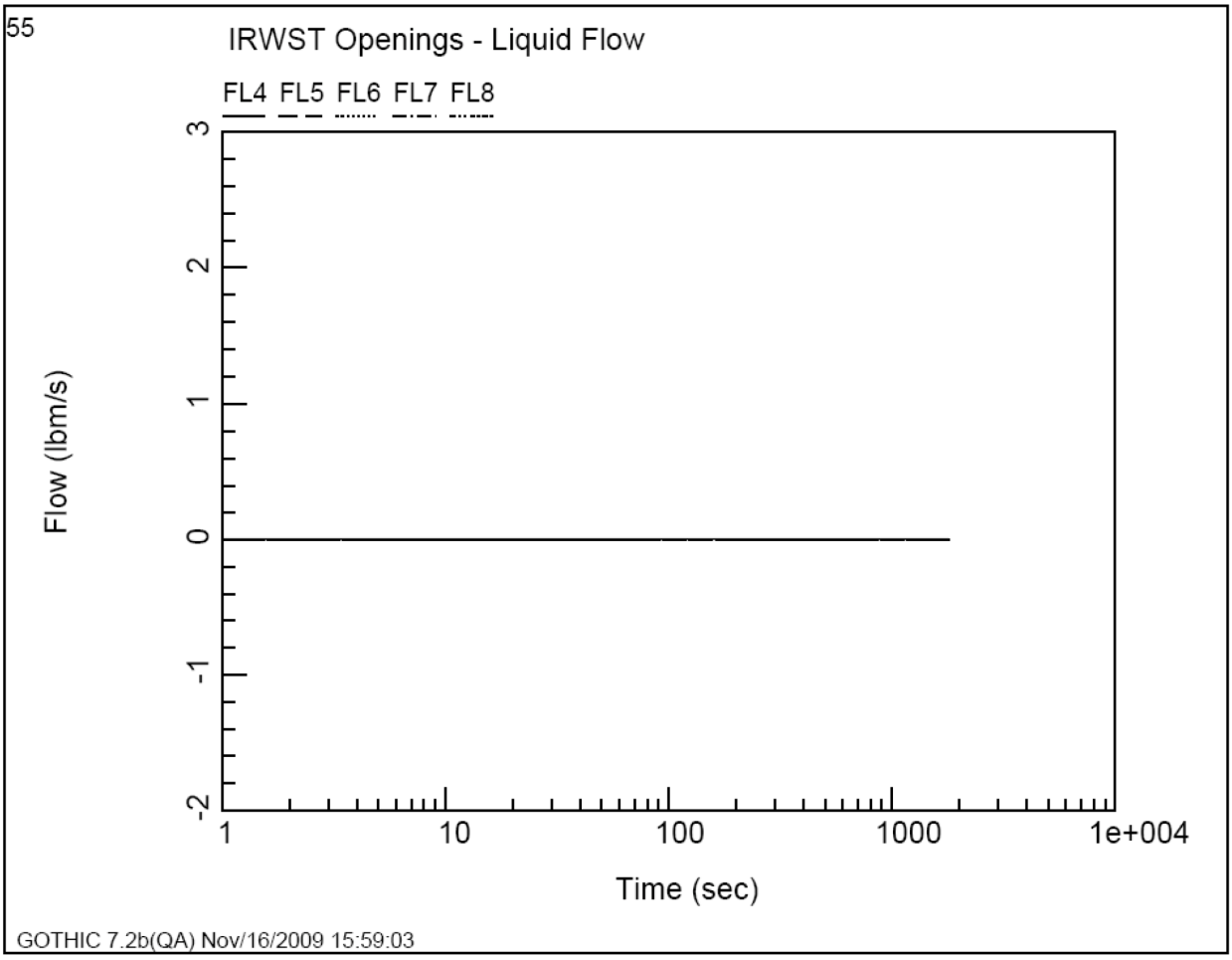

Figure 06.02.01-77-7—Water Flow into the IRWST via Drain Paths

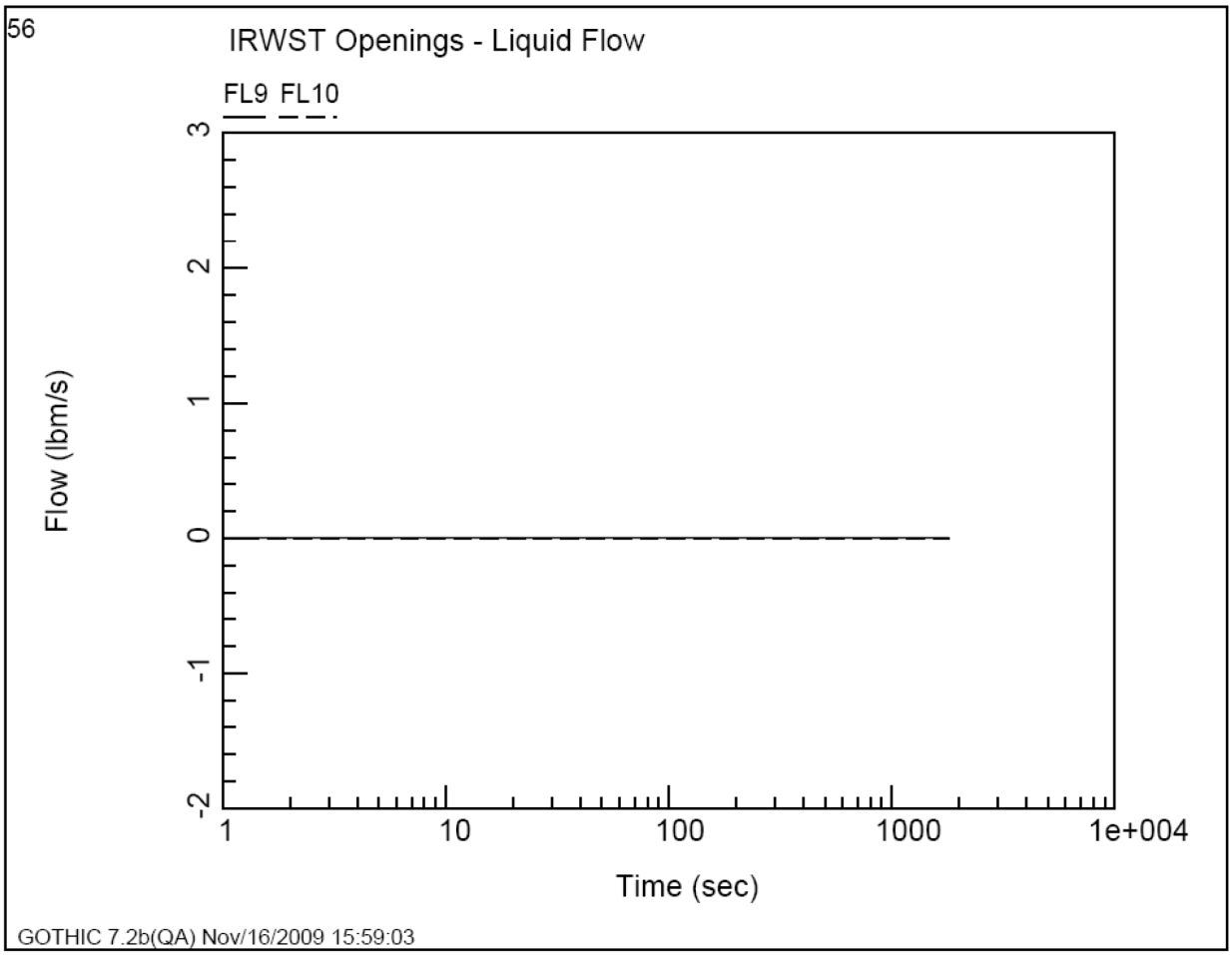

Figure 06.02.01-77-8—Flow from the Loop 1 Lower Equipment Room to Adjacent Rooms

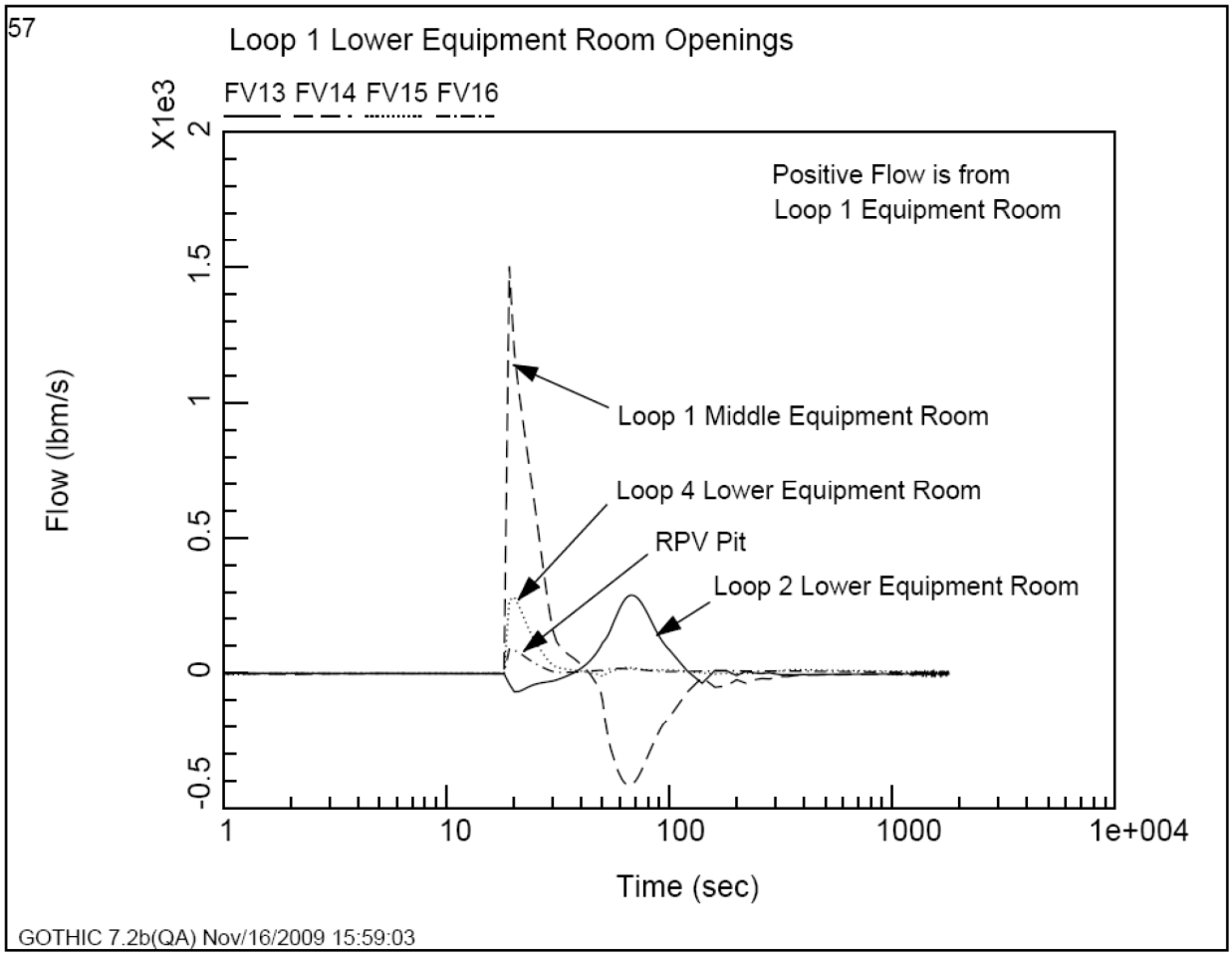

Figure 06.02.01-77-9—Flow from the Loop 1 Lower Equipment Room to Adjacent Rooms

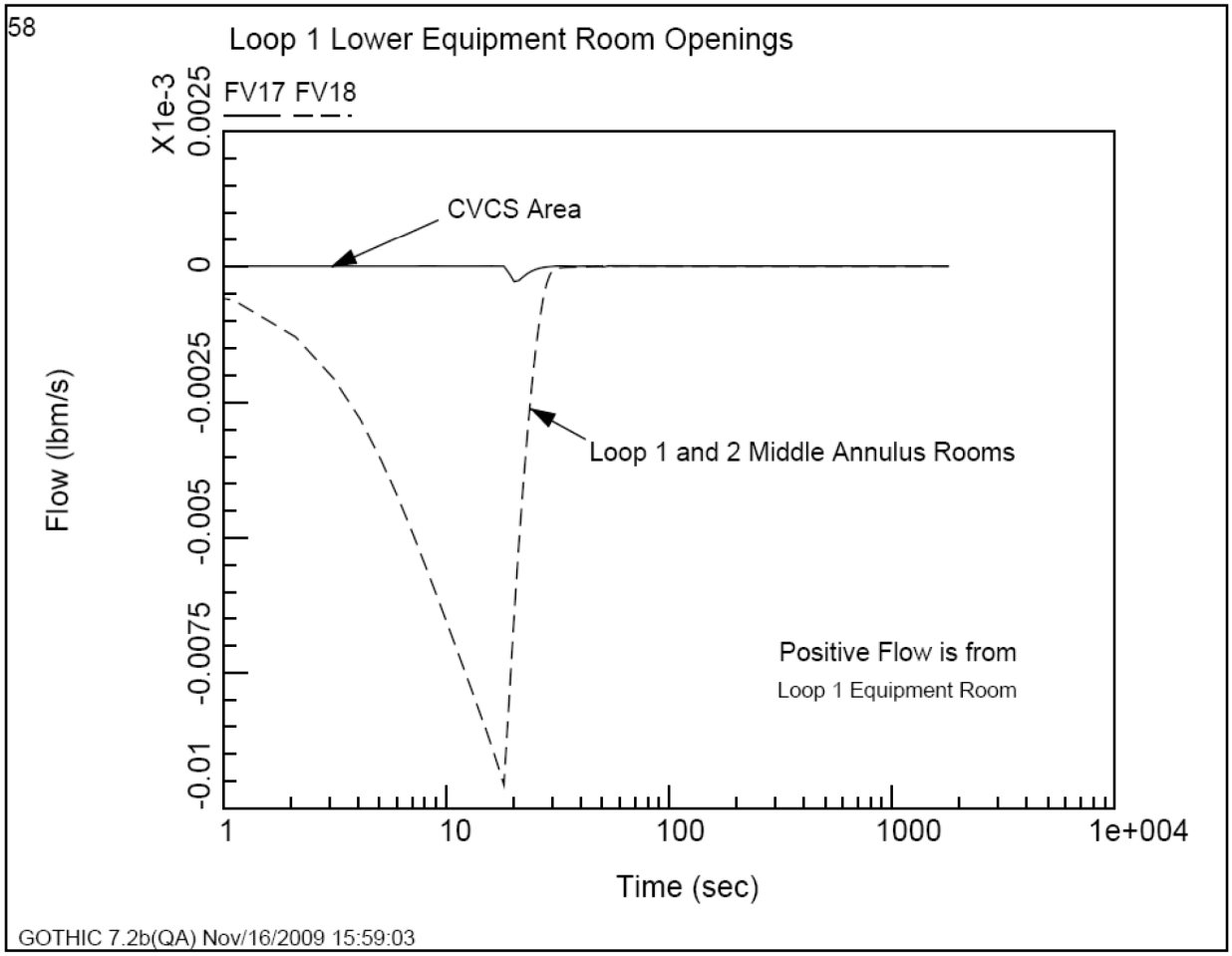

Figure 06.02.01-77-10—Flow from the Loop 2 Lower Equipment Room to Adjacent Rooms

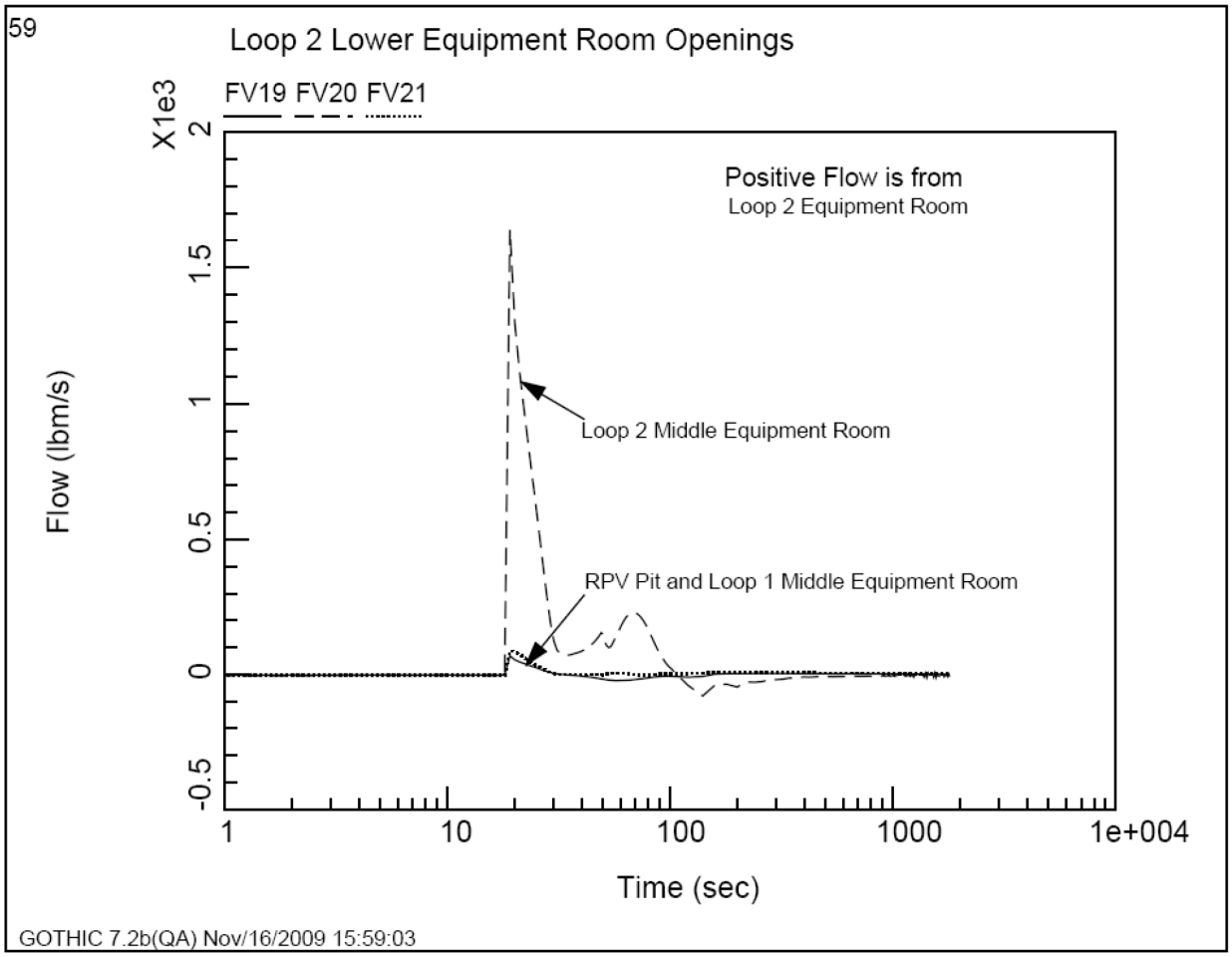

Figure 06.02.01-77-11—Flow from the Loop 2 Lower Equipment Room to Adjacent Rooms

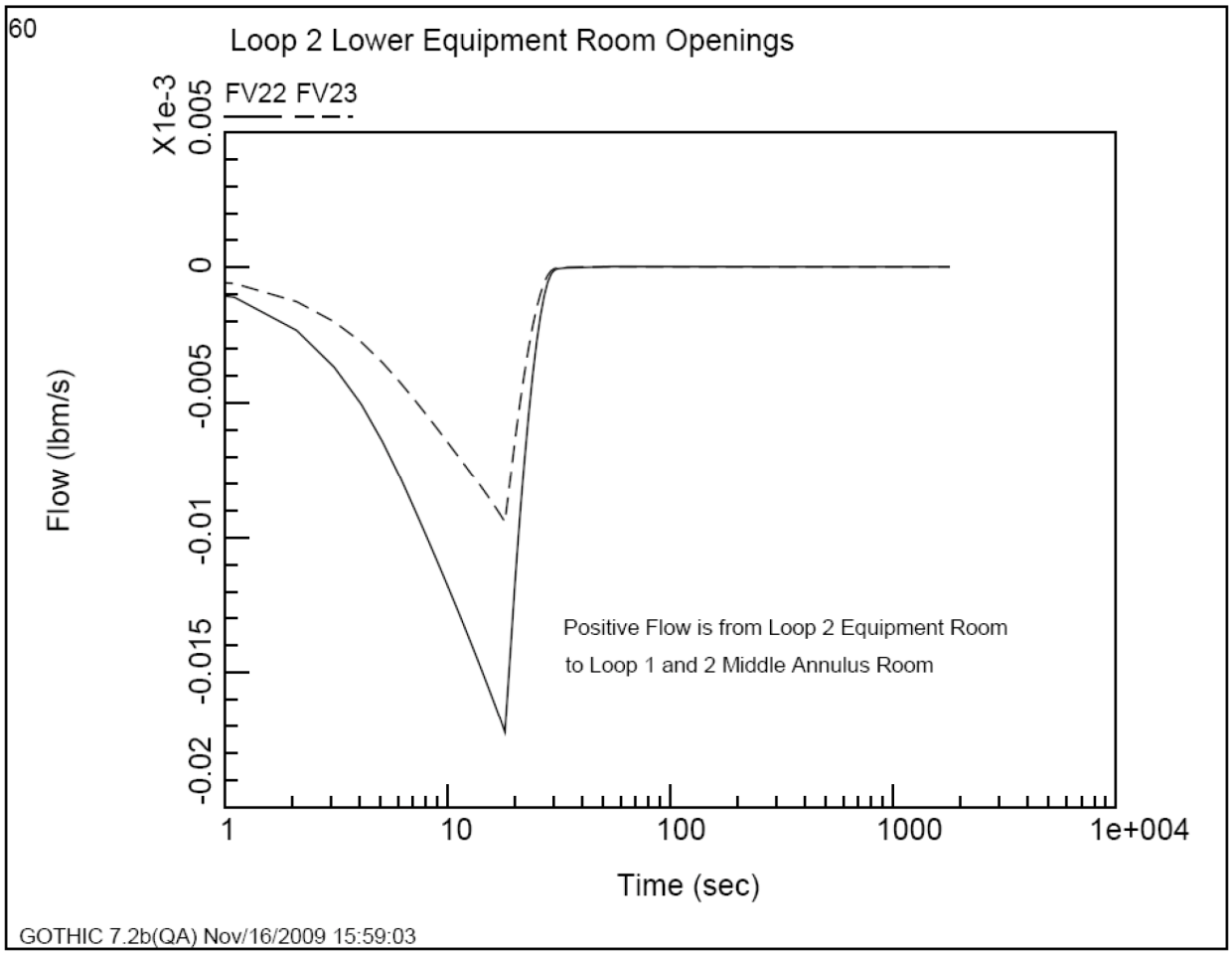

Figure 06.02.01-77-12—Flow from the Loop 1 Middle Equipment Room to Adjacent Rooms

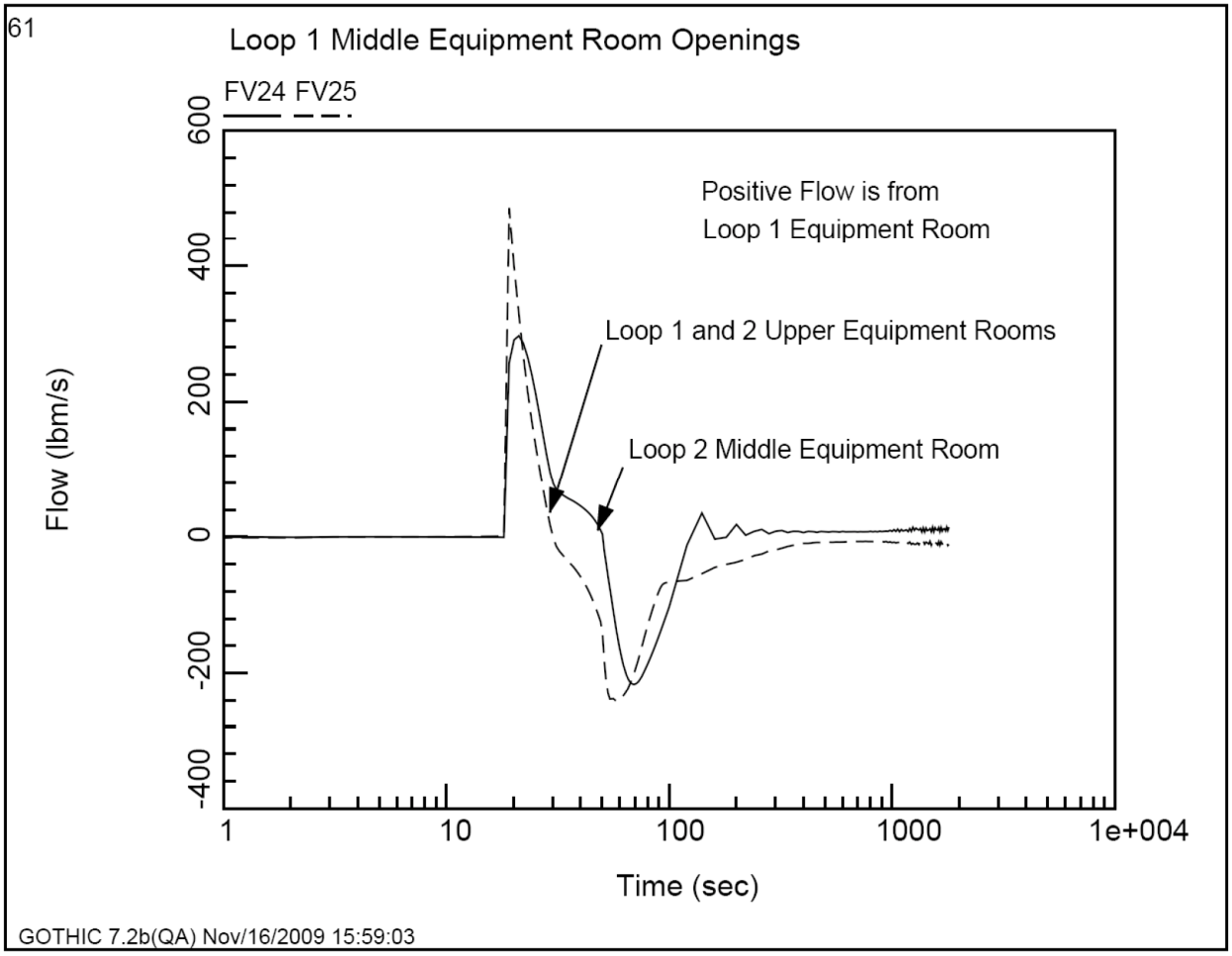

Figure 06.02.01-77-13—Flow from the Loop 1 Middle Equipment Room to Adjacent Rooms

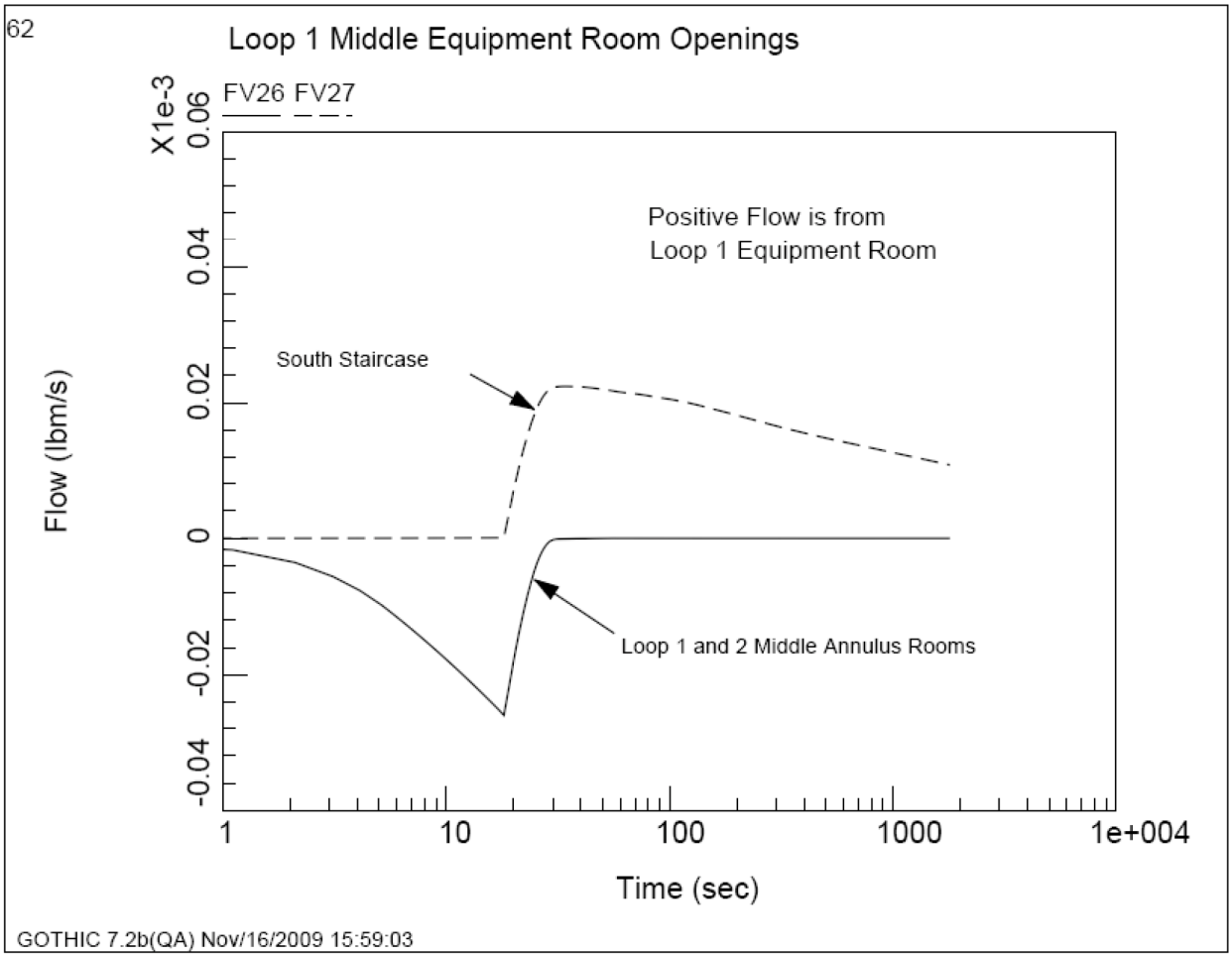

Figure 06.02.01-77-14—Flow from the Loop 2 Middle Equipment Room to Adjacent Rooms

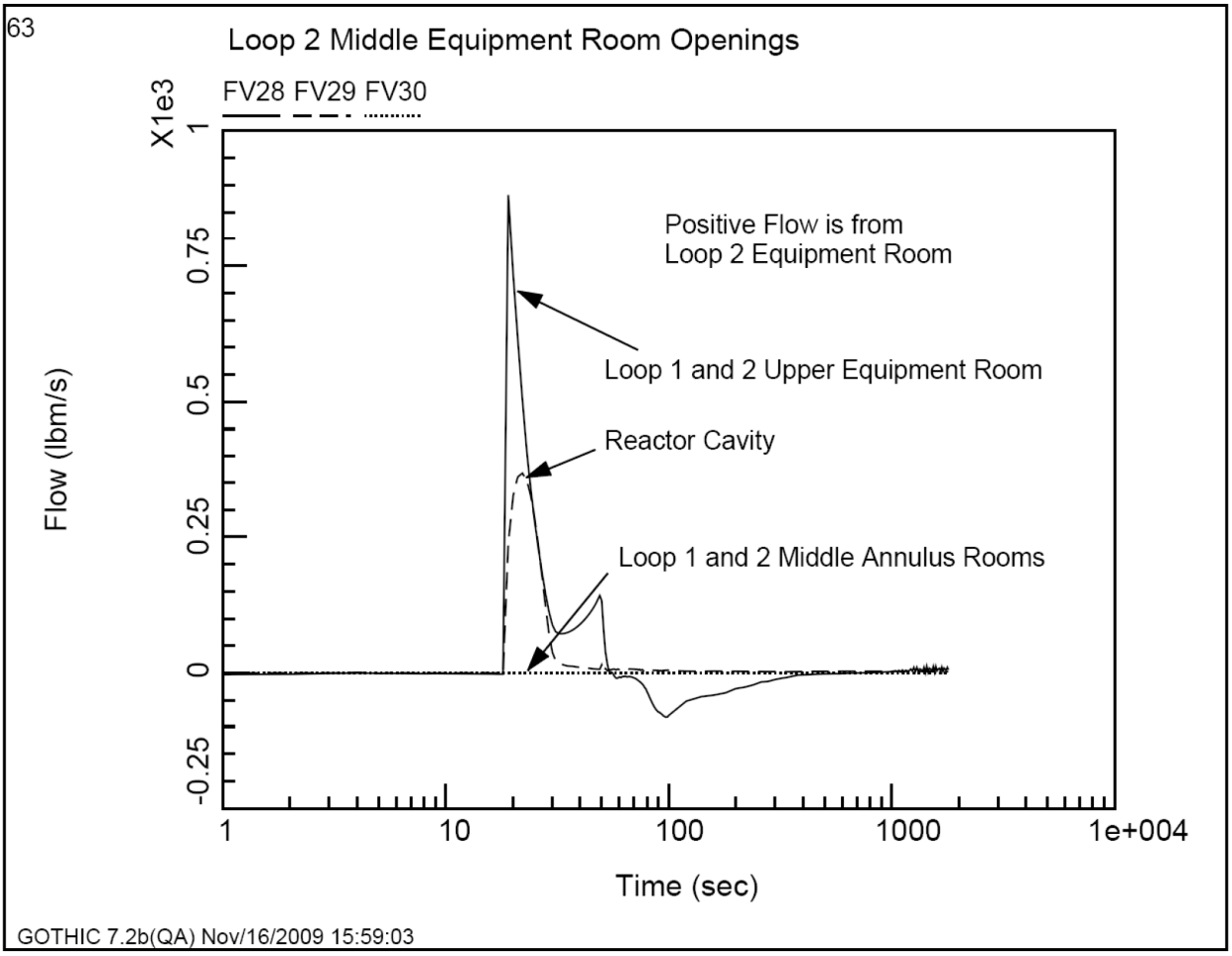

Figure 06.02.01-77-15—Flow from the Loop 1 and 2 Upper Equipment Room to Adjacent Rooms

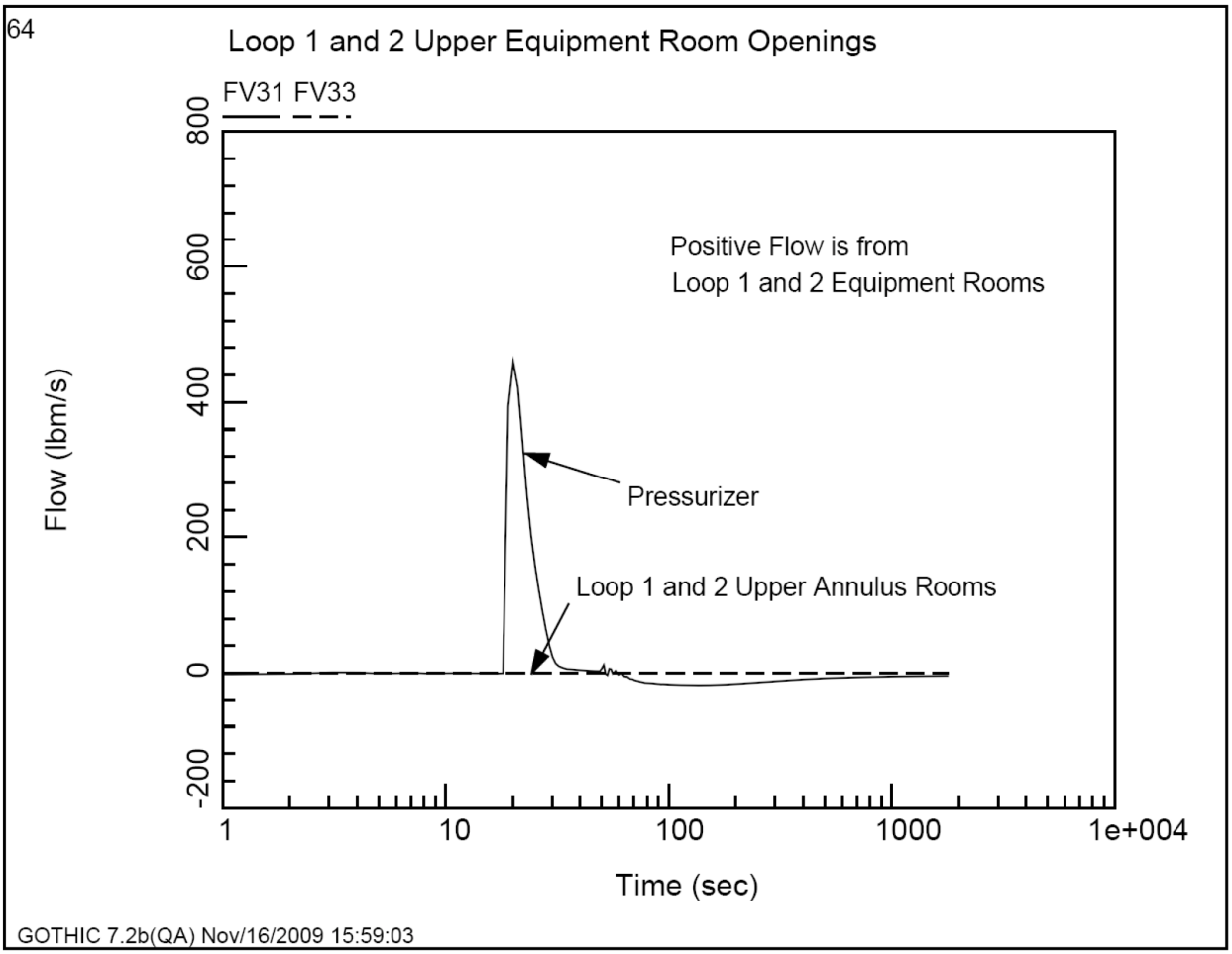

Figure 06.02.01-77-16—Flow from the Reactor Pressure Vessel Pit to Adjacent Rooms

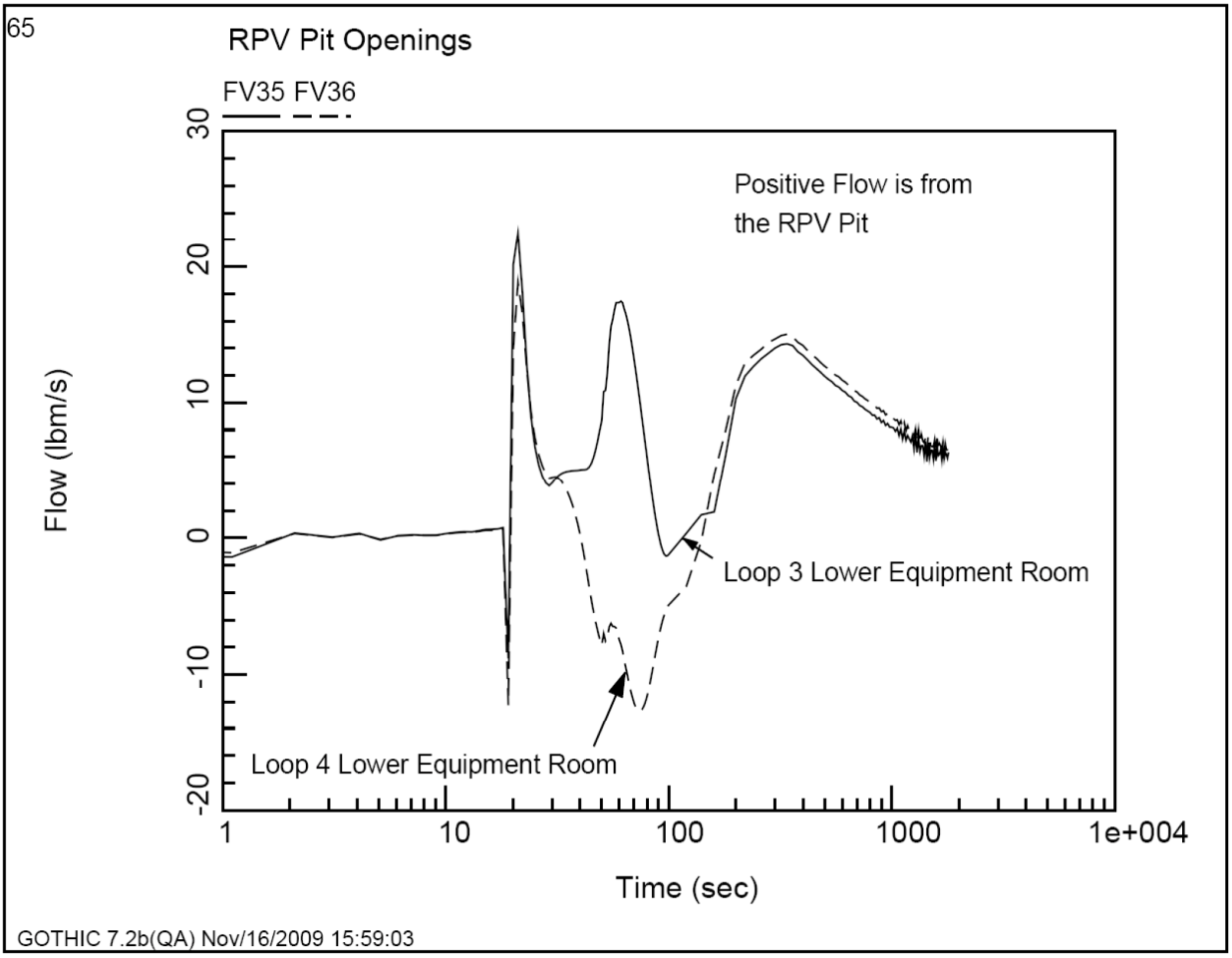

Figure 06.02.01-77-17—Flow from the Reactor Cavity to Adjacent Rooms

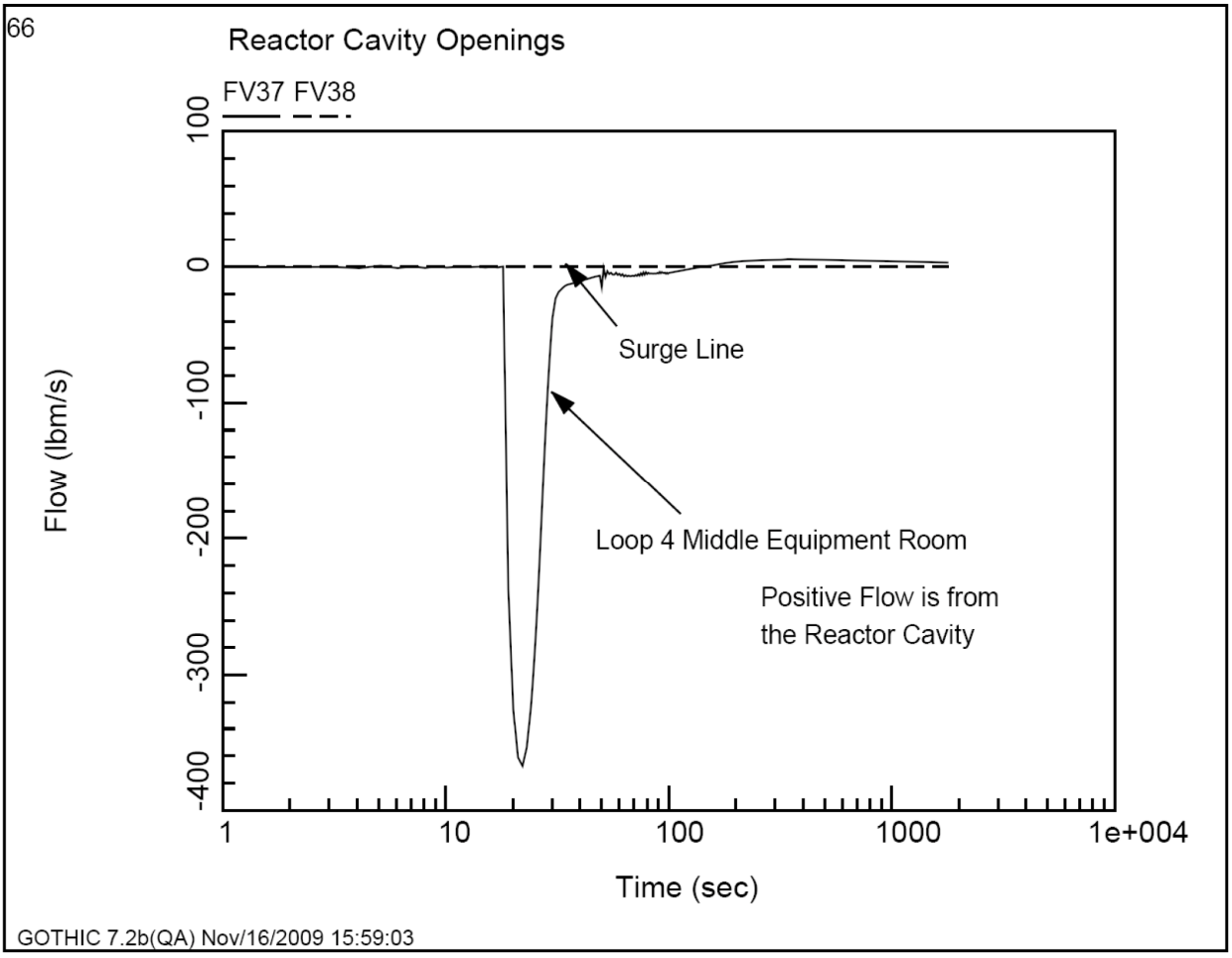

Figure 06.02.01-77-18—Flow from the Loop 3 Lower Equipment Room to Adjacent Rooms

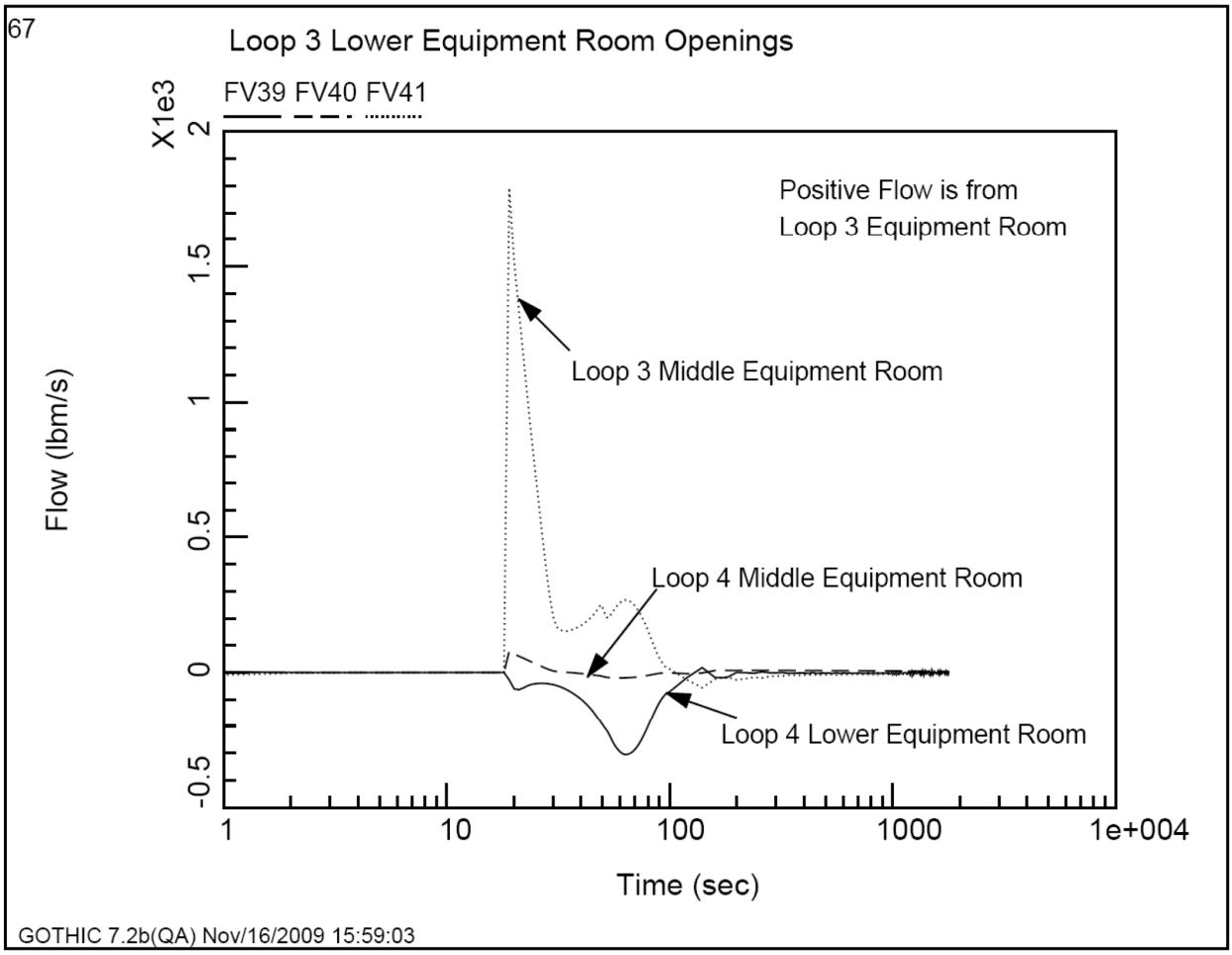

Figure 06.02.01-77-19—Flow from the Loop 3 Lower Equipment Room to Adjacent Rooms

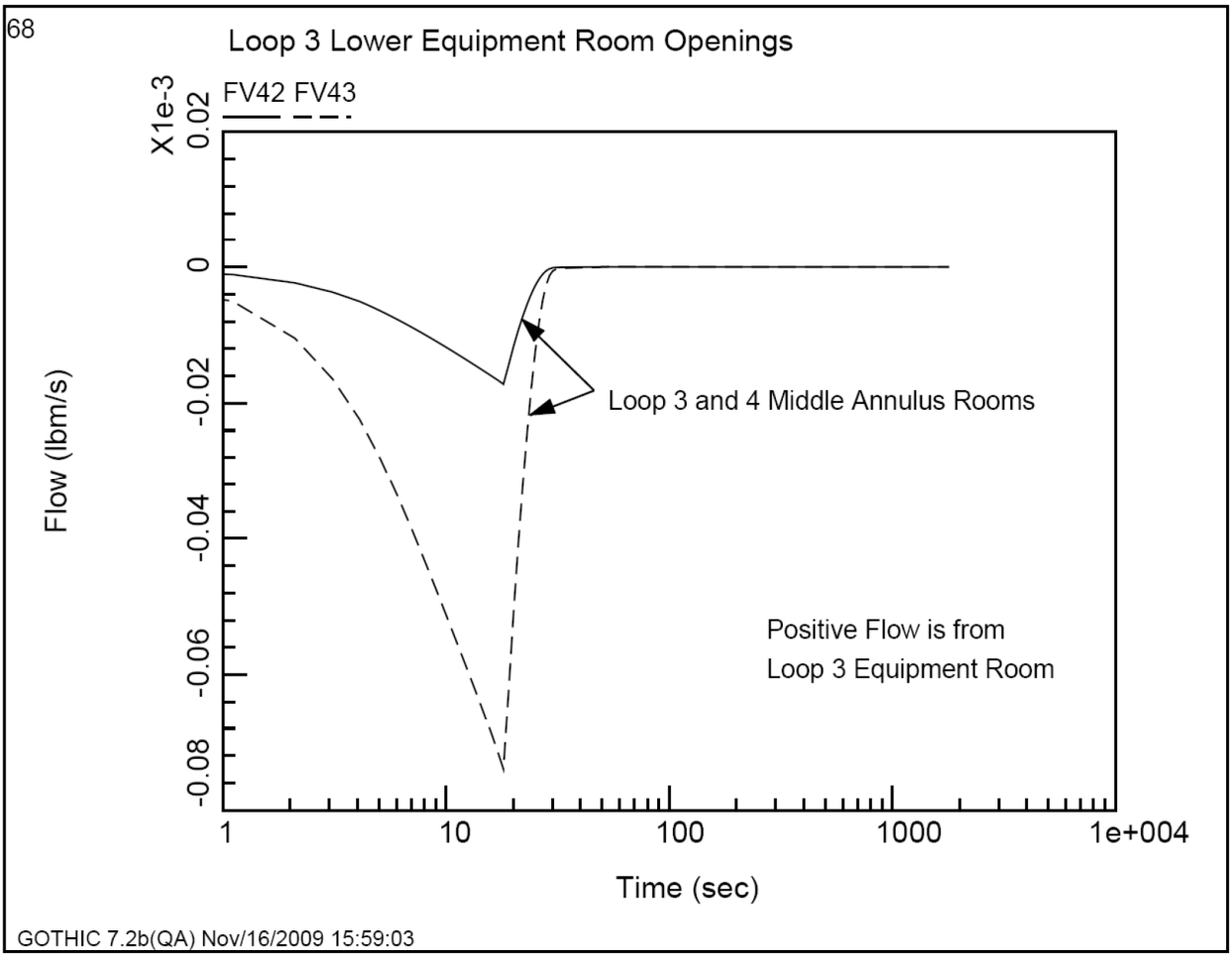

Figure 06.02.01-77-20—Flow from the Loop 4 Lower Equipment Room to Adjacent Rooms

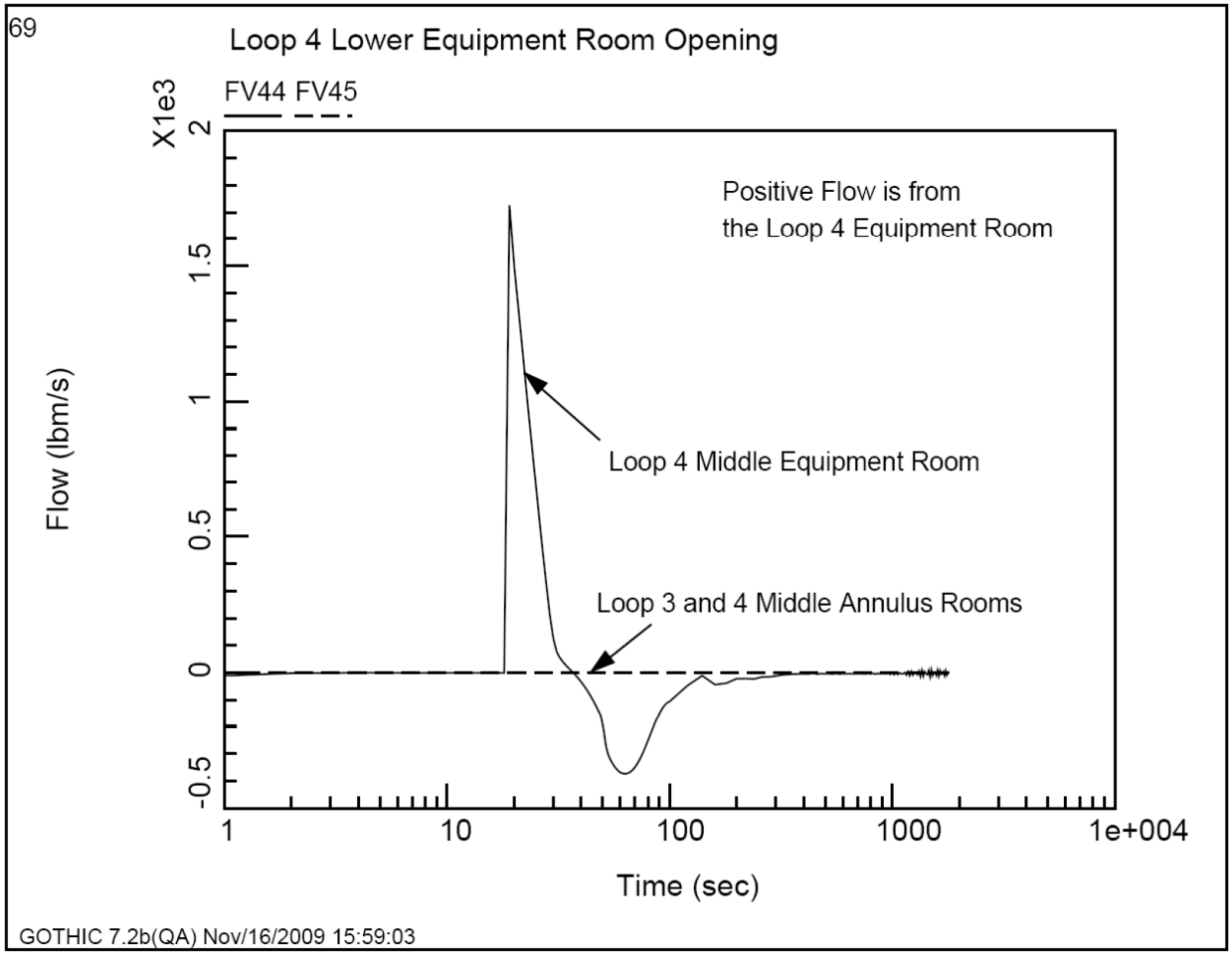

Figure 06.02.01-77-21—Flow from the Loop 3 Middle Equipment Room to Adjacent Rooms

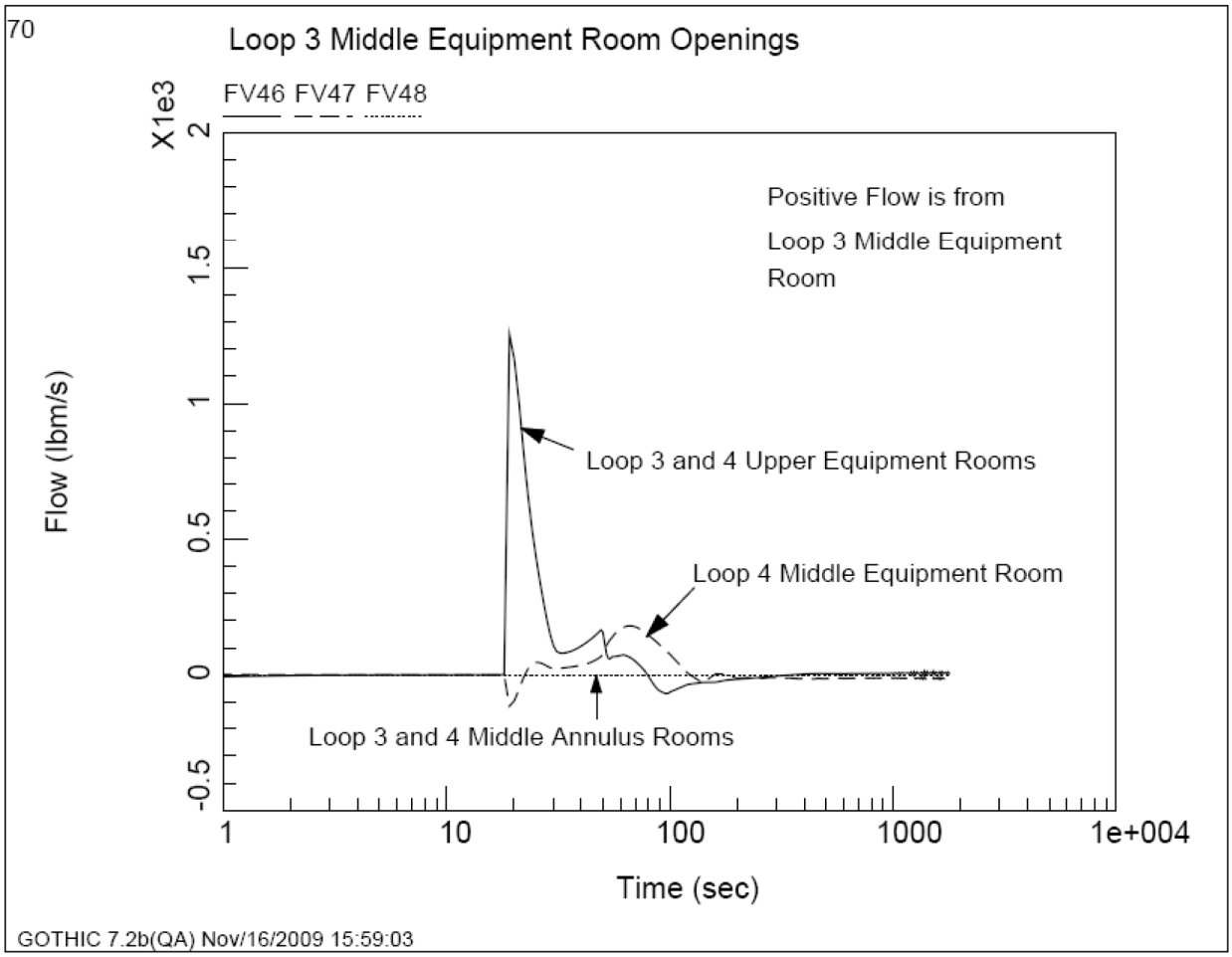

Figure 06.02.01-77-22—Flow from the Loop 4 Middle Equipment Room to Adjacent Rooms

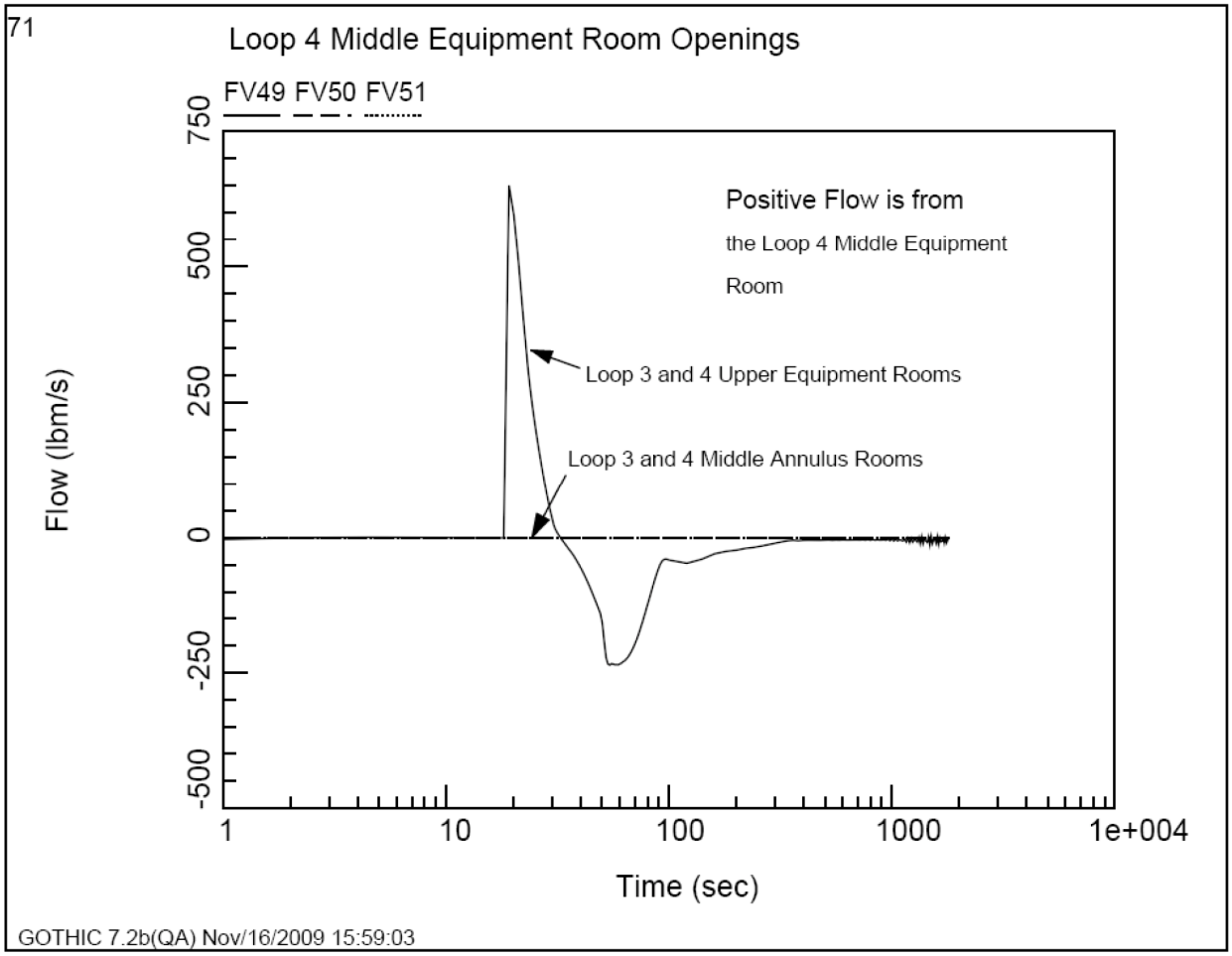

Figure 06.02.01-77-23—Flow from the Loop 3 and 4 Upper Equipment Room to Adjacent Rooms

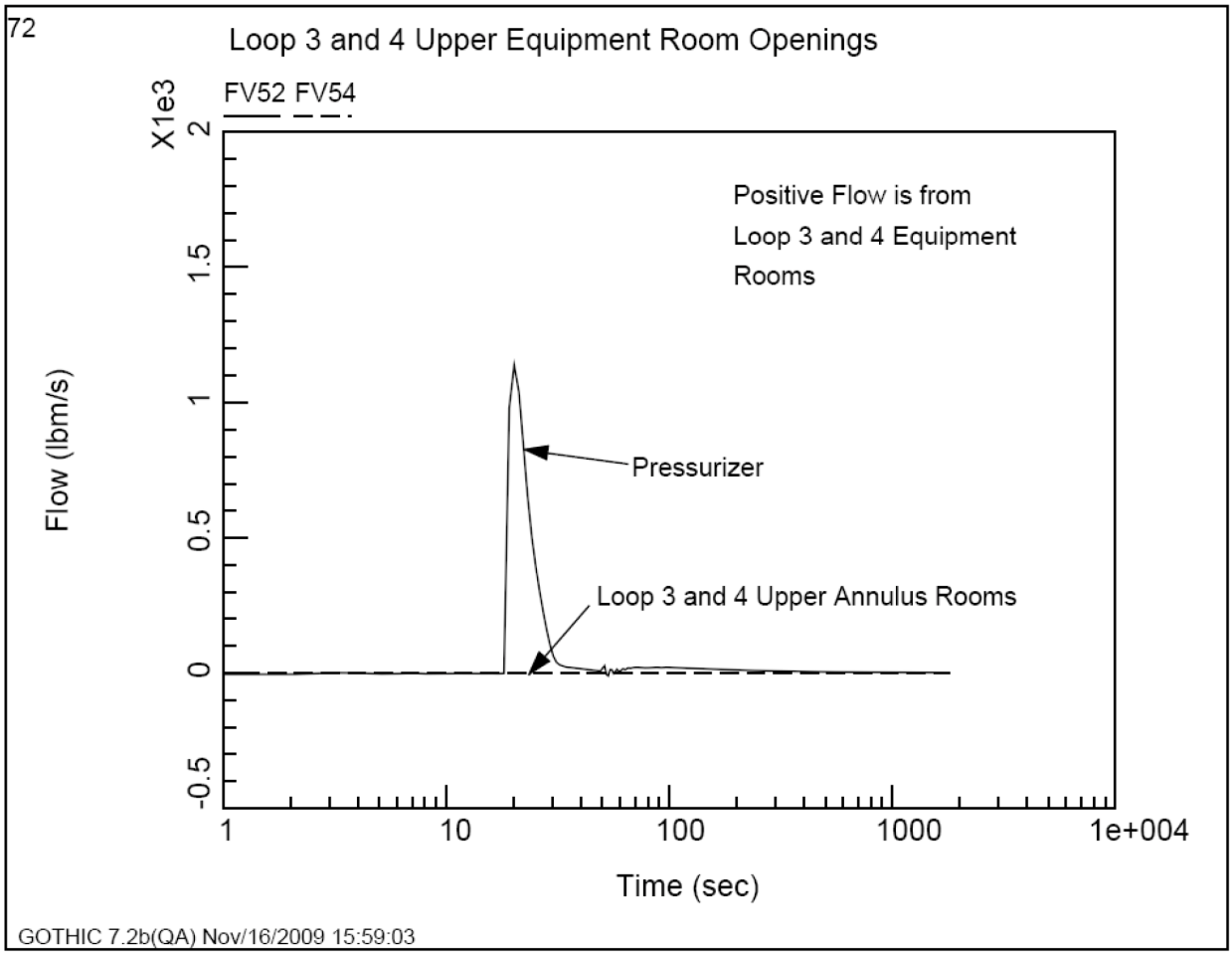

Figure 06.02.01-77-24—Flow from the Pressurizer Surge Line Room to Adjacent Rooms

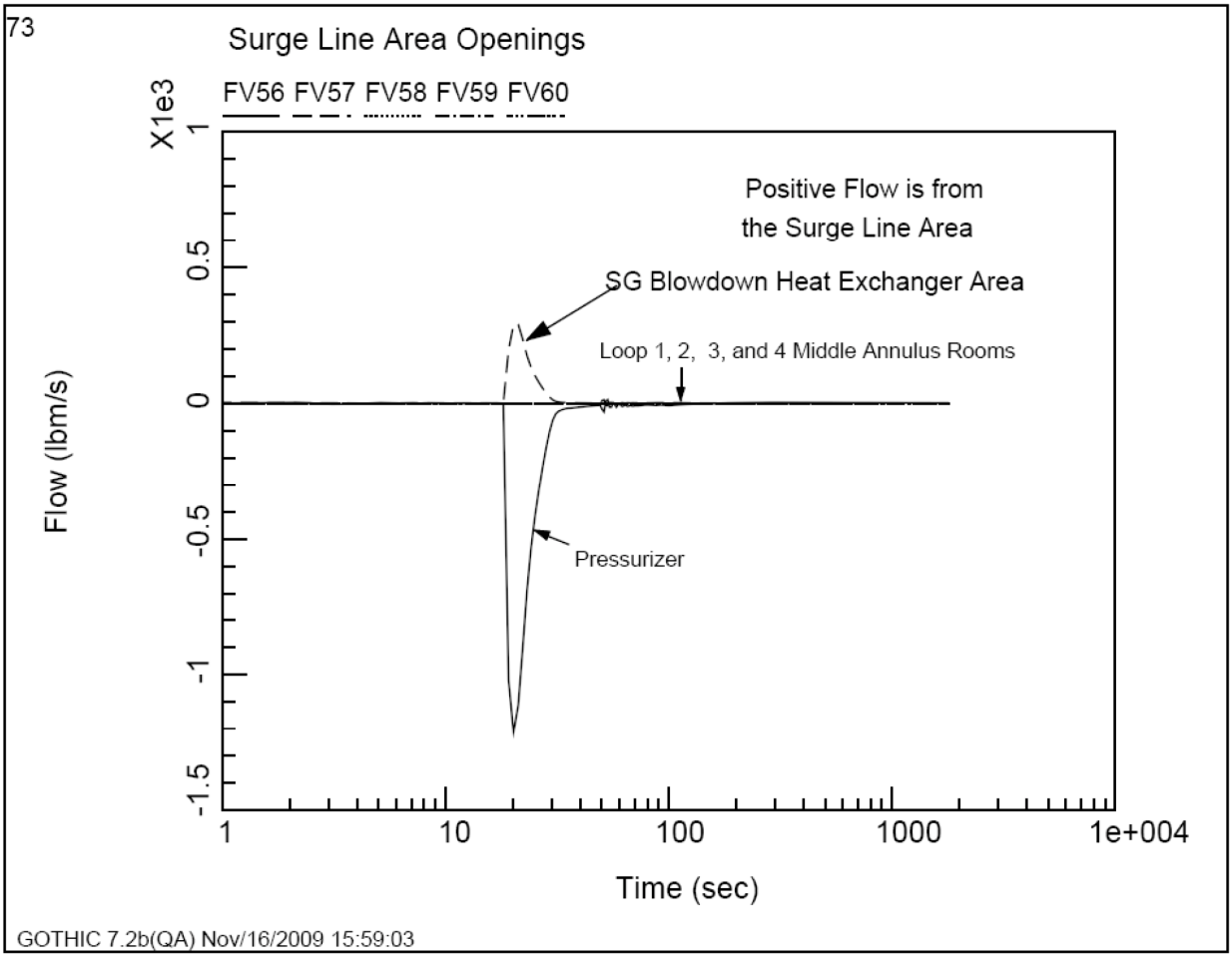

Figure 06.02.01-77-25—Flow from the Pressurizer Room to Adjacent Rooms

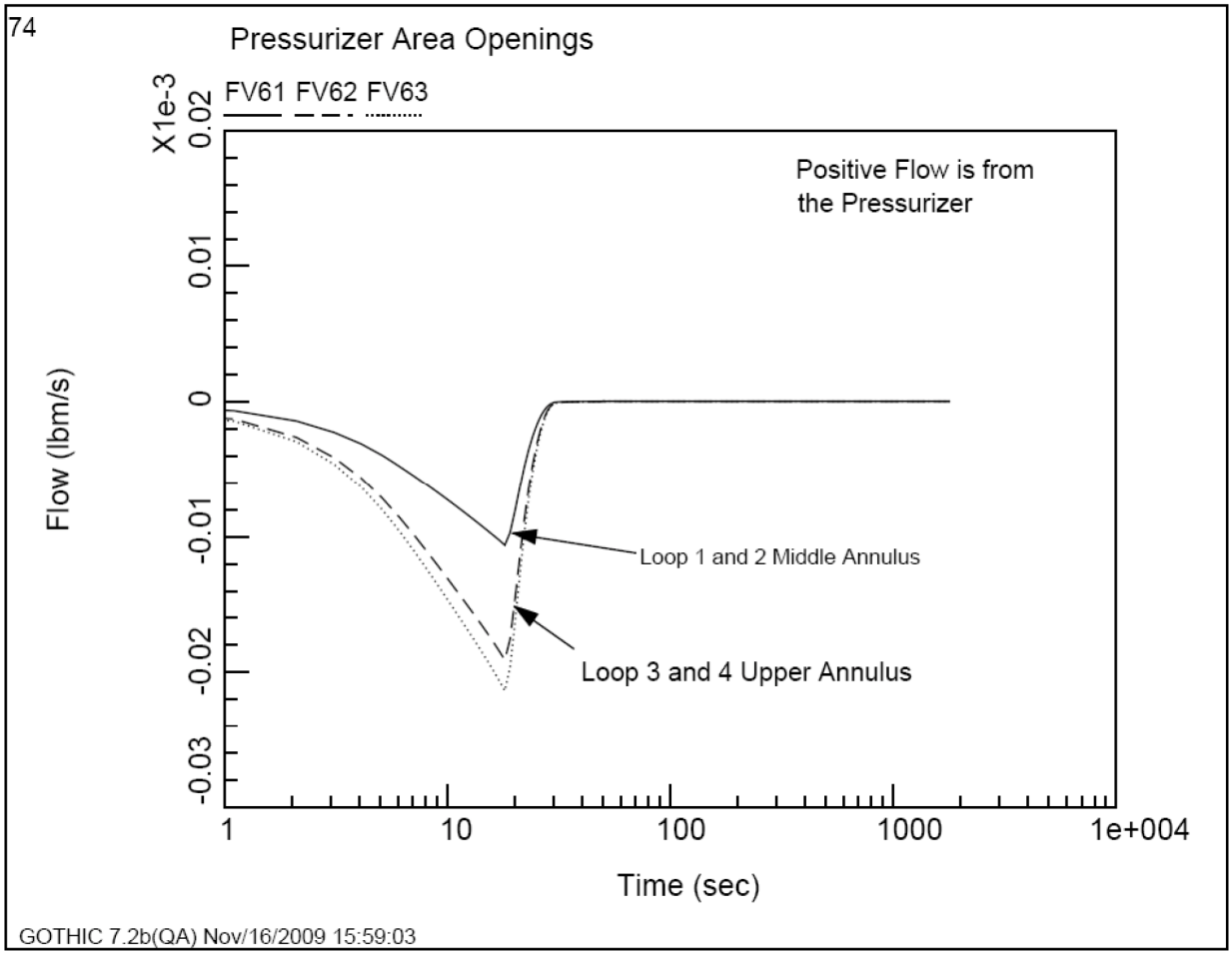

Figure 06.02.01-77-26—Flow from the CVCS Room to Adjacent Areas

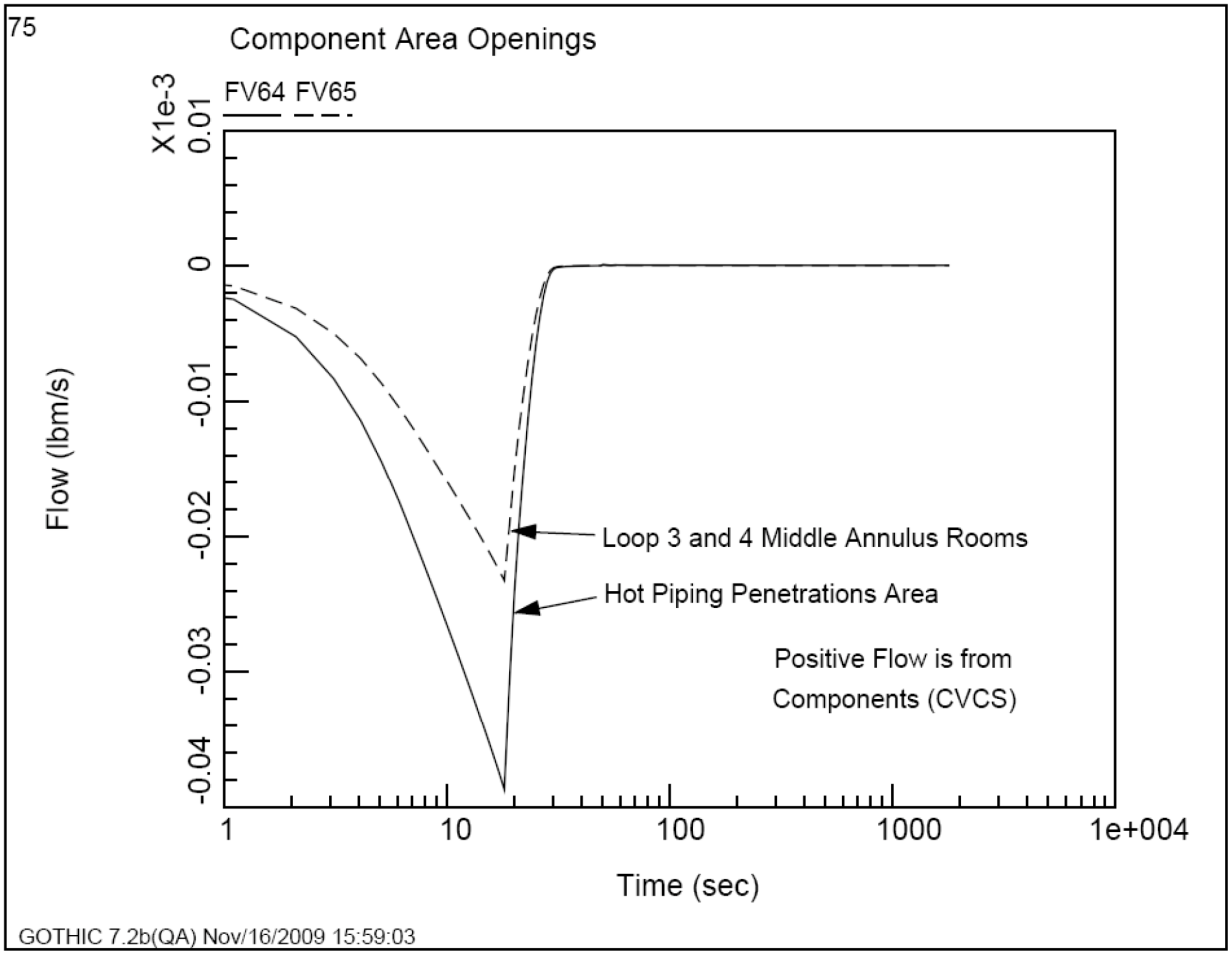

Figure 06.02.01-77-27—Flow from the Steam Generator Blowdown Heat Exchanger Room to Adjacent Areas

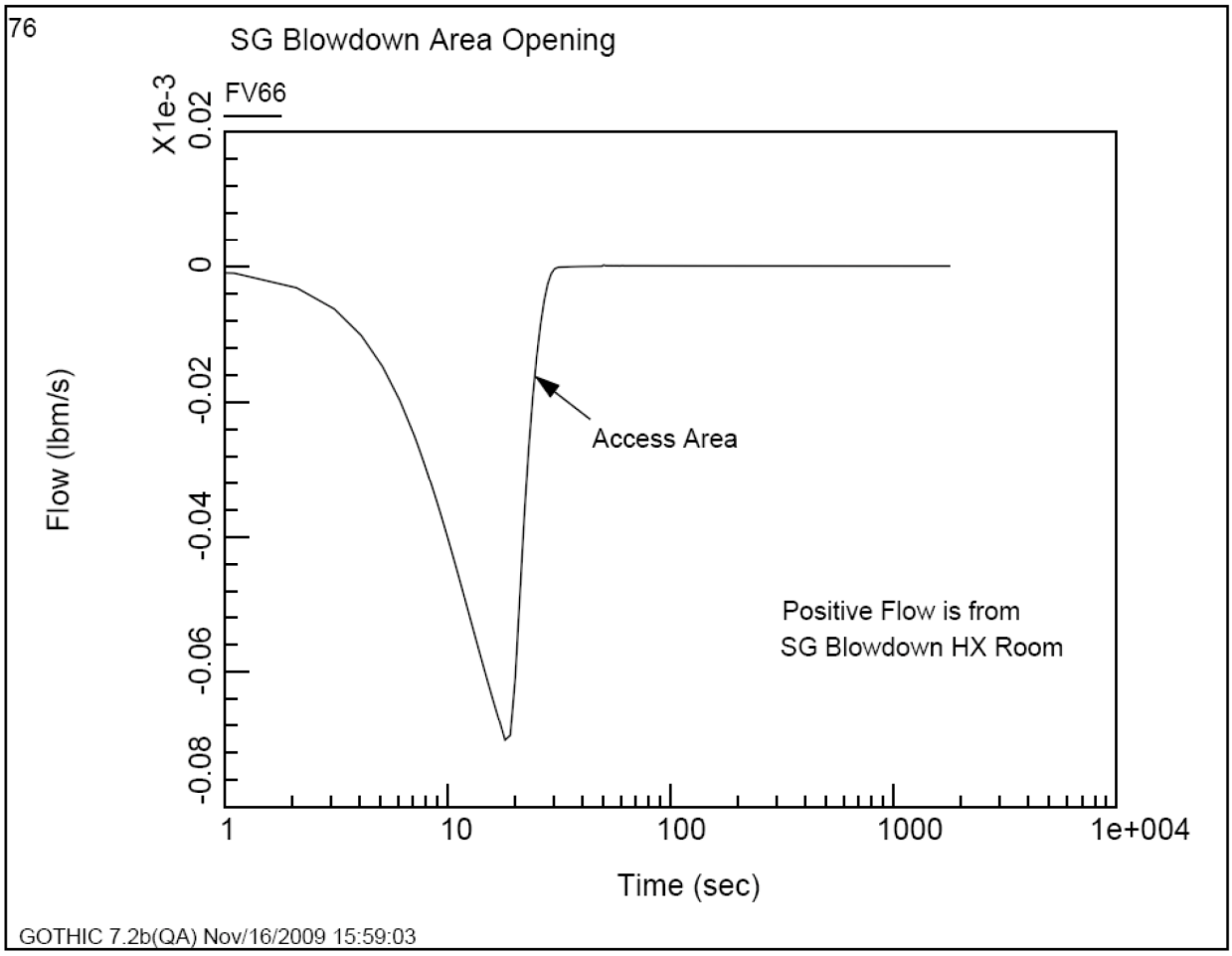

Figure 06.02.01-77-28—Flow from the Loop 1 and 2 Lower Annulus Room to Adjacent Rooms

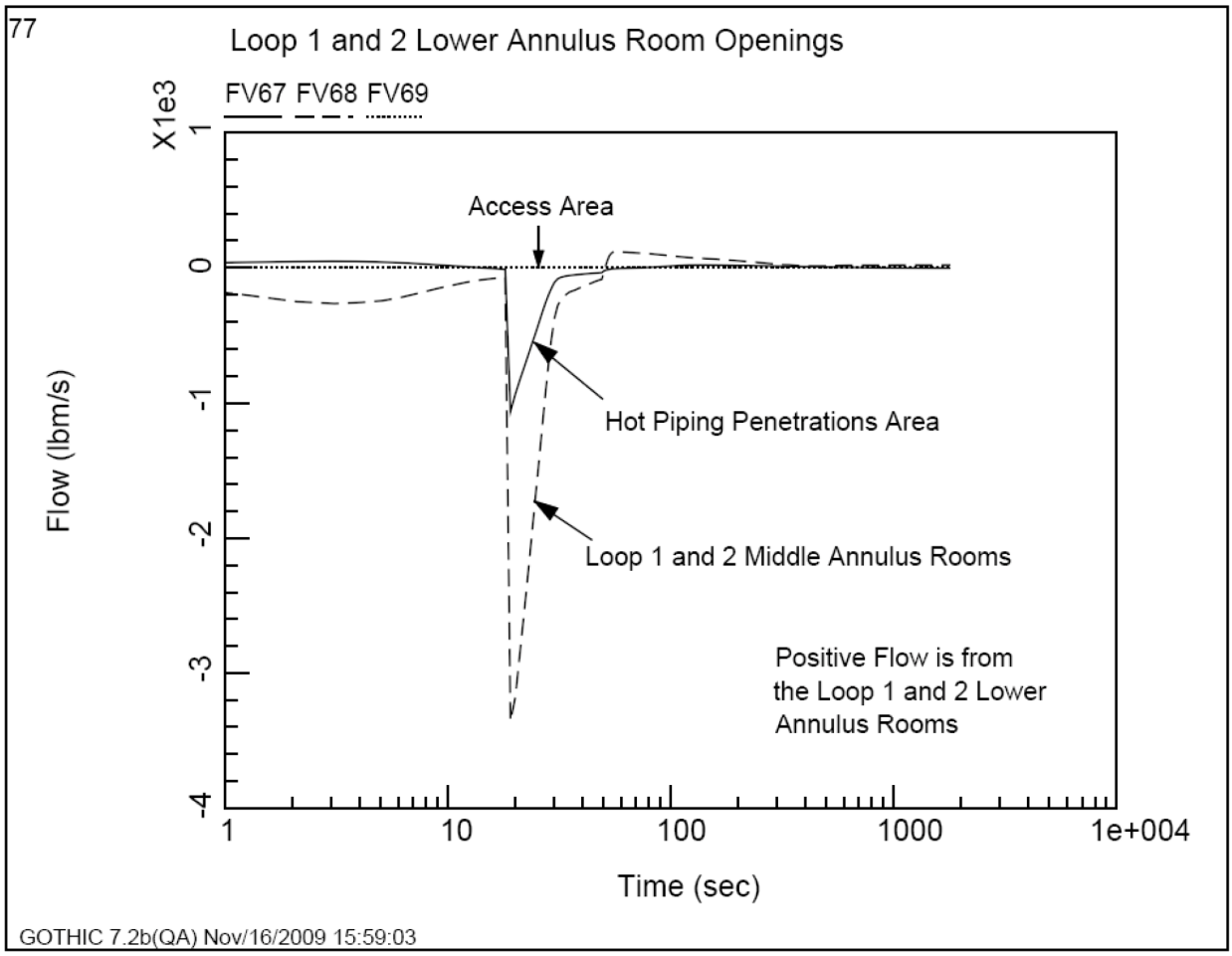

Figure 06.02.01-77-29—Flow from the Loop 3 and 4 Lower Annulus Room to Adjacent Rooms

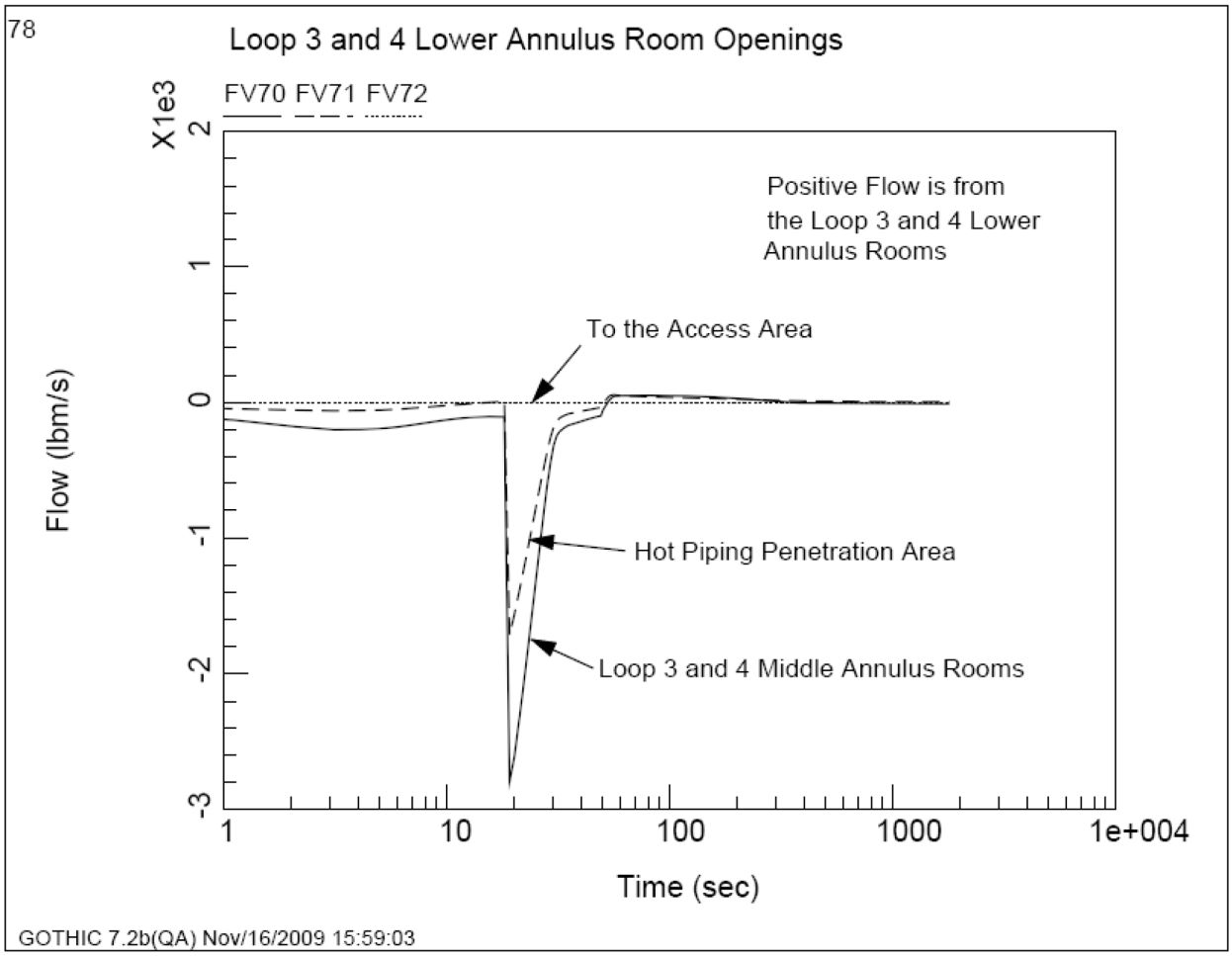

Figure 06.02.01-77-30—Flow from the Loop 1 and 2 Middle Annulus Room to Adjacent Rooms

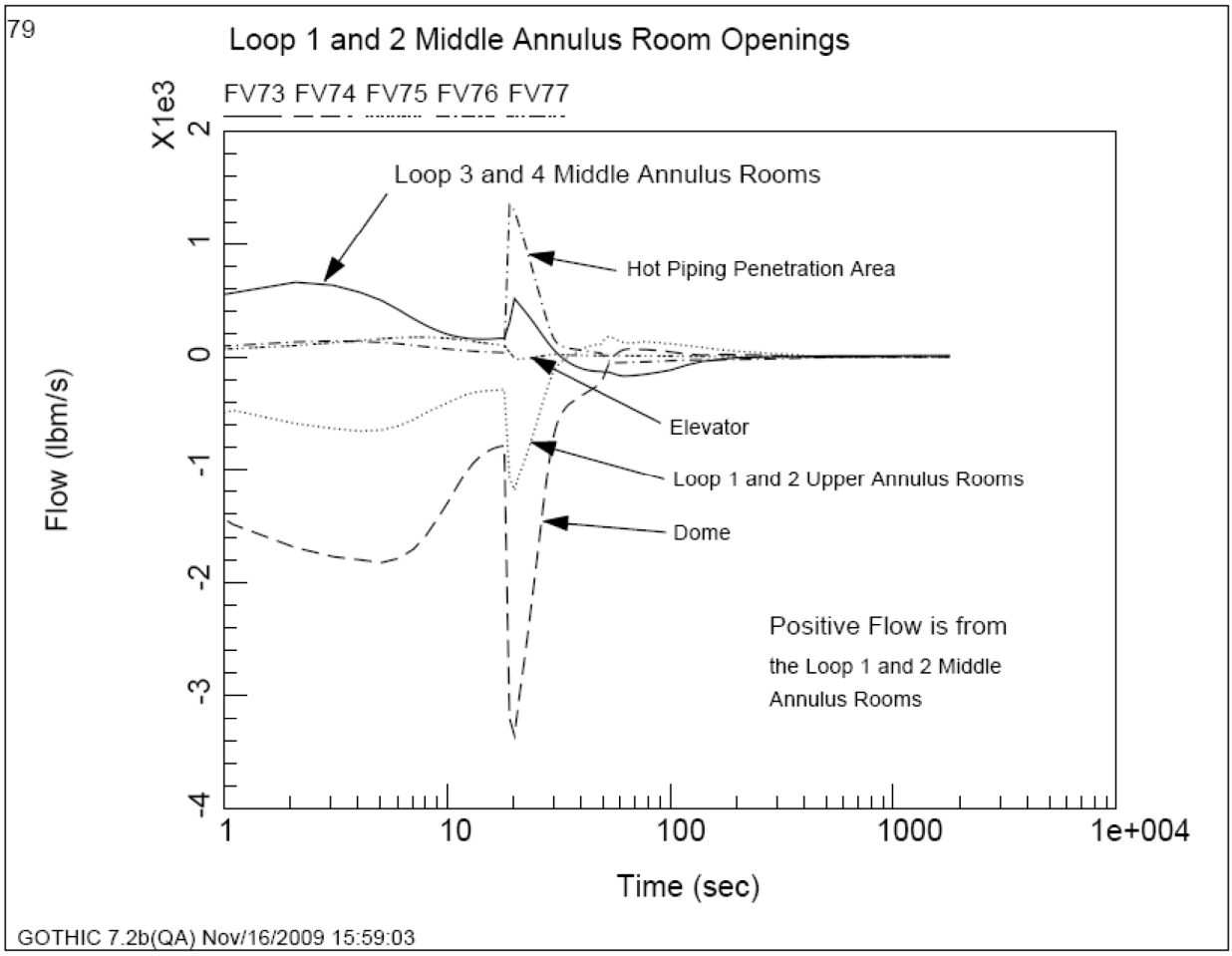

Figure 06.02.01-77-31—Flow from the Loop 1 and 2 Middle Annulus Room to Adjacent Rooms

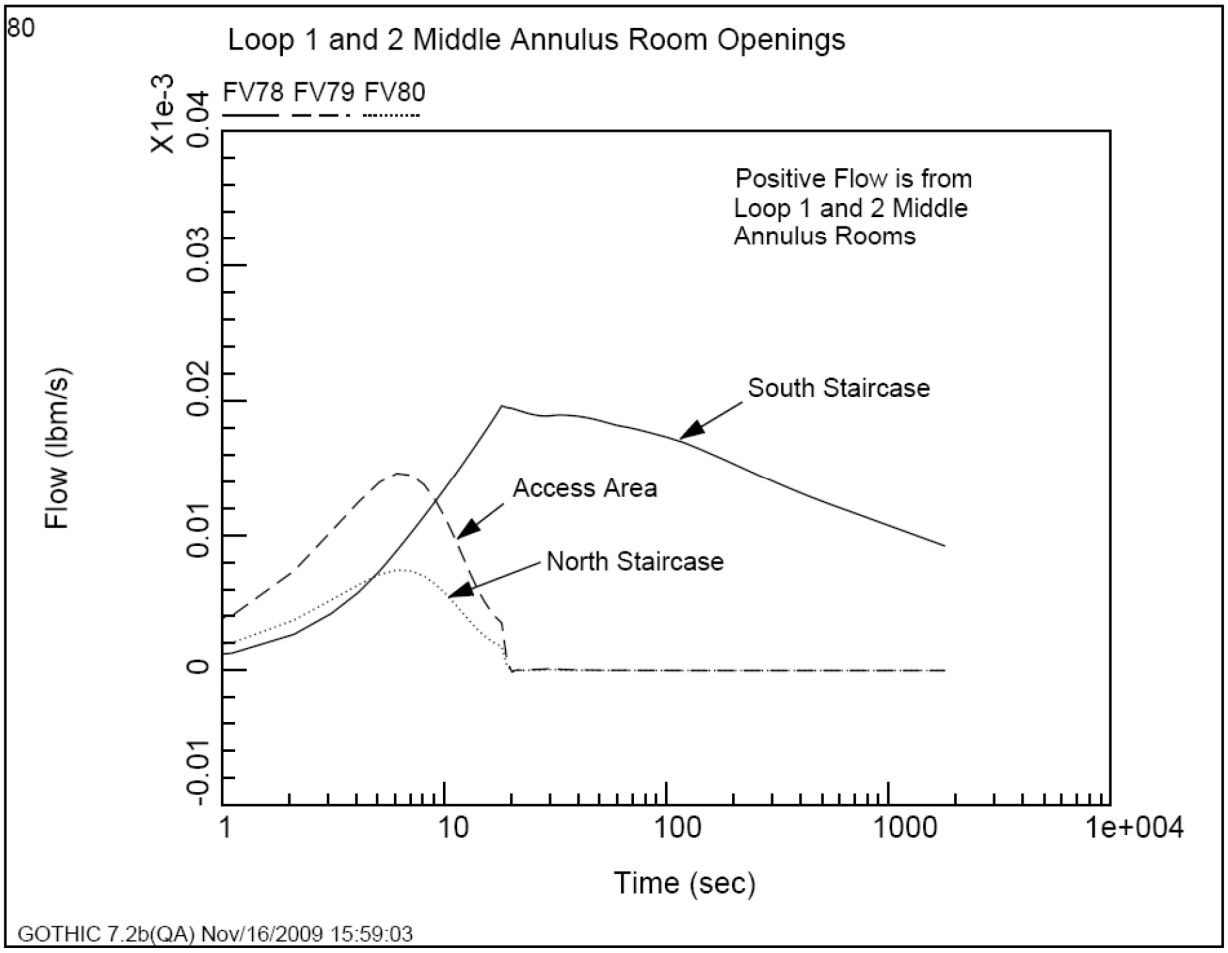

Figure 06.02.01-77-32—Flow from the Loop 3 and 4 Middle Annulus Room to Adjacent Rooms

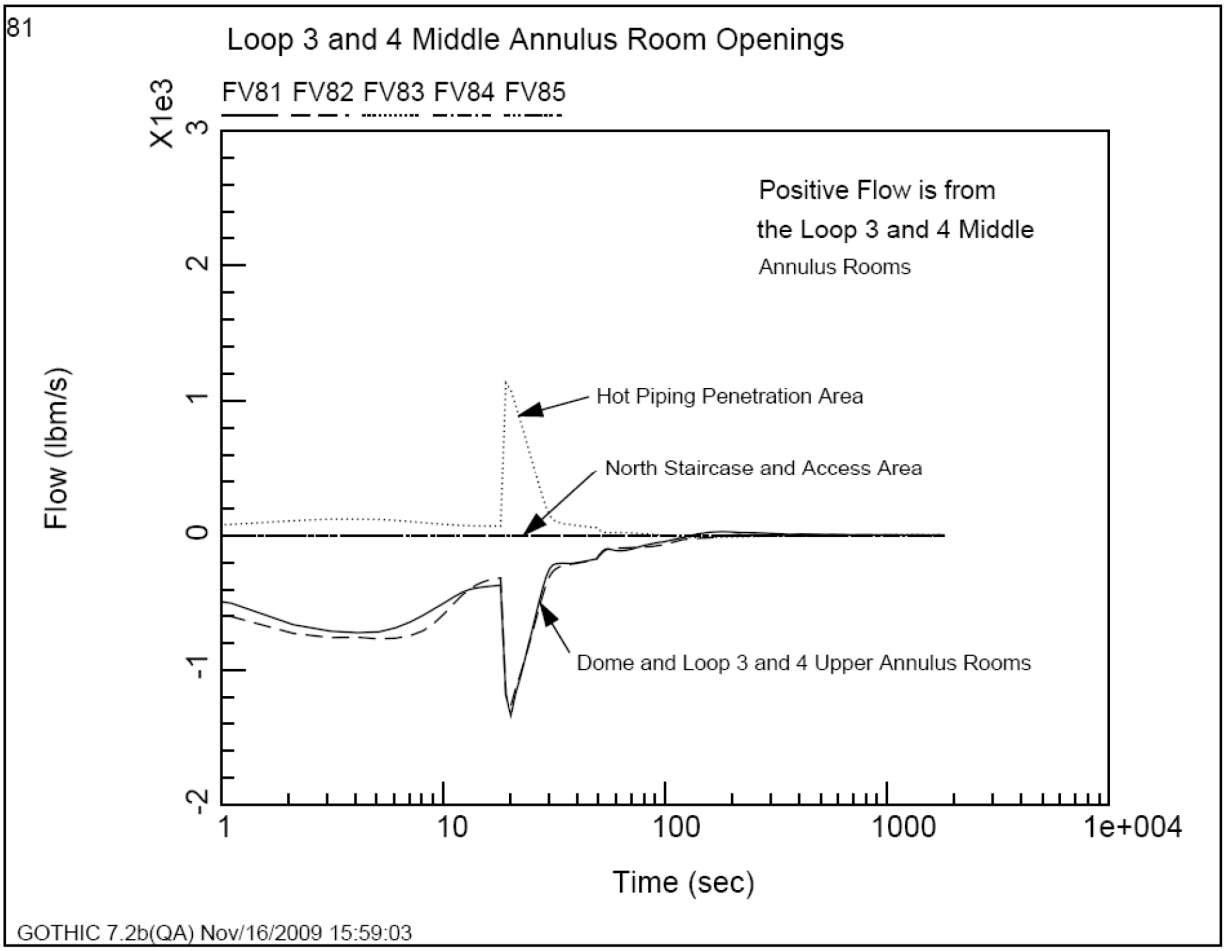

Figure 06.02.01-77-33—Flow from the Loop 1 and 2 Upper Annulus Room to Adjacent Rooms

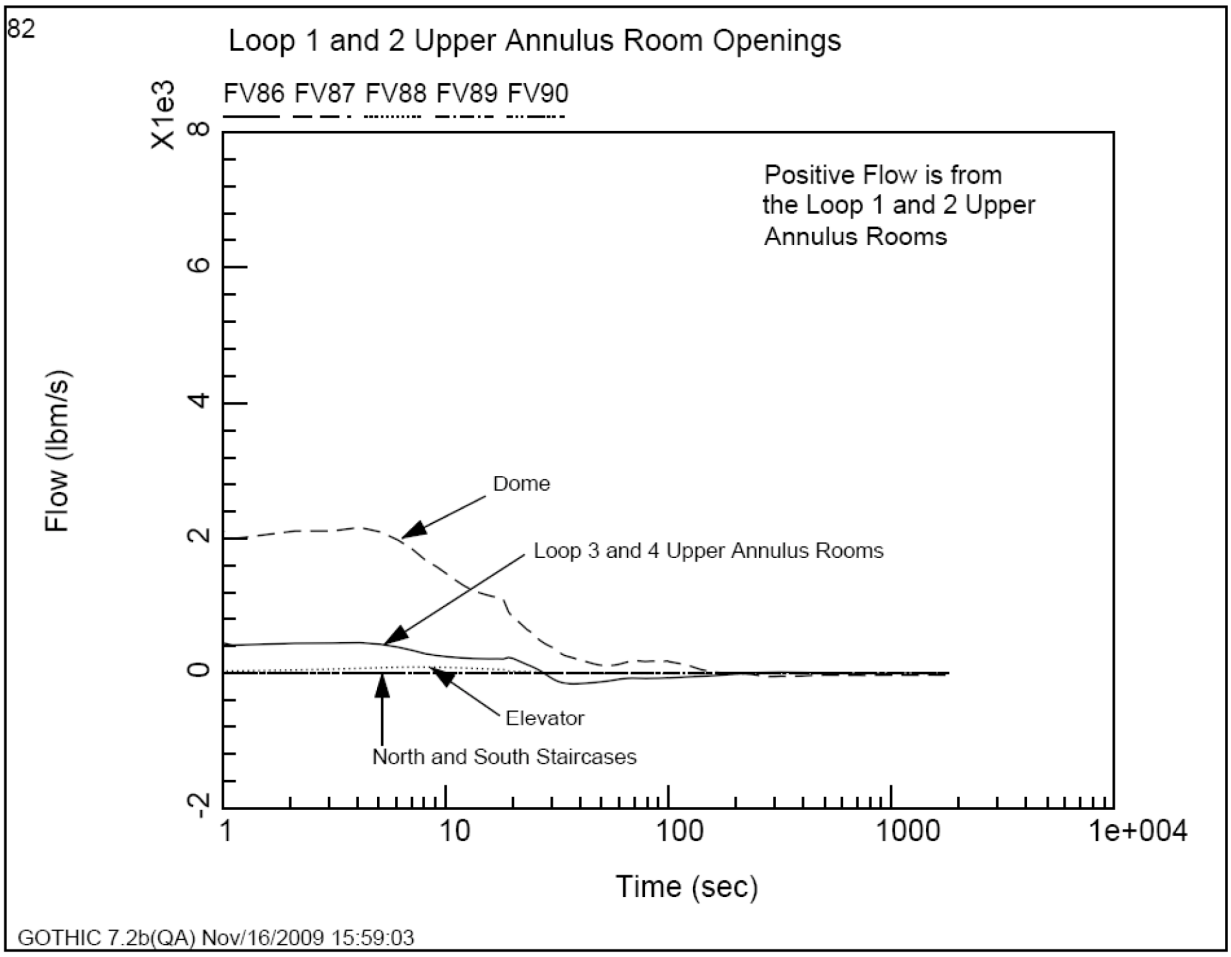

Figure 06.02.01-77-34—Flow from the Loop 3 and 4 Upper Annulus Room to the North Stairwell

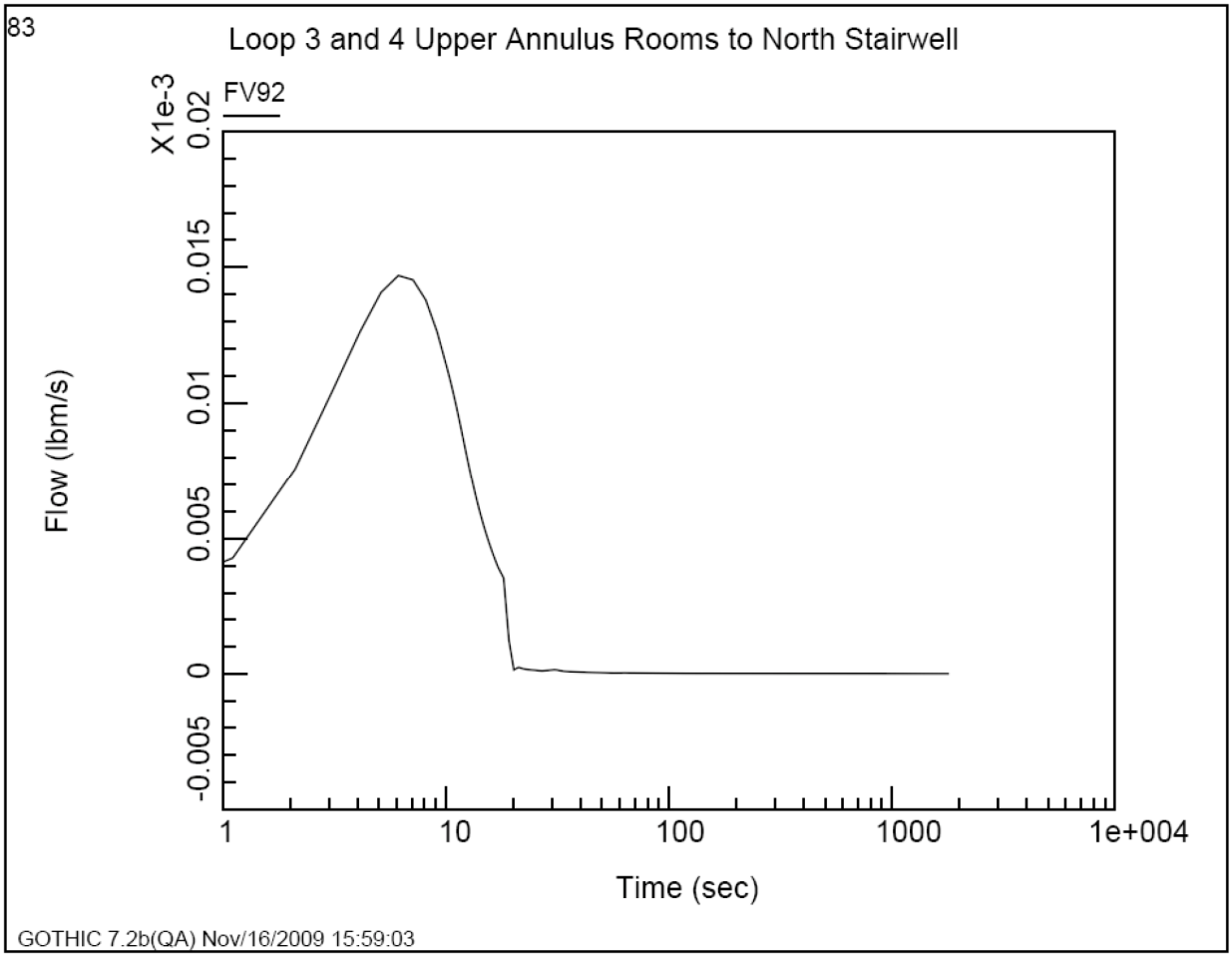

Figure 06.02.01-77-35—Flow from the Loop 1 and 2 Upper Annulus Room to the Containment Dome

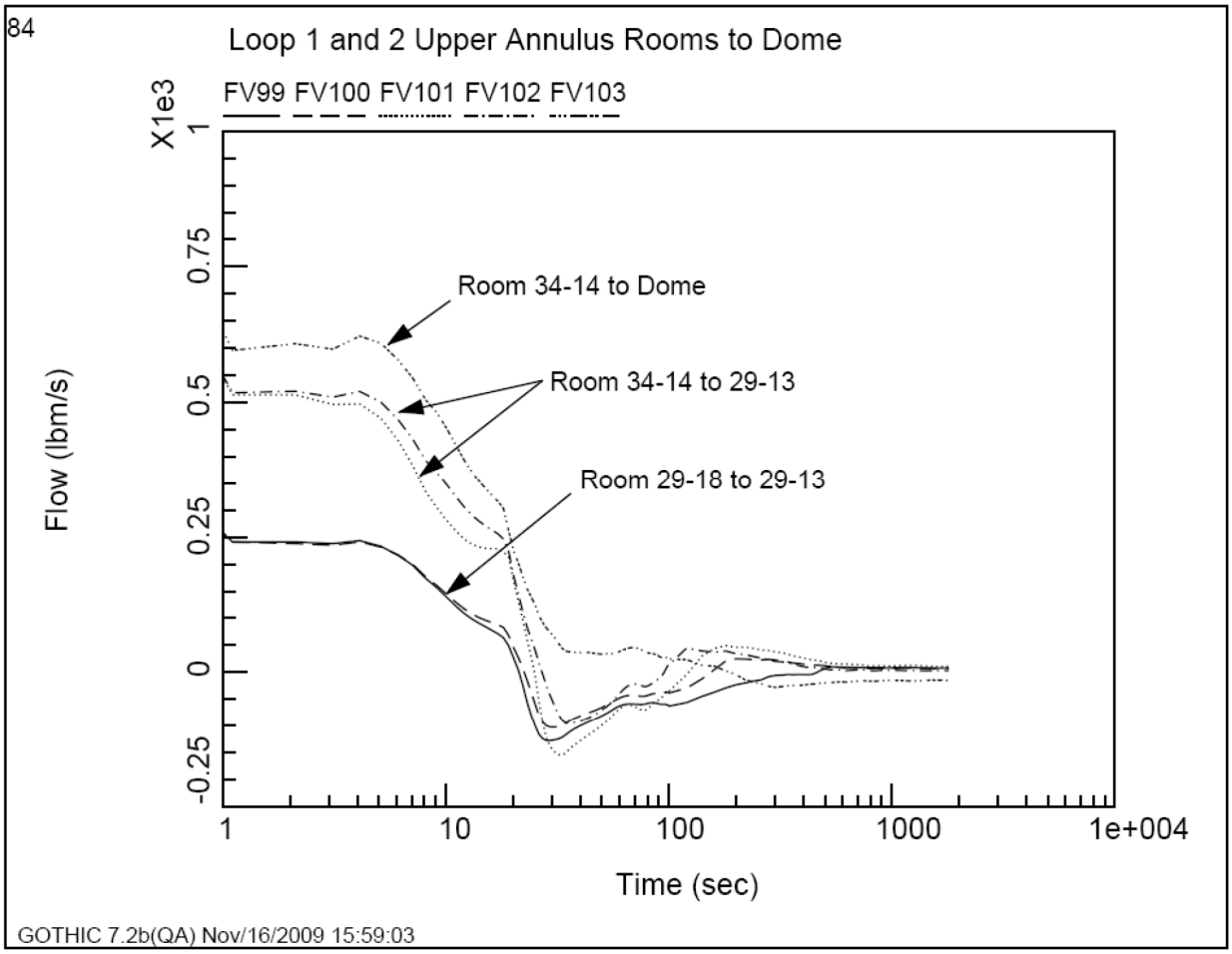

Figure 06.02.01-77-36—Flow from the Loop 1 and 2 Upper Annulus Room to the Containment Dome

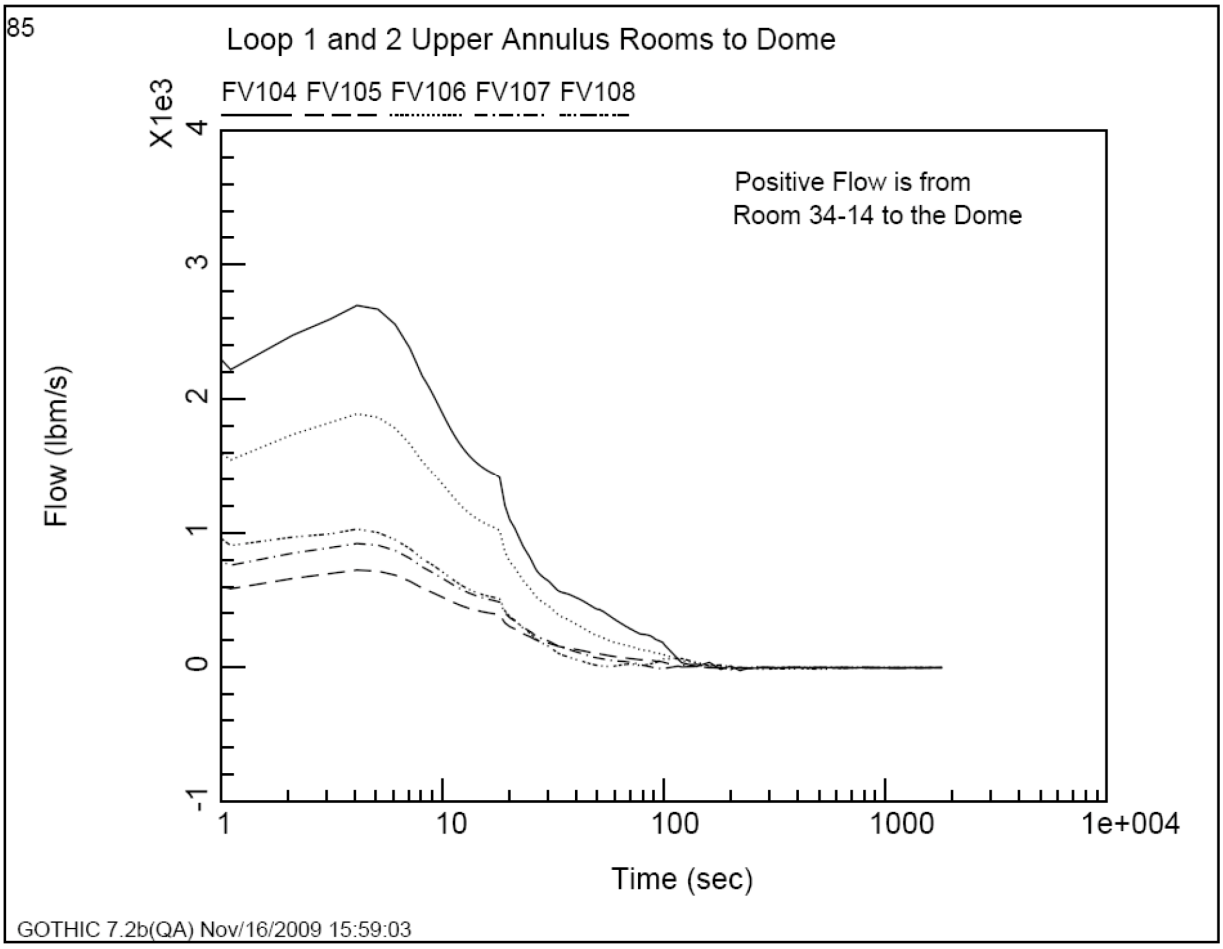

Figure 06.02.01-77-37—Flow from the Loop 3 and 4 Upper Annulus Room to the Containment Dome

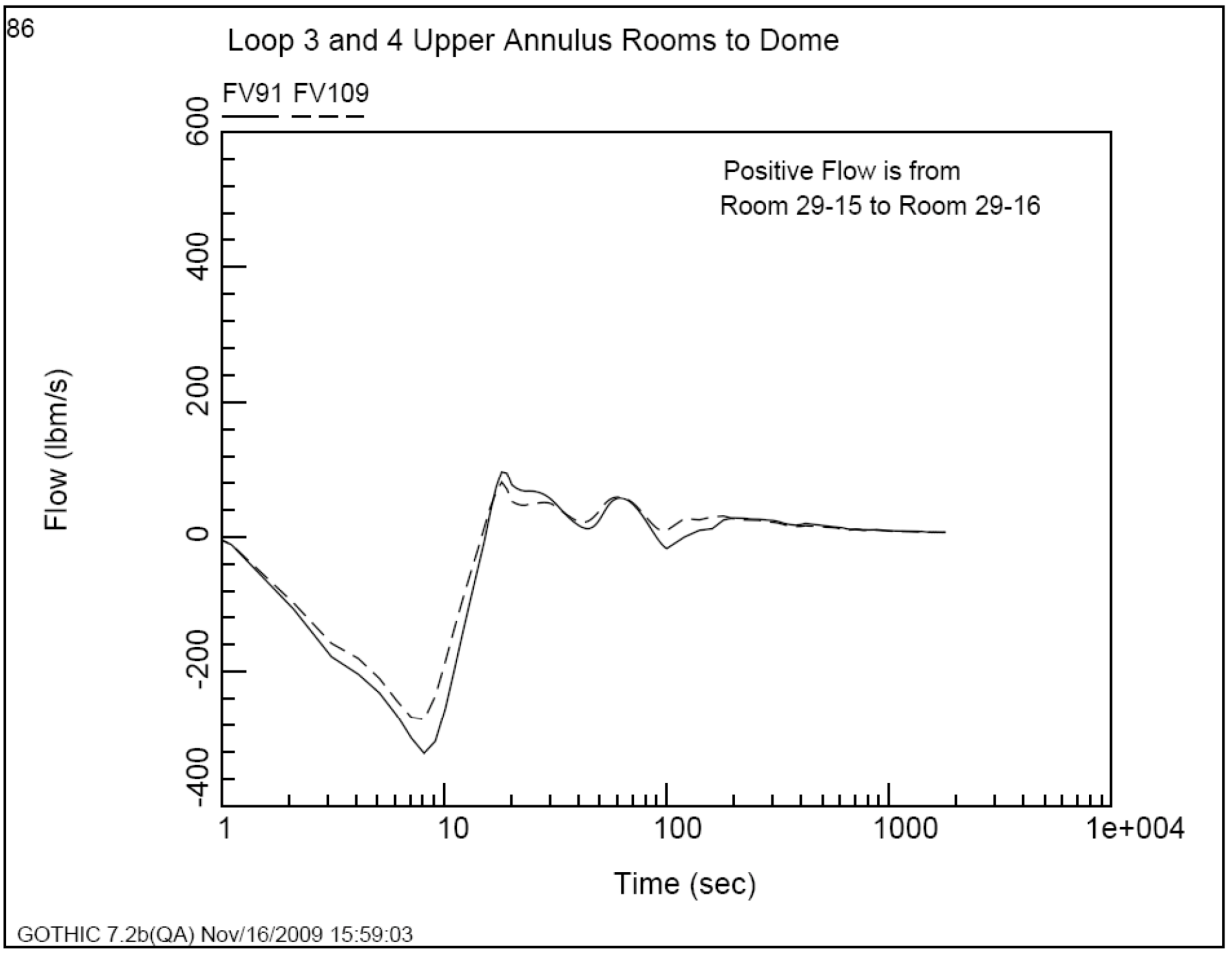

Figure 06.02.01-77-38—Flow from the Loop 3 and 4 Upper Annulus Room to the Containment Dome

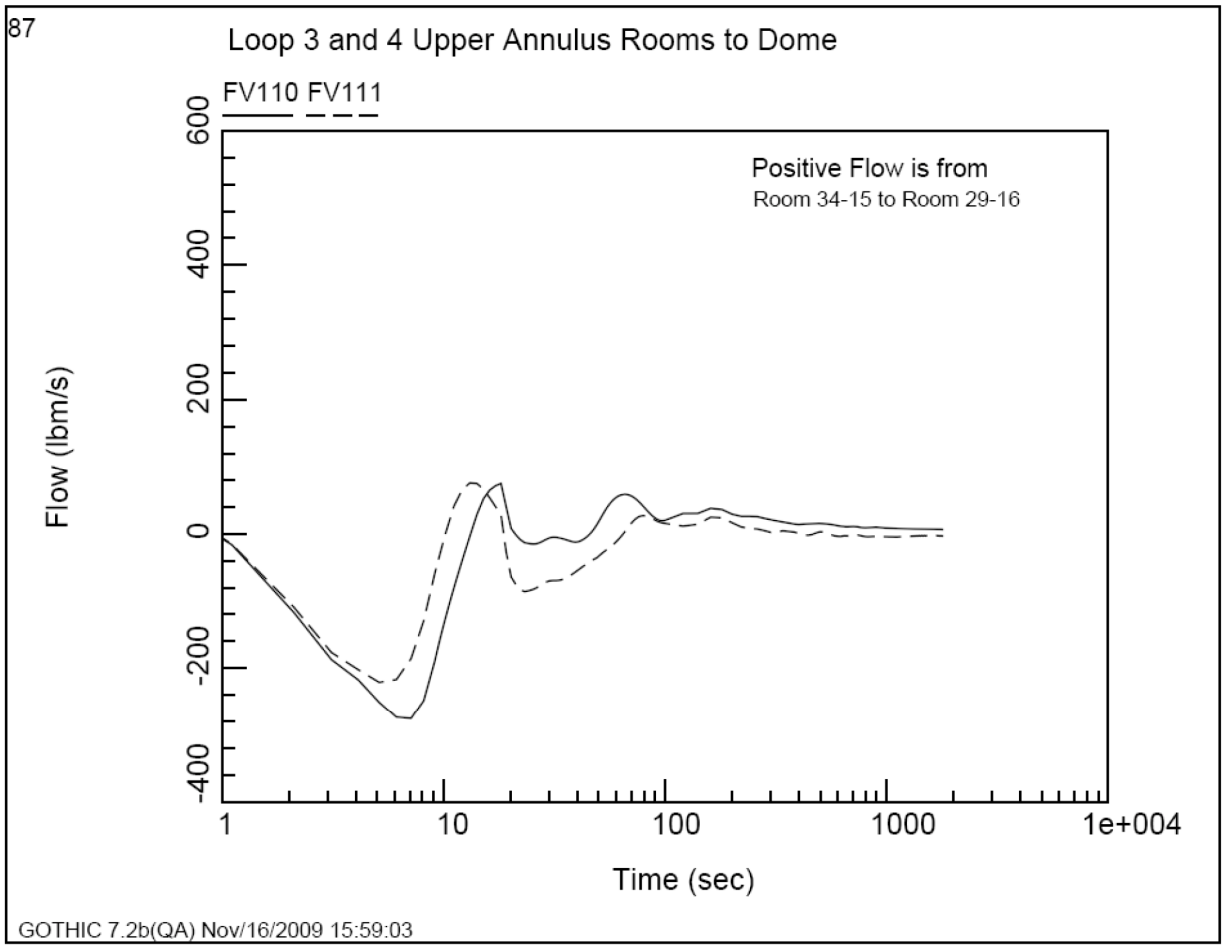

Figure 06.02.01-77-39—Flow from the Loop 3 and 4 Upper Annulus Room to the Containment Dome

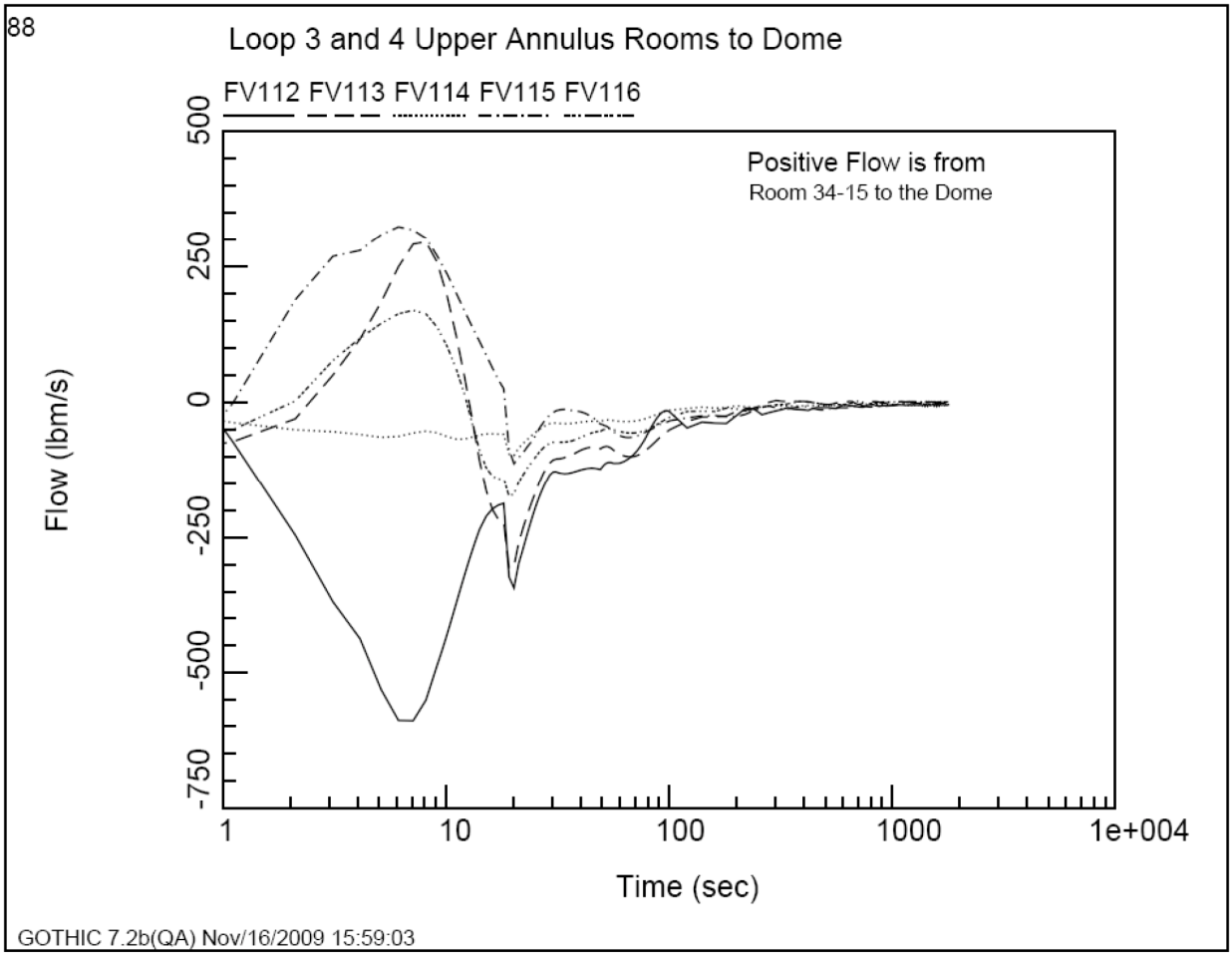

Figure 06.02.01-77-40—Flow from the Containment Dome to the South Stairwell

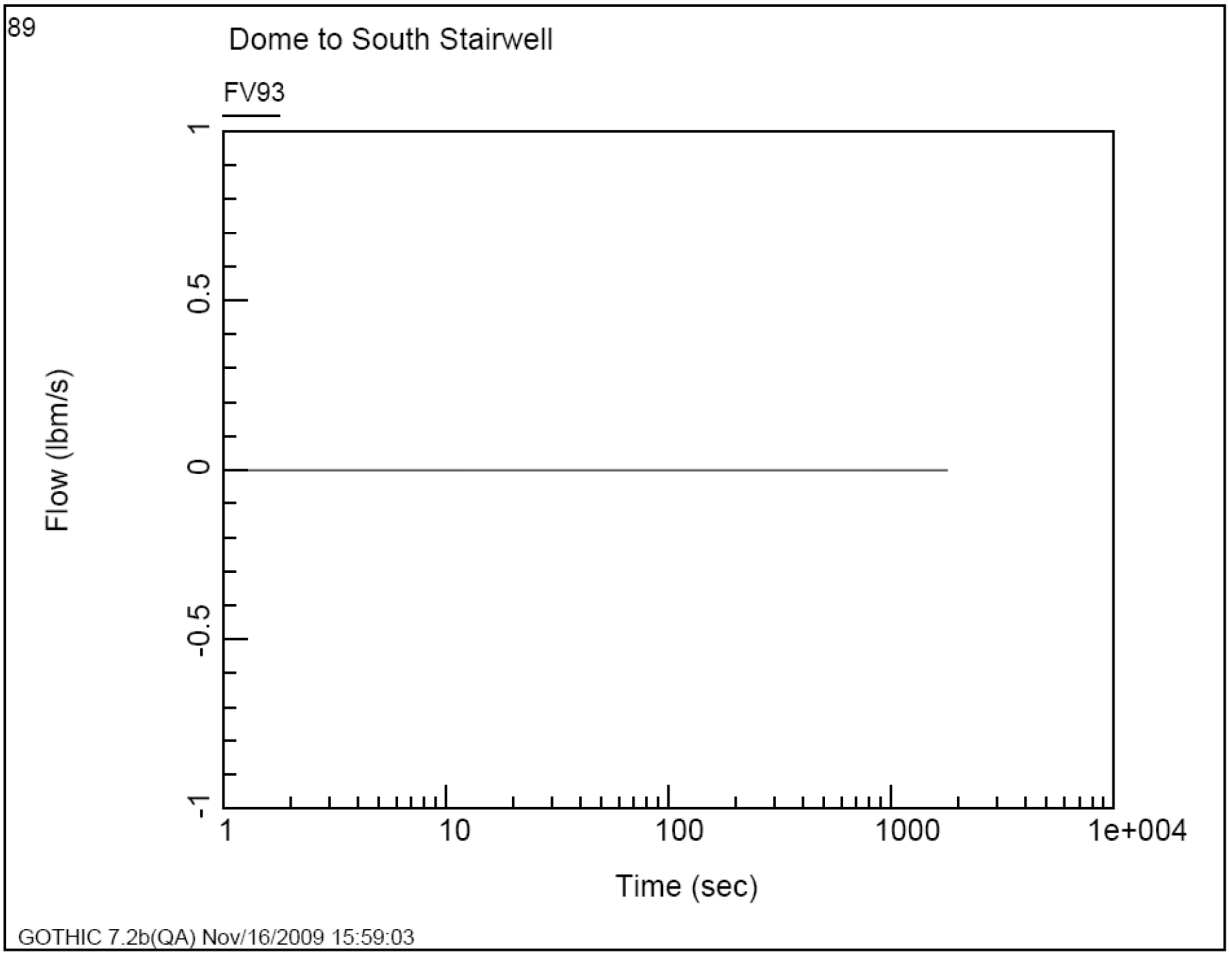

Figure 06.02.01-77-41—Flow from the Access Area to the North Staircase and the Elevator

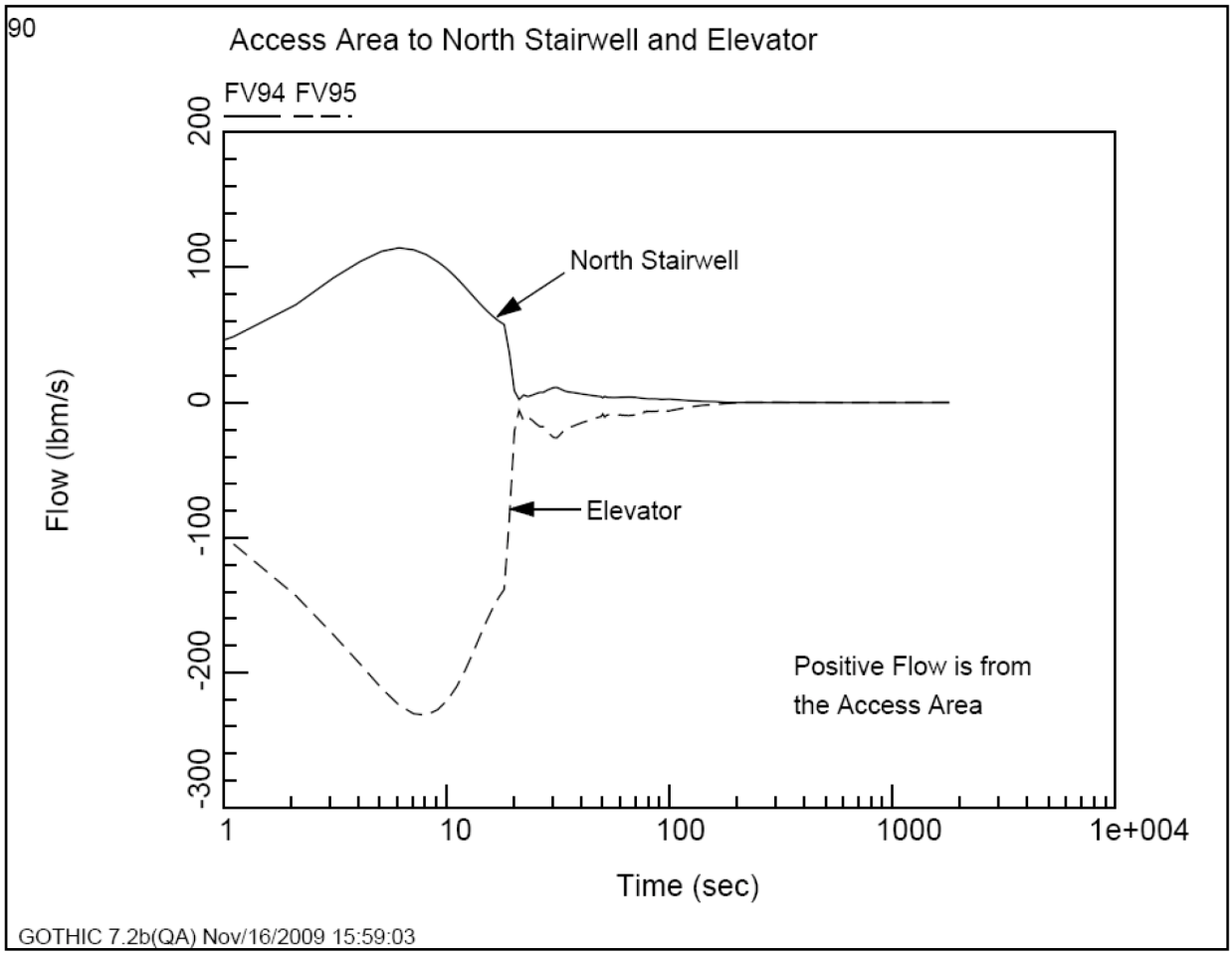

Figure 06.02.01-77-42—Flow Circulation Patterns in the Containment during Blowdown

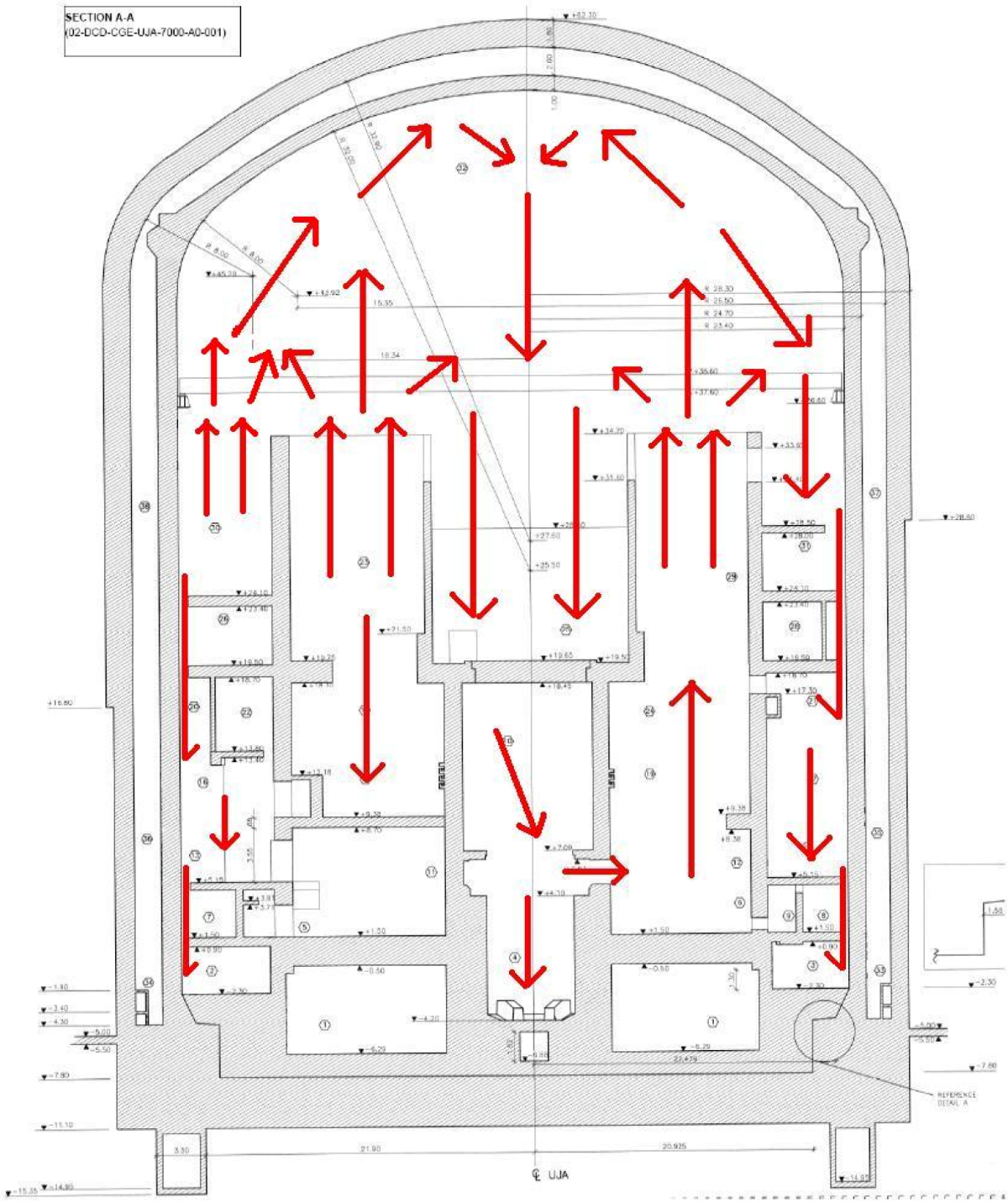
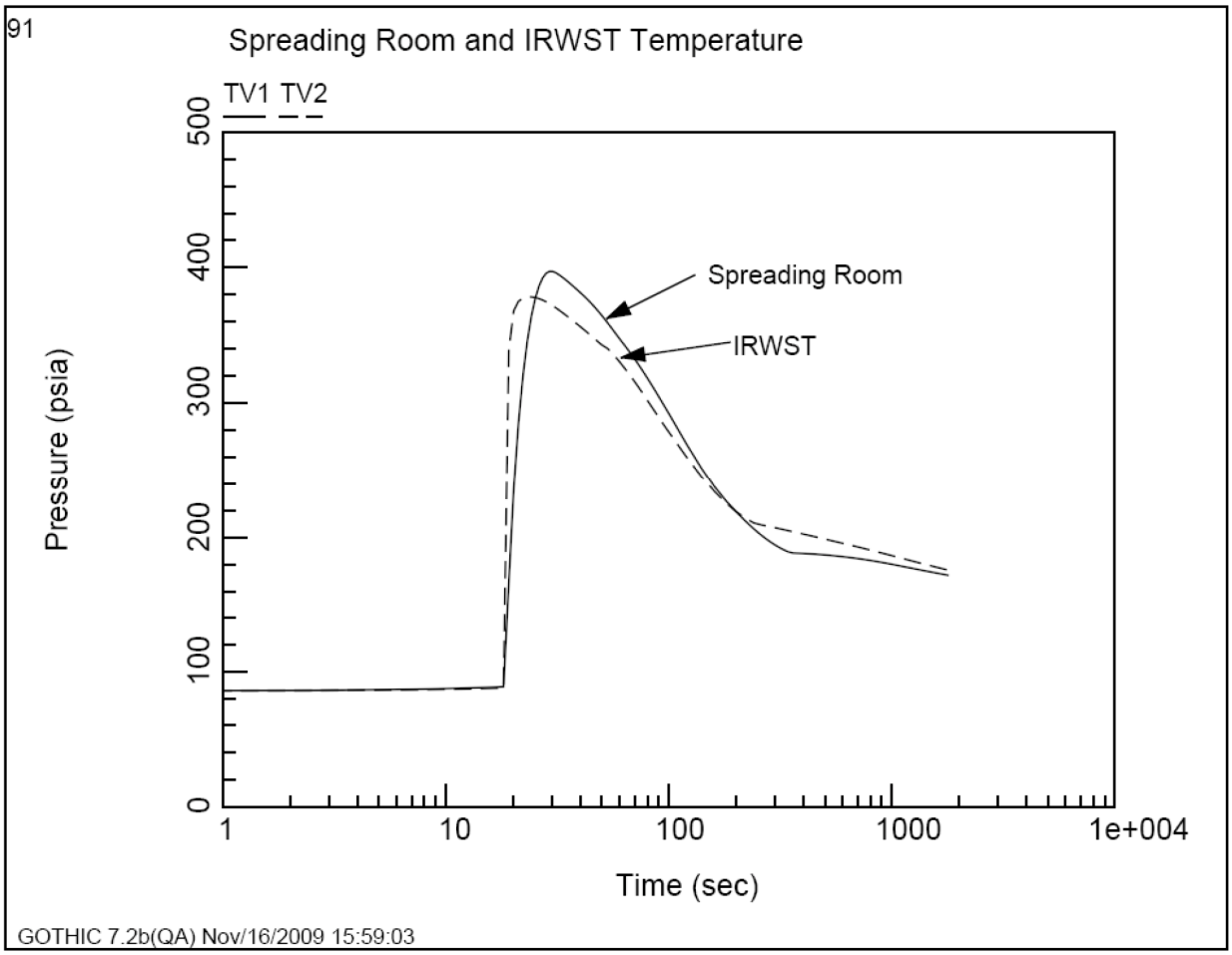
Figure 06.02.01-77-43—Temperature in the Spreading Room and IRWST