ArevaEPRDCPEm Resource

From: BRYAN Martin (EXTERNAL AREVA) [Martin.Bryan.ext@areva.com]
Sent: Thursday, August 12, 2010 2:33 PM
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. 378, Supplement 3, FSAR Ch. 6
Attachments: RAI 378 Supplement 3 Response US EPR DC.pdf

Getachew,

AREVA NP Inc. (AREVA NP) provided a response to 1 of the 15 questions of RAI 378 on May 24, 2010. Supplement 1 response to RAI 378 was sent on July 8, 2010 with a revised response schedule to provide an opportunity to interact with the NRC staff on Questions 6.2.01-83, 6.2.1-85, 6.2.1-87, 6.2.1-91, 6.2.2-45, and 6.2.3-06. Supplement 2 response to RAI 378 was sent on August 5, 2010 with a revised response schedule for Questions 6.2.1-83, 6.2.1-85, 6.2.1-87 and 6.2.1-91.

The attached file, “RAI 378 Supplement 3 Response US EPR DC.pdf” provides a technically correct and complete response to four questions (Question 6.2.1-82, 6.2.1-88, 6.2.1-89 and 6.2.1-90).

The following table indicates the respective pages in the response document, “RAI 378 Supplement 3 Response US EPR DC.pdf,” that contain AREVA NP’s response to the subject question.

Question #	Start Page	End Page
RAI 378 — 06.02.01-82	2	3
RAI 378 — 06.02.01-88	4	18
RAI 378 — 06.02.01-89	19	56
RAI 378 — 06.02.01-90	57	64

The response schedule for the remaining 10 questions is changed to provide additional opportunity to interact with the NRC staff on Questions 6.2.1-84 and 6.2.3-6 as provided below:

Question #	Final Response Date
RAI 378 — 06.02.01-83	September 9, 2010
RAI 378 — 06.02.01-84	**September 30, 2010**
RAI 378 — 06.02.01-85	September 9, 2010
RAI 378 — 06.02.01-86	August 31, 2010
RAI 378 — 06.02.01-87	September 9, 2010
RAI 378 — 06.02.01-91	September 9, 2010
RAI 378 — 06.02.01-92	August 31, 2010
RAI 378 — 06.02.01-93	August 31, 2010
RAI 378 — 06.02.02-45	October 27, 2010
RAI 378 — 06.02.03-6	**September 30, 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: Thursday, August 05, 2010 5:24 PM
To: 'Tesfaye, Getachew'
Cc: DELANO Karen (RS/NB); ROMINE Judy (RS/NB); BENNETT Kathy (RS/NB); GUCWA Len T (EXT)
Subject: Response to U.S. EPR Design Certification Application RAI No. 378, Supplement 2, FSAR Ch. 7

Getachew,

AREVA NP Inc. (AREVA NP) provided a response to 1 of the 15 questions of RAI 378 on May 24, 2010. A revised schedule was provided in Supplement 1 on July 8, 2010. To provide an additional opportunity to interact with the NRC on the responses, a revised schedule is provided below for providing technically correct and complete responses to RAI 378 questions 6.2.1-83, 6.2.1-85, 6.2.1-87, and 6.2.1-91.

Question #	Response Date
RAI 378 — 06.02.01-82	August 12, 2010
RAI 378 — 06.02.01-83	**September 9, 2010**
RAI 378 — 06.02.01-84	August 12, 2010
RAI 378 — 06.02.01-85	**September 9, 2010**
RAI 378 — 06.02.01-86	August 31, 2010
RAI 378 — 06.02.01-87	**September 9, 2010**
RAI 378 — 06.02.01-88	August 12, 2010
RAI 378 — 06.02.01-89	August 12, 2010
RAI 378 — 06.02.01-90	August 12, 2010
RAI 378 — 06.02.01-91	**September 9, 2010**
RAI 378 — 06.02.01-92	August 31, 2010
RAI 378 — 06.02.01-93	August 31, 2010
RAI 378 — 06.02.02-45	October 27, 2010
RAI 378 — 06.02.03-6	August 12, 2010

Sincerely,

Martin (Marty) C. Bryan
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From: BRYAN Martin (EXT)
Sent: Thursday, July 08, 2010 1:50 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. 378, Supplement 1, FSAR Ch. 6

Getachew,

AREVA NP Inc. (AREVA NP) provided a response to 1 of the 15 questions of RAI 378 on May 24, 2010. To provide an opportunity to interact with the NRC on the response, a revised schedule is provided below for providing technically correct and complete responses to RAI 378 questions 6.2.01-83, 6.2.1-85, 6.2.1-87, 6.2.1-91, 6.2.2-45, and 6.2.3.06.

Question #	Response Date
RAI 378 — 06.02.01-82	August 12, 2010
RAI 378 — 06.02.01-83	**August 5, 2010**
RAI 378 — 06.02.01-84	August 12, 2010
RAI 378 — 06.02.01-85	**August 5, 2010**
RAI 378 — 06.02.01-86	August 31, 2010
RAI 378 — 06.02.01-87	**August 5, 2010**
RAI 378 — 06.02.01-88	August 12, 2010
RAI 378 — 06.02.01-89	August 12, 2010
RAI 378 — 06.02.01-90	August 12, 2010
RAI 378 — 06.02.01-91	**August 5, 2010**
RAI 378 — 06.02.01-92	August 31, 2010
RAI 378 — 06.02.01-93	August 31, 2010
RAI 378 — 06.02.02-45	**October 27, 2010**
RAI 378 — 06.02.03-6	**August 12, 2010**

Sincerely,

Martin (Marty) C. Bryan
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Martin.Bryan.ext@areva.com

From: BRYAN Martin (EXT)
Sent: Monday, May 24, 2010 5:50 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. 378, FSAR Ch. 6

Getachew,

Attached please find AREVA NP Inc.'s response to the subject request for additional information (RAI). The attached file, "RAI 378 Response US EPR DC.pdf" provides a technically correct and complete response to 1 of the 15 questions.

The following table indicates the respective pages in the response document, "RAI 378 Response US EPR DC.pdf," that contain AREVA NP's response to the subject questions.

Question #	Start Page	End Page
RAI 378 — 06.02.01-82	2	2
RAI 378 — 06.02.01-83	3	3
RAI 378 — 06.02.01-84	4	4
RAI 378 — 06.02.01-85	5	5
RAI 378 — 06.02.01-86	6	6

RAI 378 — 06.02.01-87	7	7
RAI 378 — 06.02.01-88	8	8
RAI 378 — 06.02.01-89	9	9
RAI 378 — 06.02.01-90	10	10
RAI 378 — 06.02.01-91	11	11
RAI 378 — 06.02.01-92	12	12
RAI 378 — 06.02.01-93	13	13
RAI 378 — 06.02.02-45	14	14
RAI 378 — 06.02.02-46	15	16
RAI 378 — 06.02.03-6	17	17

A complete answer is not provided for 14 of the 15 questions. The schedule for a technically correct and complete response to these questions is provided below.

Question #	Response Date
RAI 378 — 06.02.01-82	August 12, 2010
RAI 378 — 06.02.01-83	July 8, 2010
RAI 378 — 06.02.01-84	August 12, 2010
RAI 378 — 06.02.01-85	July 8, 2010
RAI 378 — 06.02.01-86	August 31, 2010
RAI 378 — 06.02.01-87	July 8, 2010
RAI 378 — 06.02.01-88	August 12, 2010
RAI 378 — 06.02.01-89	August 12, 2010
RAI 378 — 06.02.01-90	August 12, 2010
RAI 378 — 06.02.01-91	July 8, 2010
RAI 378 — 06.02.01-92	August 31, 2010
RAI 378 — 06.02.01-93	August 31, 2010
RAI 378 — 06.02.02-45	July 8, 2010
RAI 378 — 06.02.03-6	July 14, 2010

Sincerely,

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From: Tesfaye, Getachew [mailto:Getachew.Tesfaye@nrc.gov]
Sent: Friday, April 23, 2010 9:41 AM
To: ZZ-DL-A-USEPR-DL
Cc: Jensen, Walton; Peng, Shie-Jeng; Hayes(NRO), Michelle; Ashley, Clinton; Jackson, Christopher; McKirgan, John; Carneal, Jason; Colaccino, Joseph; ArevaEPRDCPEm Resource
Subject: U.S. EPR Design Certification Application RAI No. 378 (4409,4513,4490), FSAR Ch. 6

Attached please find the subject requests for additional information (RAI). A draft of the RAI was provided to you on March 17, 2010, and discussed with your staff on April 13 and 16, 2010. Drat RAI Questions 06.02.01-87 and 06.02.01-89 were modified as a result of those discussions. 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: 1824

Mail Envelope Properties (BC417D9255991046A37DD56CF597DB7107307C9B)

Subject: Response to U.S. EPR Design Certification Application RAI No. 378, Supplement 3, FSAR Ch. 6
Sent Date: 8/12/2010 2:32:46 PM
Received Date: 8/12/2010 2:32:57 PM
From: BRYAN Martin (EXTERNAL AREVA)

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

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Tracking Status: None
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Tracking Status: None

Post Office: AUSLYNCMX02.adom.ad.corp

Files	**Size**	**Date & Time**
MESSAGE	8754	8/12/2010 2:32:57 PM
RAI 378 Supplement 3 Response US EPR DC.pdf		1671452

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

Response to

Request for Additional Information No. 378(4409, 4513, 4490), Revision 2
Supplement 3

4/23/2010

U. S. EPR Standard Design Certification
AREVA NP Inc.
Docket No. 52-020
SRP Section: 06.02.01 - Containment Functional Design
SRP Section: 06.02.02 - Containment Heat Removal Systems
SRP Section: 06.02.03 - Secondary Containment Functional Design

Application Section: 06.02.

QUESTIONS for Containment and Ventilation Branch 1 (AP1000/EPR Projects)
(SPCV)

Question 06.02.01-82:

FSAR Rev. 2 interim Section 6.2.1.4.1 lists SG fluid inventory among the significant parameters which must be considered in determining the M&E release following a MSLB. Provide the steam generator inventory which was used in the analyses as function of power level, describe how these inventories were determined, address how these values were made to conservative for containment analysis and describe how these values will be verified for the as built plant. This question is a follow-up to the February 9 and 10, 2010 audit on containment analyses.

Response to Question 06.02.01-82:

The values for the mass inventory of the steam generator (SG) as a function of power level are provided in Table 06.02.01-82-1.

The target inventories for several power levels were determined from the geometric characteristics of the U. S. EPR SG (model 79/19 TE), the operating data, and the operating temperatures. The target values used for certain intermediate power levels are obtained by interpolation. Table 06.02.01-82-1 shows that initial SG inventory increases with decreasing initial power level. The initial SG mass sensitivity is intrinsically incorporated in the power level sensitivity. Greater initial SG inventory tends to cause higher peak containment pressure. For initialization of the input decks, the mass of the SG inventory was brought close to the target value with out falling below it. Each of the SG inventory values is greater than the target value by less than one percent.

Due to liquid swell, greater initial SG level will increase the amount of liquid release relative to the amount of steam release. To minimize the effect of liquid swell, the liquid level of the SG was initialized low to account for instrument uncertainty. In order to maximize the total released mass out the break, the target SG inventory given in Table 06.02.01-82-1 is not the inventory associated with the lower SG liquid level, but rather the nominal inventory for a given power level, which is greater than the inventory associated with the lower SG liquid level. This approach verifies that the limiting containment response relative to initial SG mass is captured, as evidenced by the fact that the limiting case is the double ended guillotine break from 20 percent power, which has a lower SG initial inventory than zero percent power.

FSAR Impact:

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

Table 06.02.01-82-1—Initial SG Inventory

Power Level	Target SG Inventory (lb)	Calculated SG Inventory (lb)	% Difference from Target
100%	181,784	182,436	0.36
80%	188,970	189,806	0.44
60%	195,280	196,301	0.52
50%	200,548	201,623	0.54
40%	205,816	207,006	0.58
20%	220,000	221,609	0.73
0%	240,640	242,958	0.96

Question 06.02.01-88:

This question is a follow-up to the February 9 and 10, 2010 audit on containment analyses. For the postulated cold leg pump suction (CLPS) LOCA as reported in the FSAR 6.2 Rev. 2 interim (Figures 6.2.1-16 and -17), provide the following information. No more that 5 traces should be given per figure:

a. Location of the maximum temperature reported in the FSAR (elevation and sub- divided node or lumped parameter node).

b. Time history plots for atmospheric temperatures in the sub-divided dome (at elevations along the containment centerline, (19 elevations). Use the same time scale as the FSAR.

c. Time history plots for atmospheric temperature below the dome (lump parameter nodes 1-30, excluding sub-divided dome region). Use the same time scale as the FSAR.

d. Time history plots for gas velocity in pathways (FP #31 and 53 – rupture foils; FP# 11 and 12 – IRWST dampers; FP# 74 and 82 – middle annulus to dome; FP# 115 and 123 – upper annulus to dome). Use the same time scale as the FSAR.

Response to Question 06.02.01-88:

a) The temperature reported in U.S. EPR FSAR Tier 2, Figure 6.2.1-17 is the vapor temperature in the room that contains the break (equipment room – lumped parameter node #10).

b) Figure 06.02.01-88-1 through Figure 06.02.01-88-4 show the time history atmospheric temperature for the sub-divided dome region. The temperatures are taken along the containment centerline. The plots are divided based on elevation, with Level 1 at the bottom of the dome and Level 19 at the top.

c) Figure 06.02.01-88-5 through Figure 06.02.01-88-10 show the time history atmospheric temperature for volumes below the dome region (lumped parameter nodes one through 30, excluding the sub-divided node region).

d) Figure 06.02.01-88-11 through Figure 06.02.01-88-14 show the time history gas velocity for the requested pathways.

FSAR Impact:

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

Figure 06.02.01-88-1—Subdivided Dome Vapor Temperature (Level 1-5)

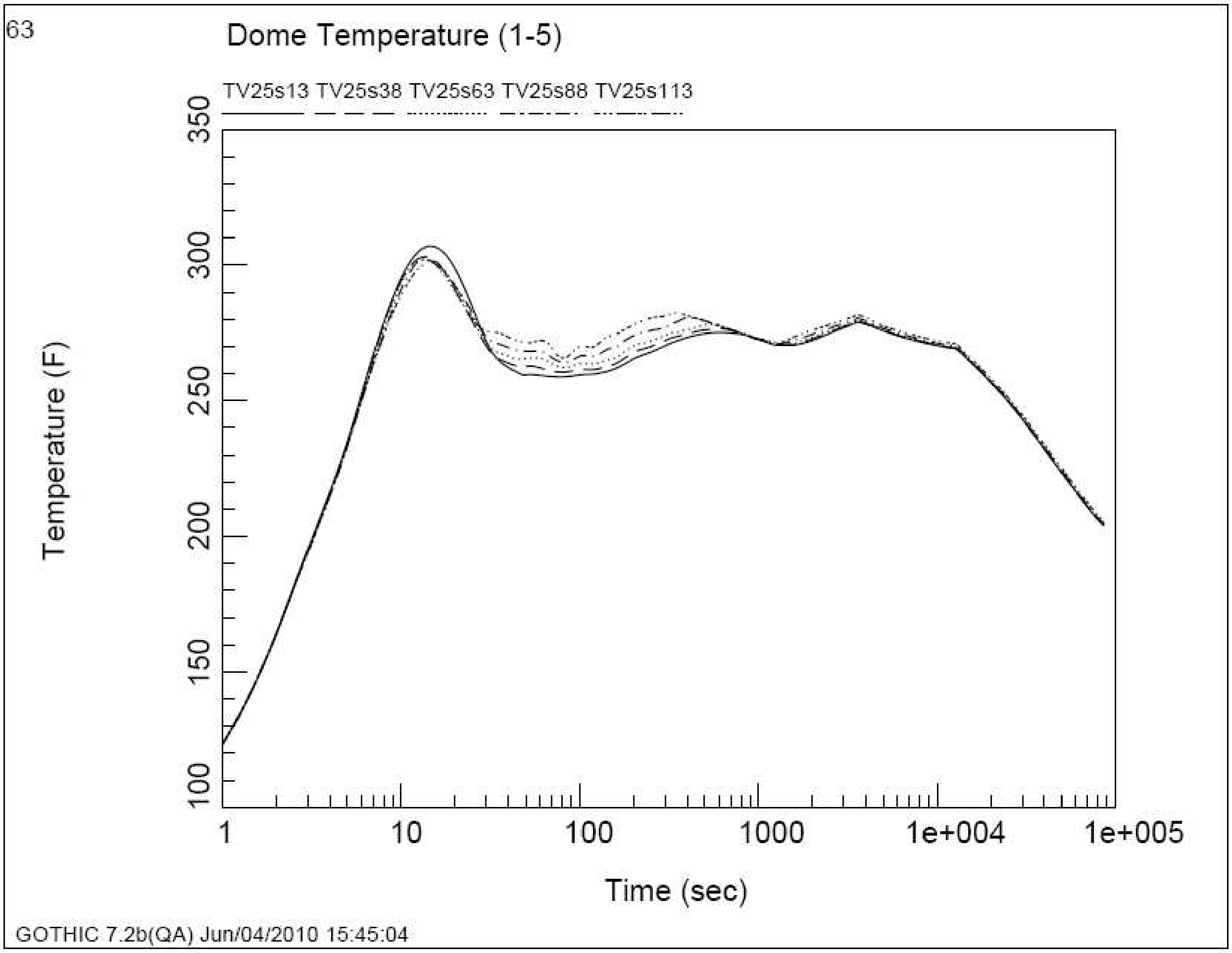


Figure 06.02.01-88-2—Subdivided Dome Vapor Temperature (Level 6-10)

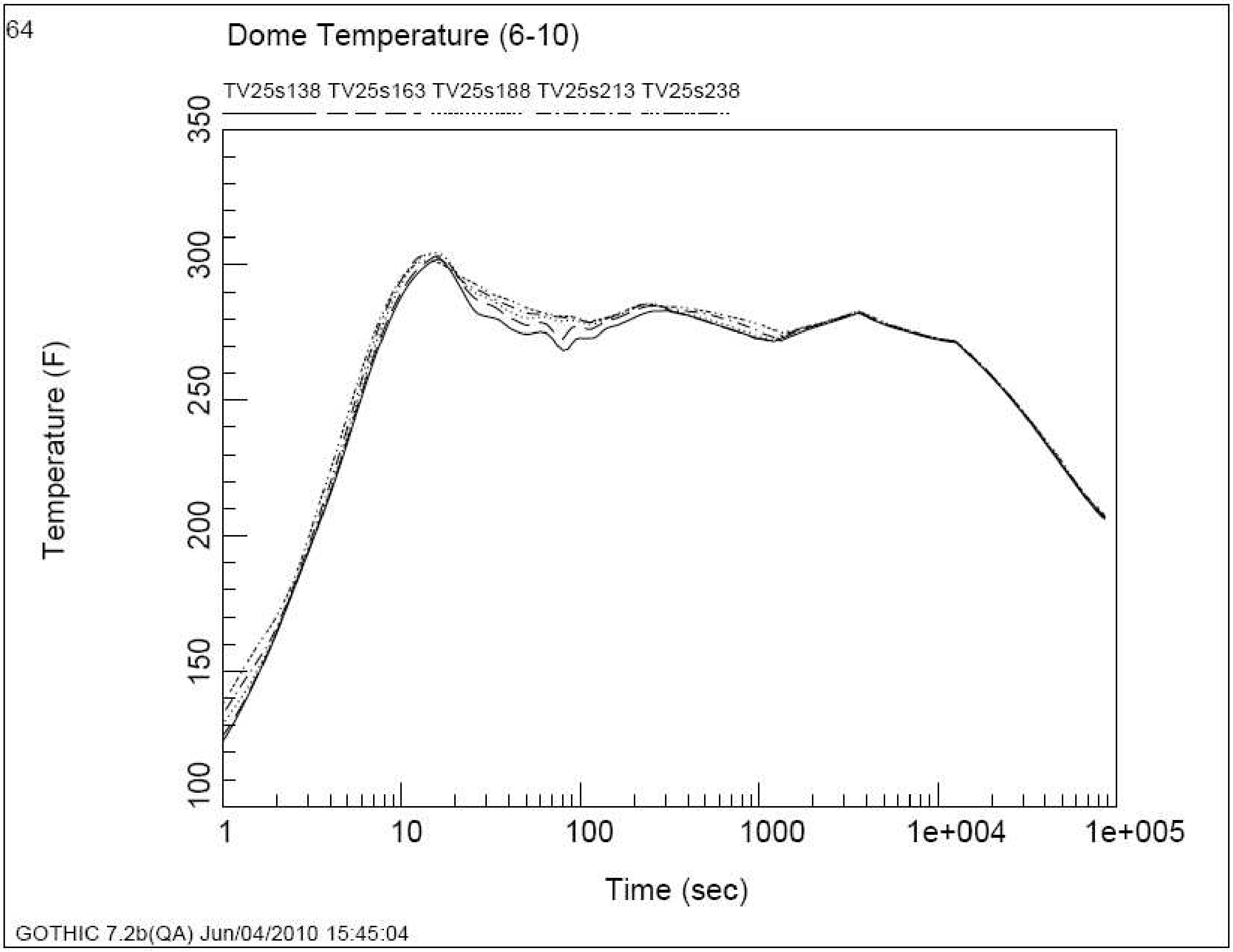


Figure 06.02.01-88-3—Subdivided Dome Vapor Temperature (Level 11-15)

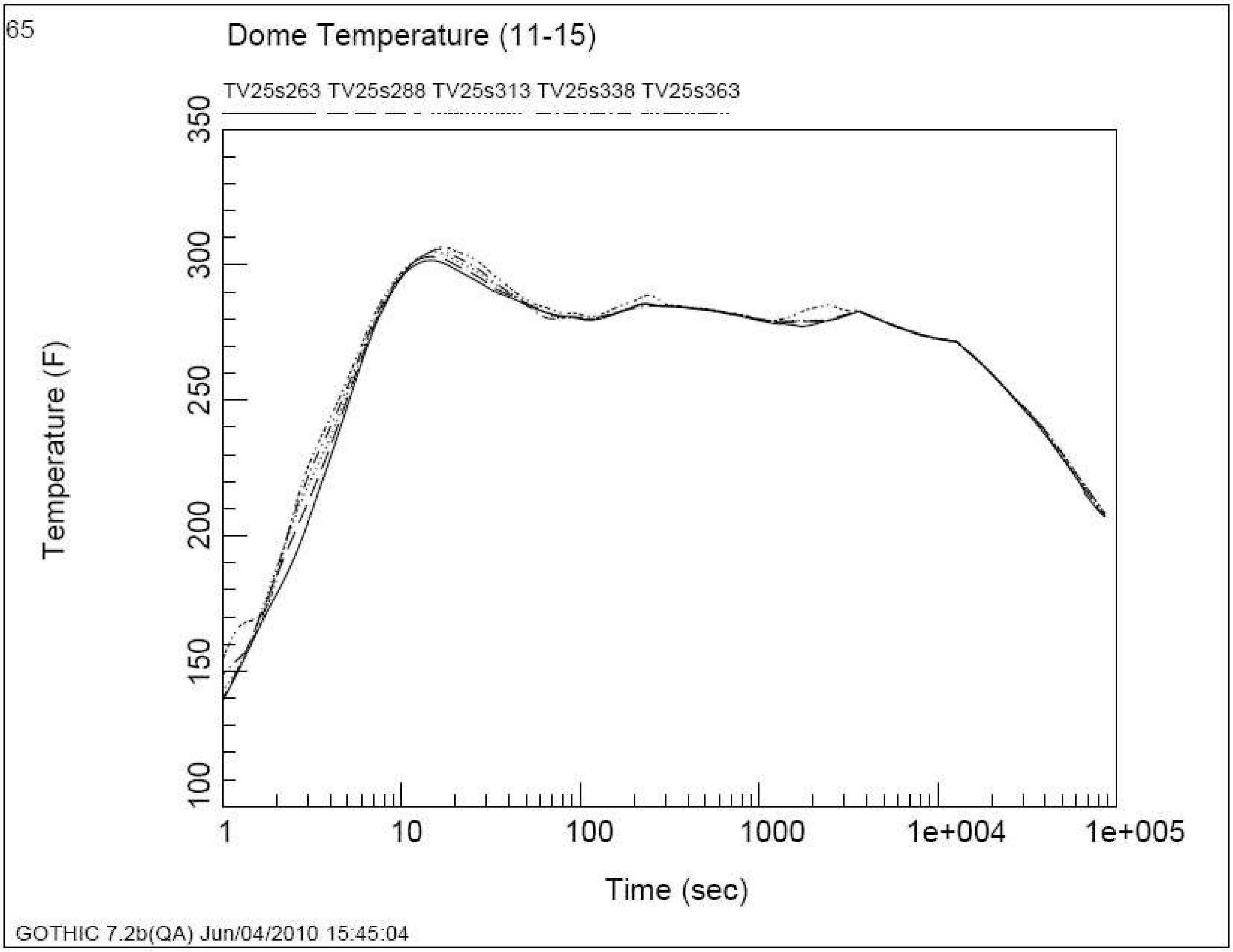


Figure 06.02.01-88-4—Subdivided Dome Vapor Temperature (Level 16-19)

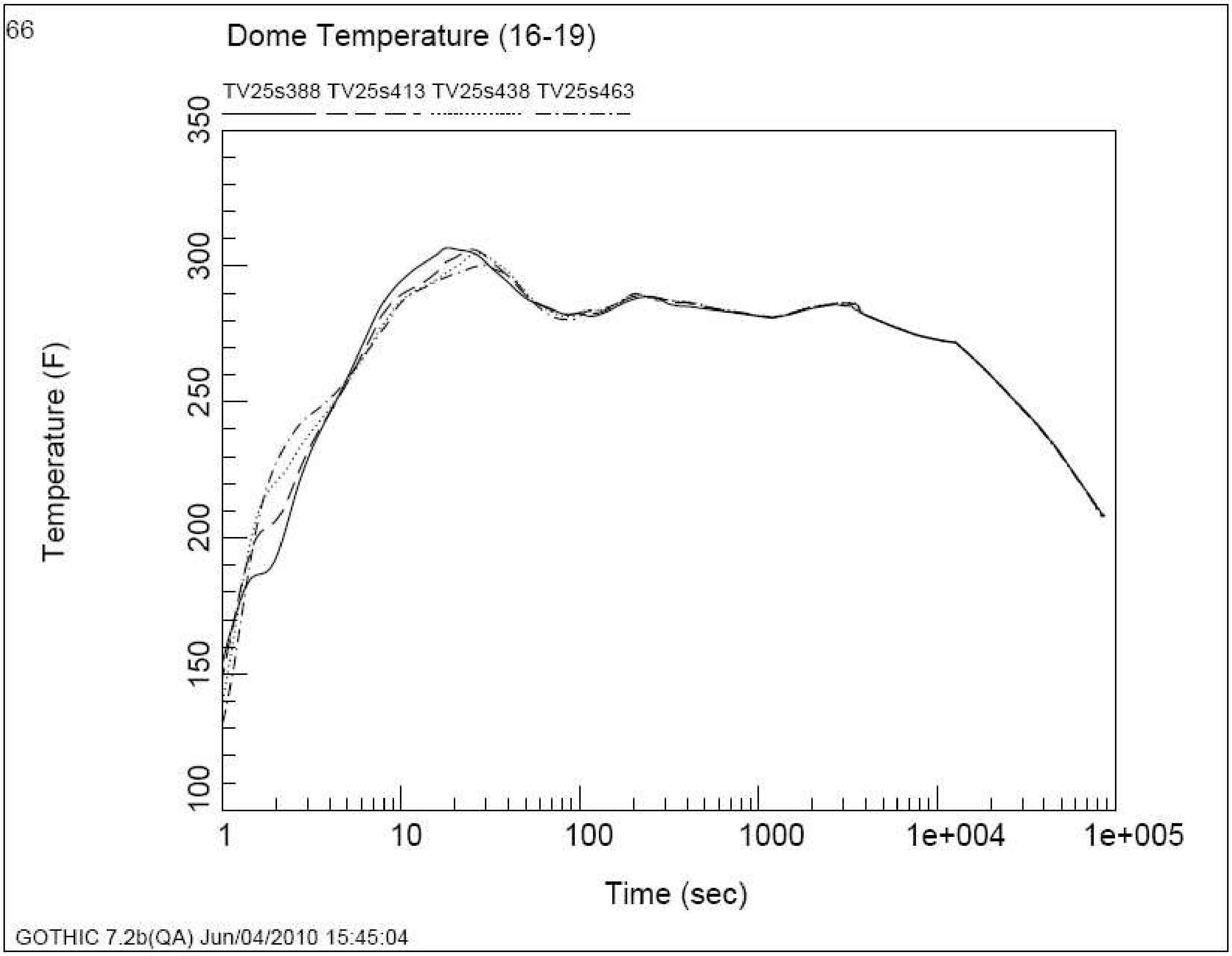


Figure 06.02.01-88-5—Lumped Volume Vapor Temperature (Node 1-5)

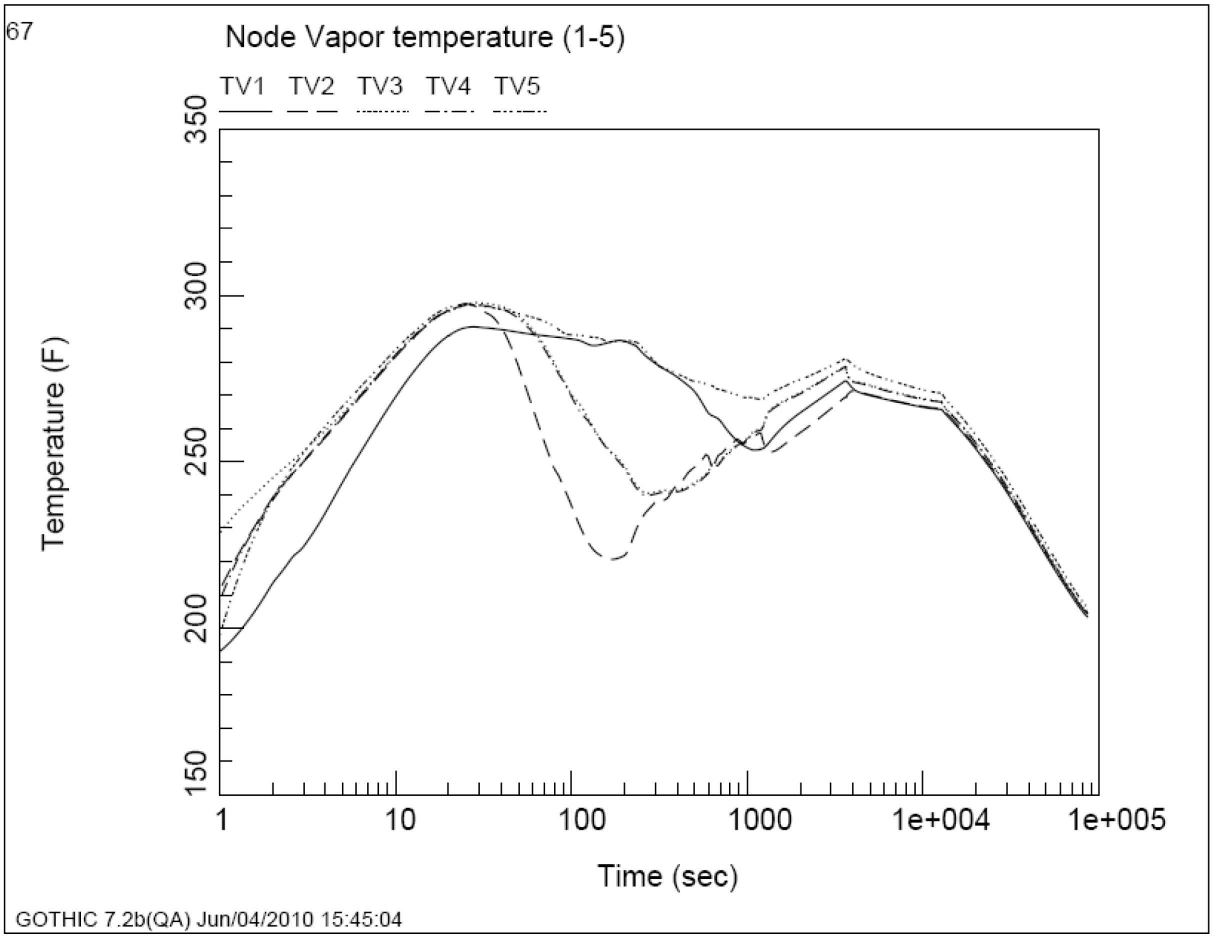


Figure 06.02.01-88-6—Lumped Volume Vapor Temperature (Node 6-10)

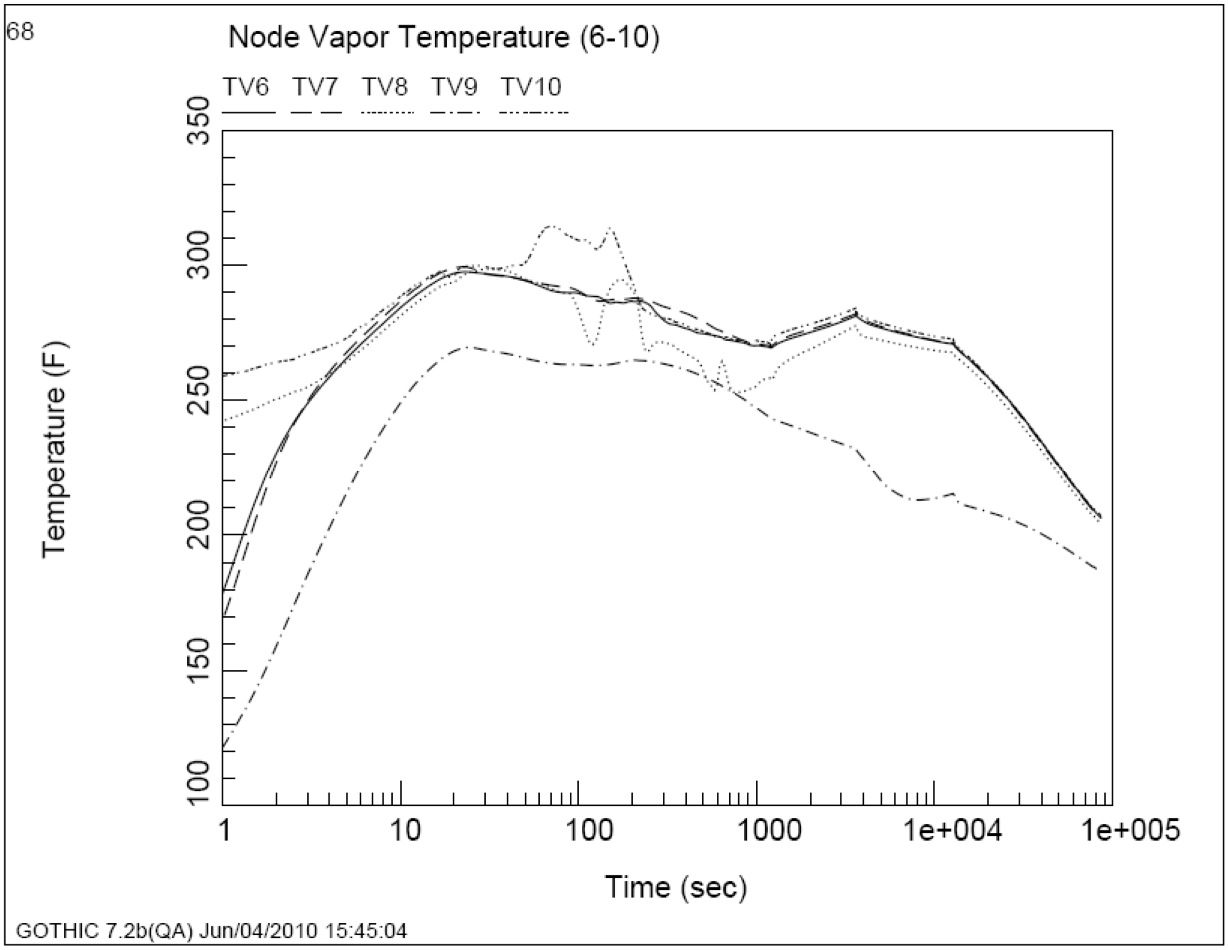


Figure 06.02.01-88-7—Lumped Volume Vapor Temperature (Node 11-15)

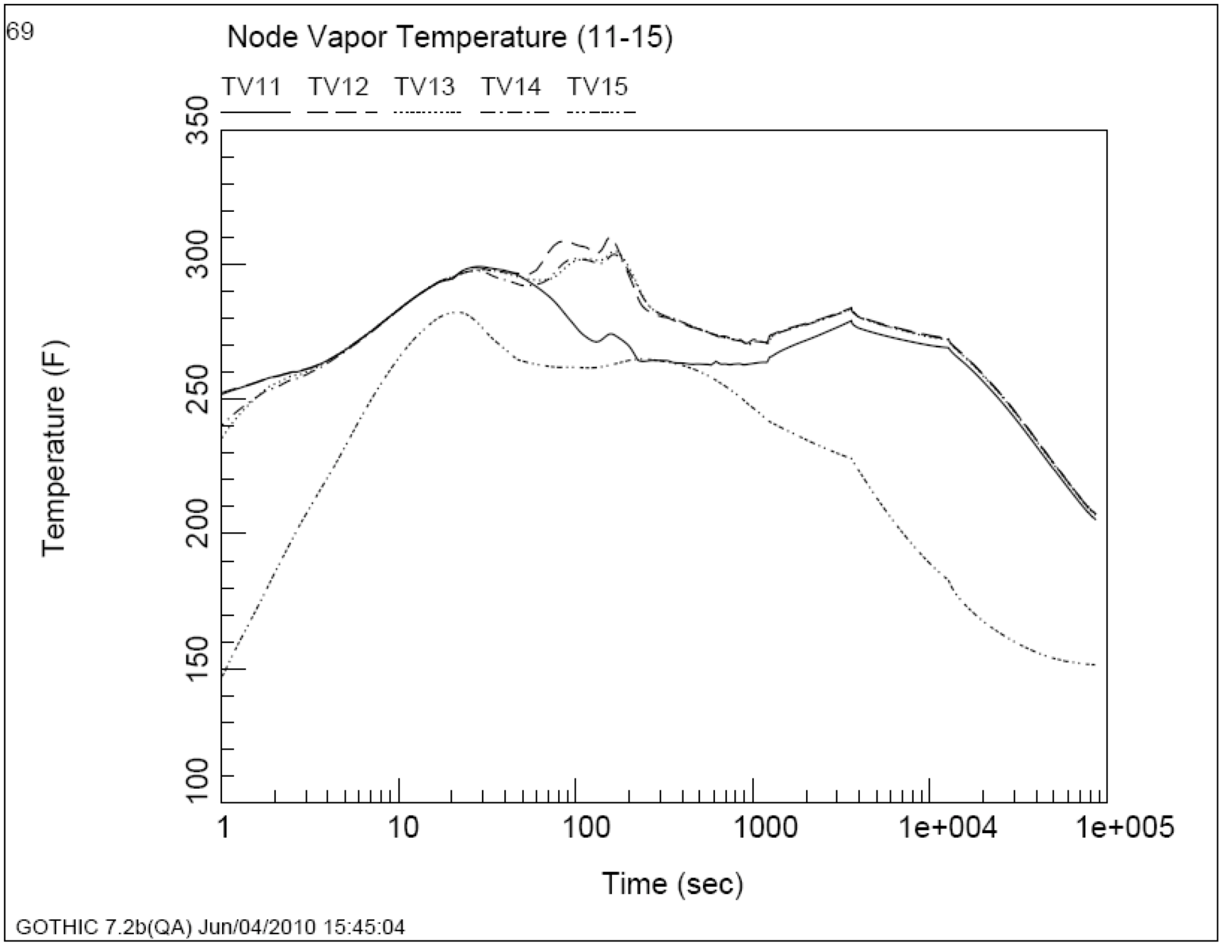


Figure 06.02.01-88-8—Lumped Volume Vapor Temperature (Node 16-20)

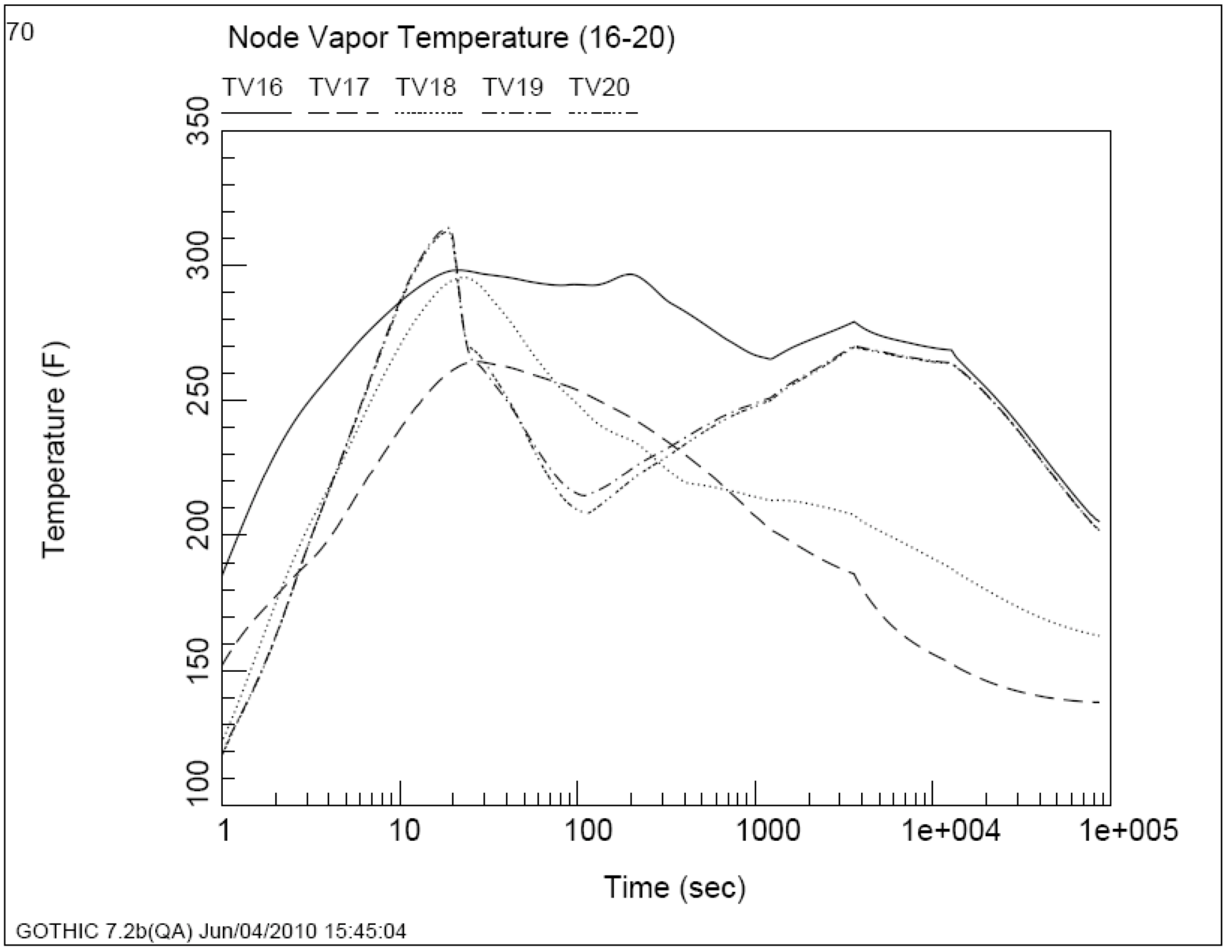


Figure 06.02.01-88-9—Lumped Volume Vapor Temperature (Node 21-24 and 26)

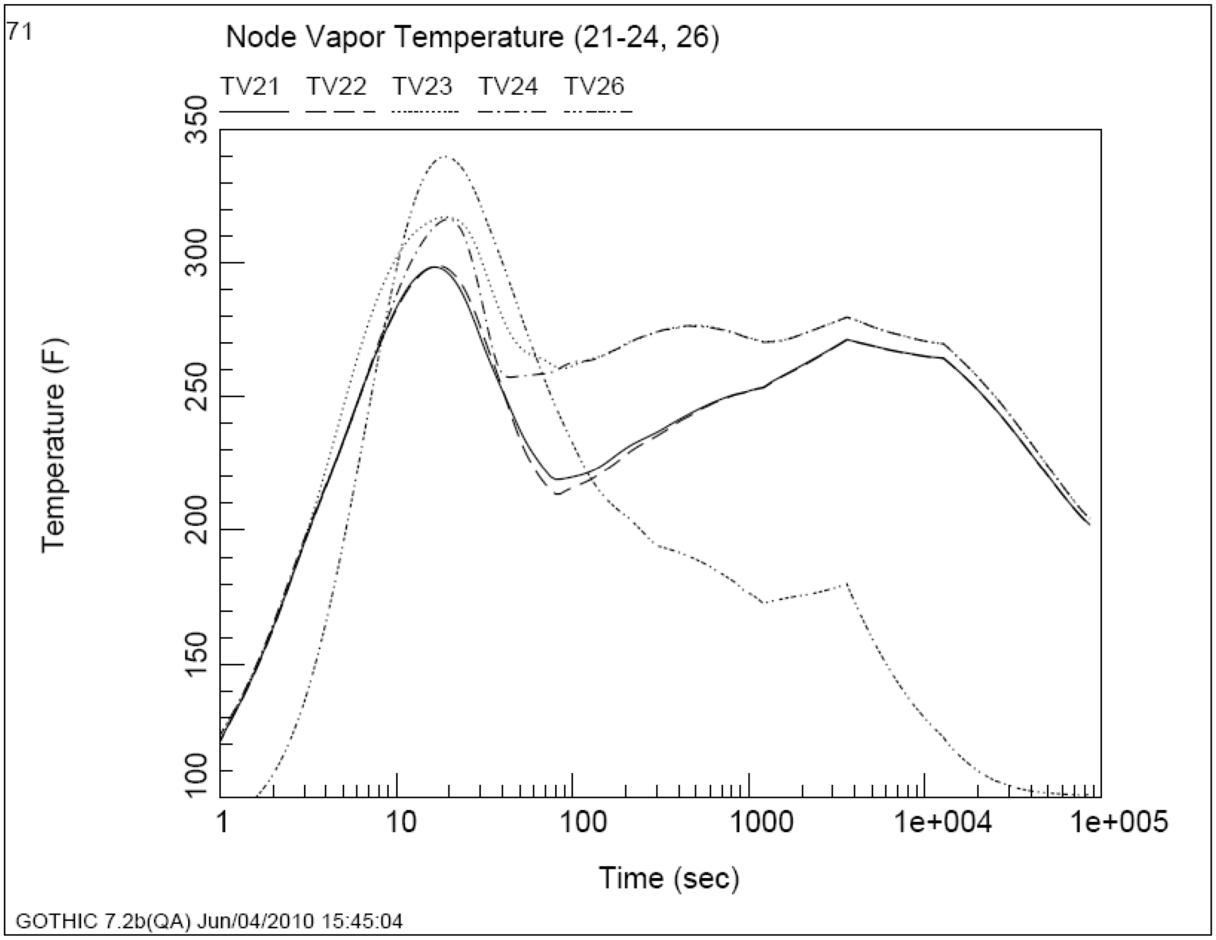


Figure 06.02.01-88-10—Lumped Volume Vapor Temperature (Node 27-30)

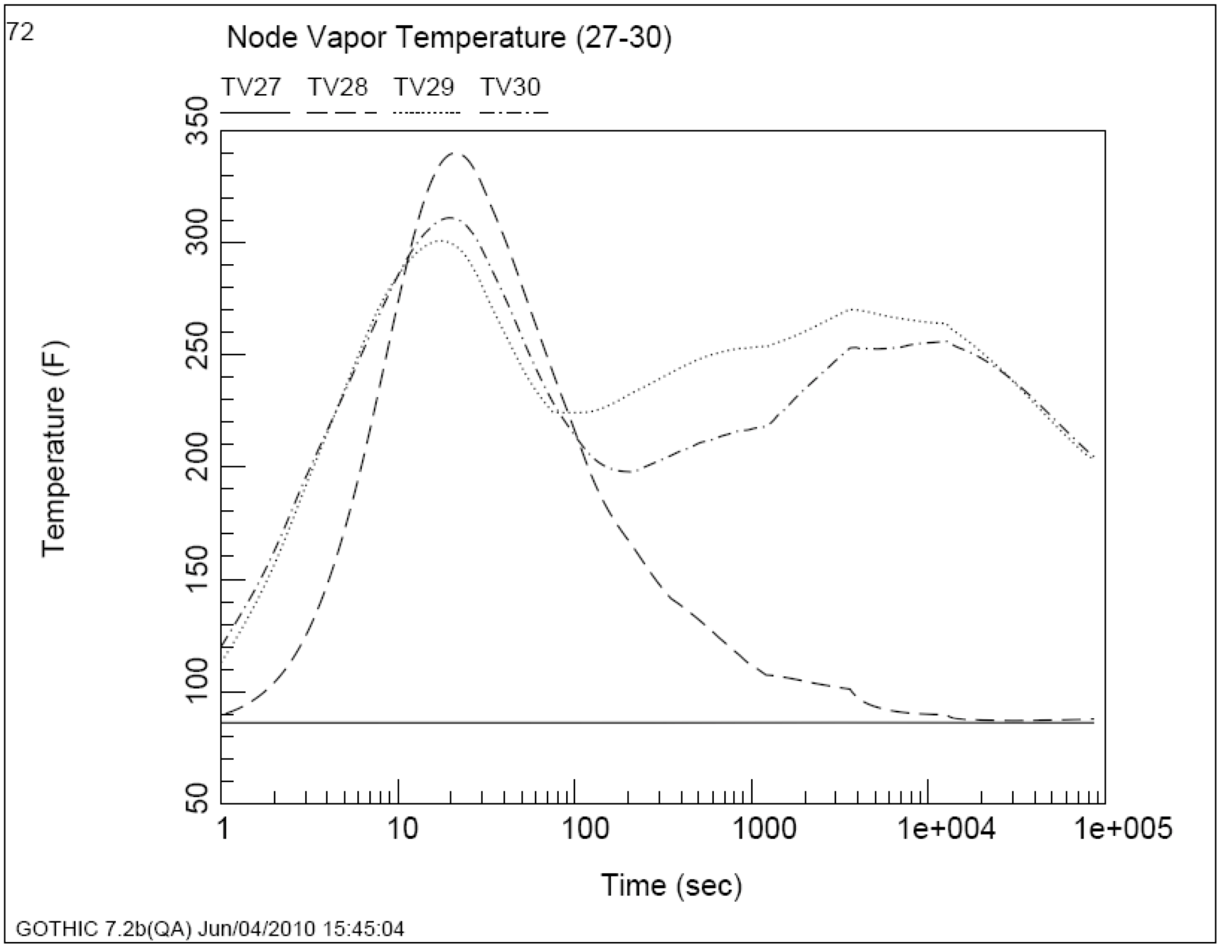


Figure 06.02.01-88-11—Gas Velocity – Rupture Foils (FP 31 & 53)

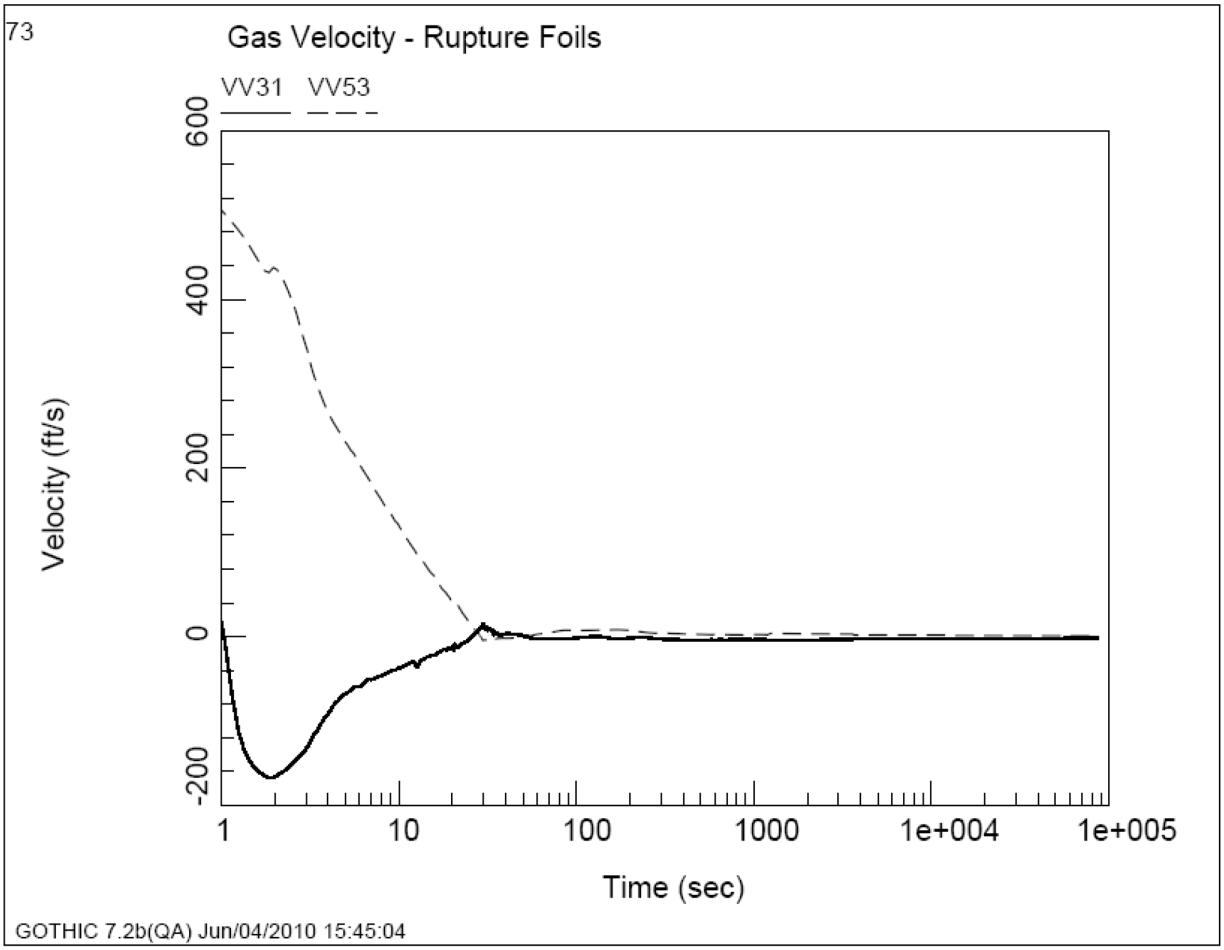


Figure 06.02.01-88-12—Gas Velocity – IRWST Dampers (FP 11 & 12)

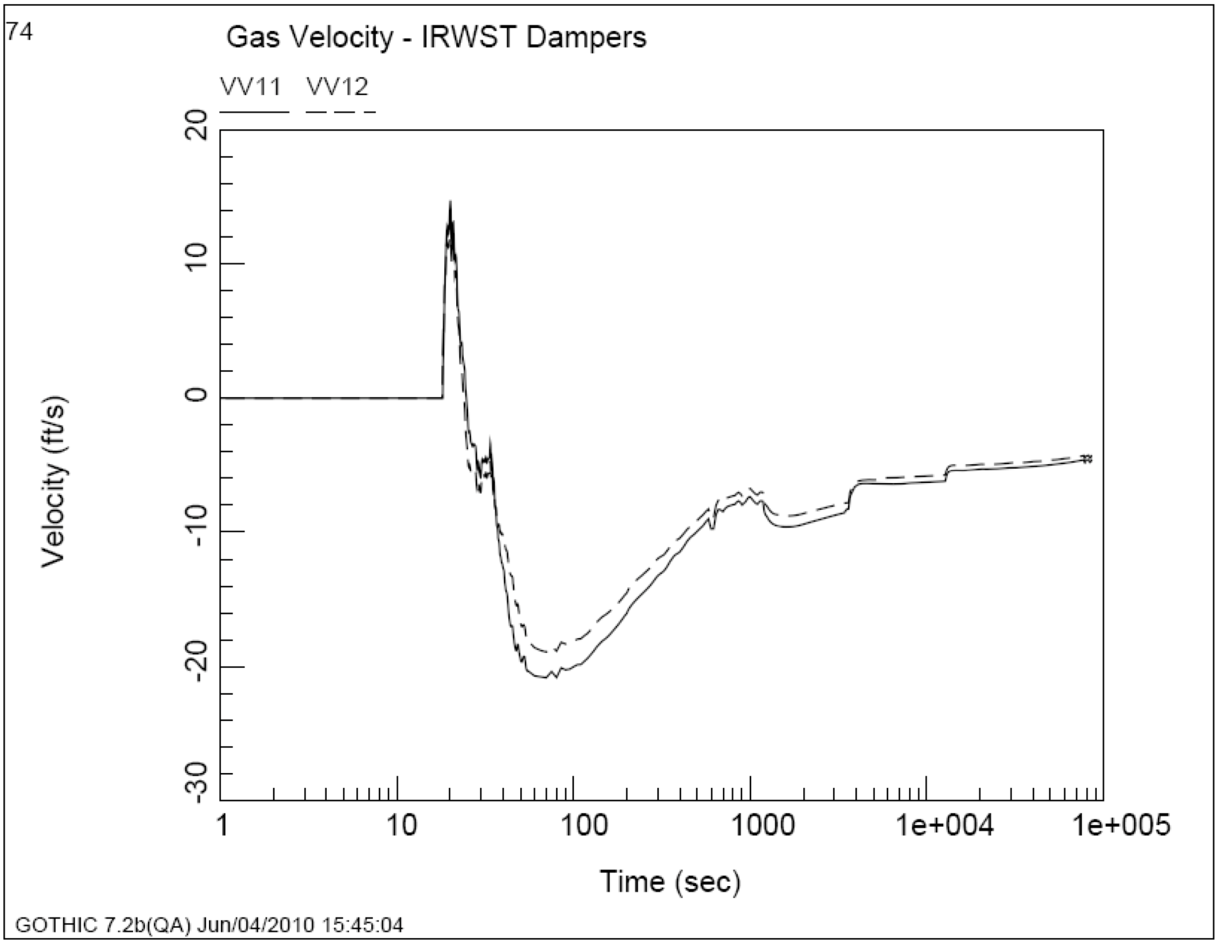


Figure 06.02.01-88-13—Gas Velocity – Middle Annulus to Dome (FP 74 & 82)

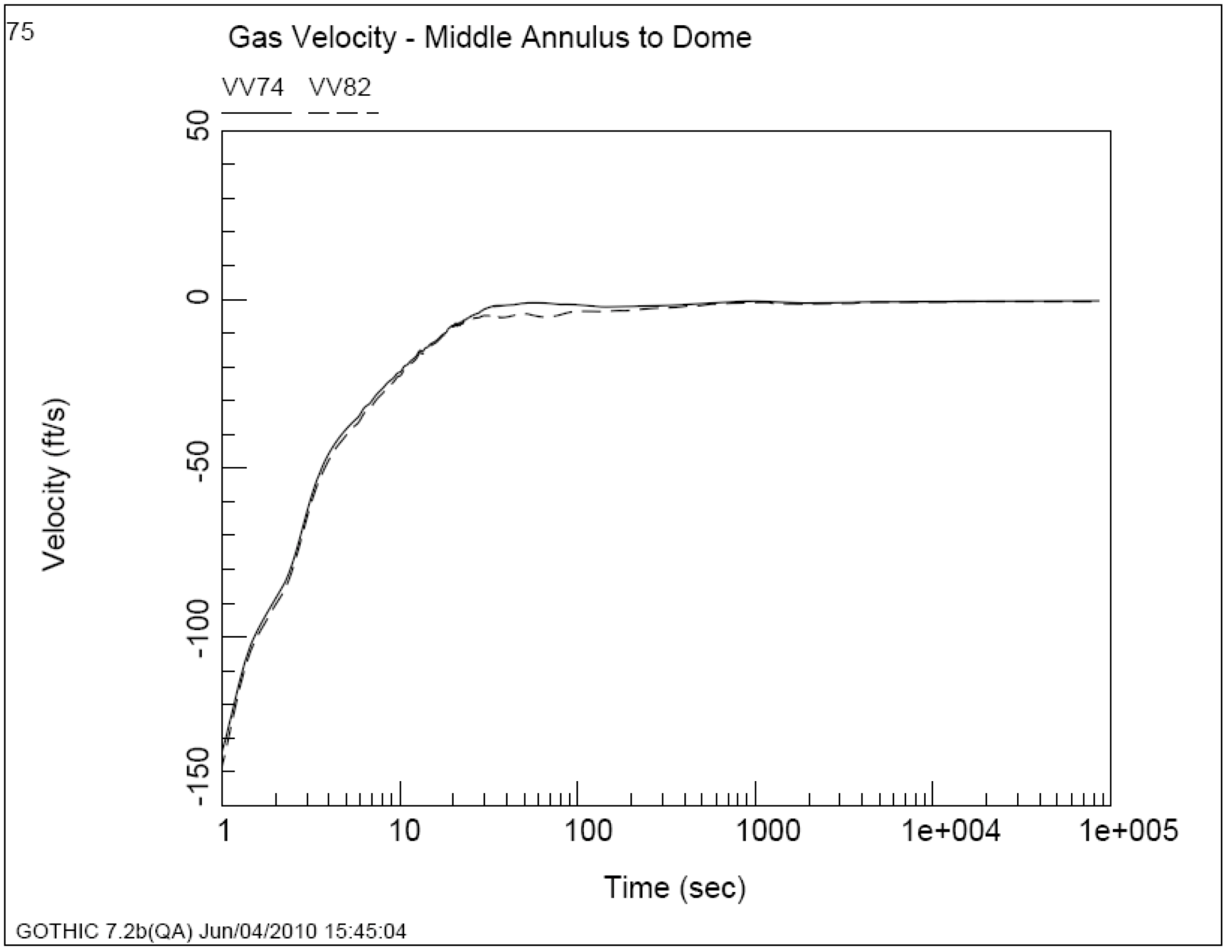
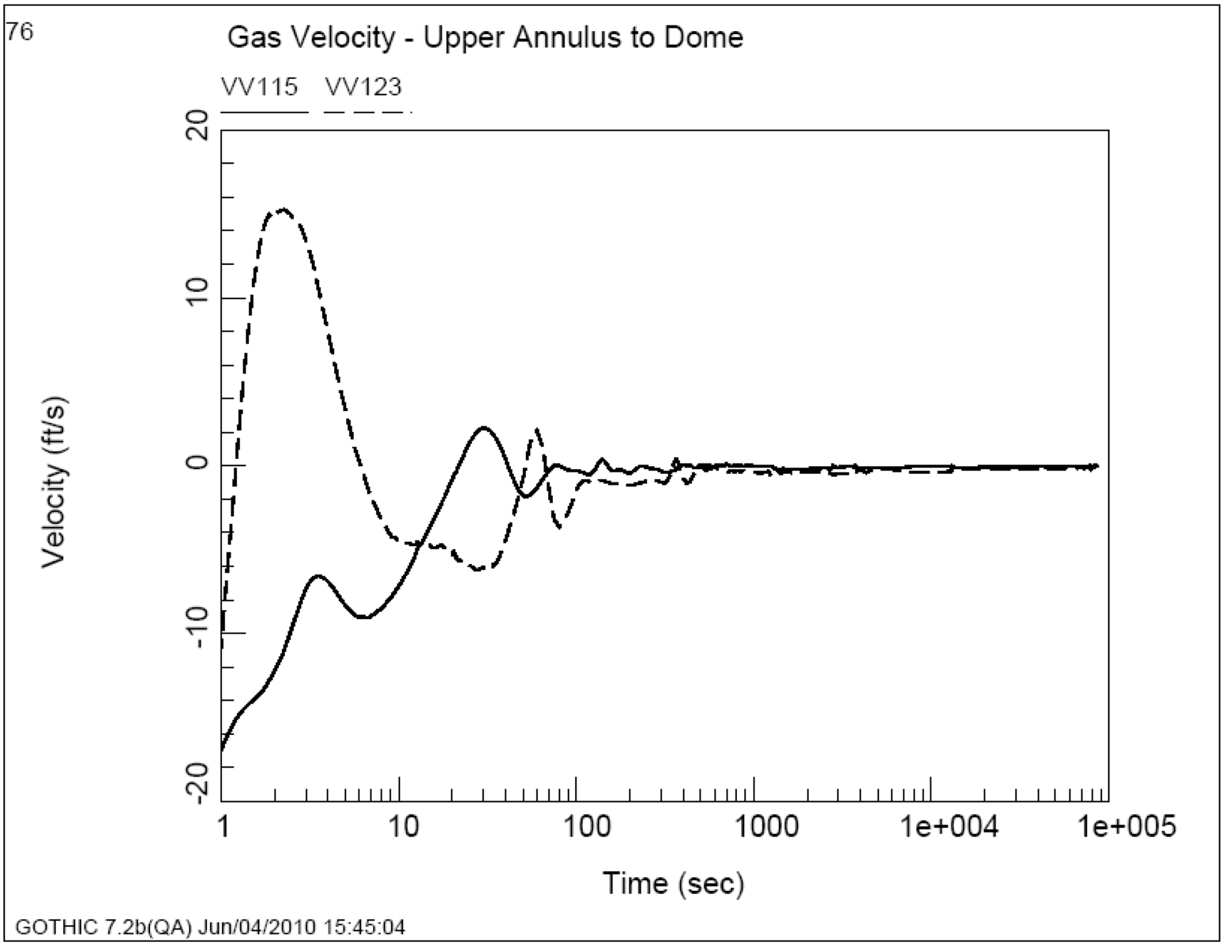


Figure 06.02.01-88-14—Gas Velocity – Upper Annulus to Dome (FP 115 & 123)



Question 06.02.01-89:

This question is a follow-up to the February 9 and 10, 2010 audit on containment analyses. For the postulated DEG main steam line break at 20% reactor power analyzed by AREVA as described in FSAR 6.2 Rev. 2 interim, provide the following information. All plots should be extended to 1800 seconds with no more than 5 traces per figure:

a. The location of the break (elevation, and local subdivided cell number or lumped parameter node number)

b. The location of the maximum atmospheric temperature (elevation, and local subdivided cell number or lumped parameter node number)

c. Time history plots for maximum atmospheric temperature location and pressure. The atmospheric temperature plot should include both gas (vapor) and saturation temperatures.

d. Time history atmospheric temperature plots for lumped parameter nodes below the dome (nodes 1-30, excluding node 25). The atmospheric temperature plots should include both gas (vapor) and saturation temperatures.

e. Time history atmospheric temperature plots for subdivided nodes in the dome region nearest the containment centerline (19 vertical locations). The atmospheric temperature plots should include both gas (vapor) and saturation temperatures.

f. A time history temperature plot for the inner containment shell (note sub-divided or lumped parameter node in figure) in proximity to the location of maximum atmospheric (gas) temperature.

Response to Question 06.02.01-89:

a) The break is located in the L1 and L2 upper annulus rooms modeled by the lumped parameter node 23 in GOTHIC. The elevation of the break flow path is at +93.4 feet.

b) The maximum atmospheric temperature occurs in the containment dome in the subdivided cell 134 of Volume 25. Cell 134 of Volume 25 has an elevation of +98.59 feet.

c) The time history plots for maximum atmospheric temperature location and pressure are given in Figures 06.02.01-89-1 and 06.02.01-89-2.

d) The time history atmospheric temperature plots for the lumped parameter nodes below the dome (nodes one through 30, excluding node 25) are given in Figures 06.02.01-89-3 through 06.02.01-89-18.

e) The time history atmospheric temperature plots for subdivided nodes in the dome region nearest the containment centerline are given in Figures 06.02.01-89-19 through 06.02.01-89-28.

f) The time history atmospheric temperature plots for the inner containment shell in proximity to the location of maximum atmospheric temperature are given in Figures 06.02.01-89-29 through 06.02.01-89-36.

FSAR Impact:

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

Figure 06.02.01-89-1—Temperature at Maximum Temperature Location

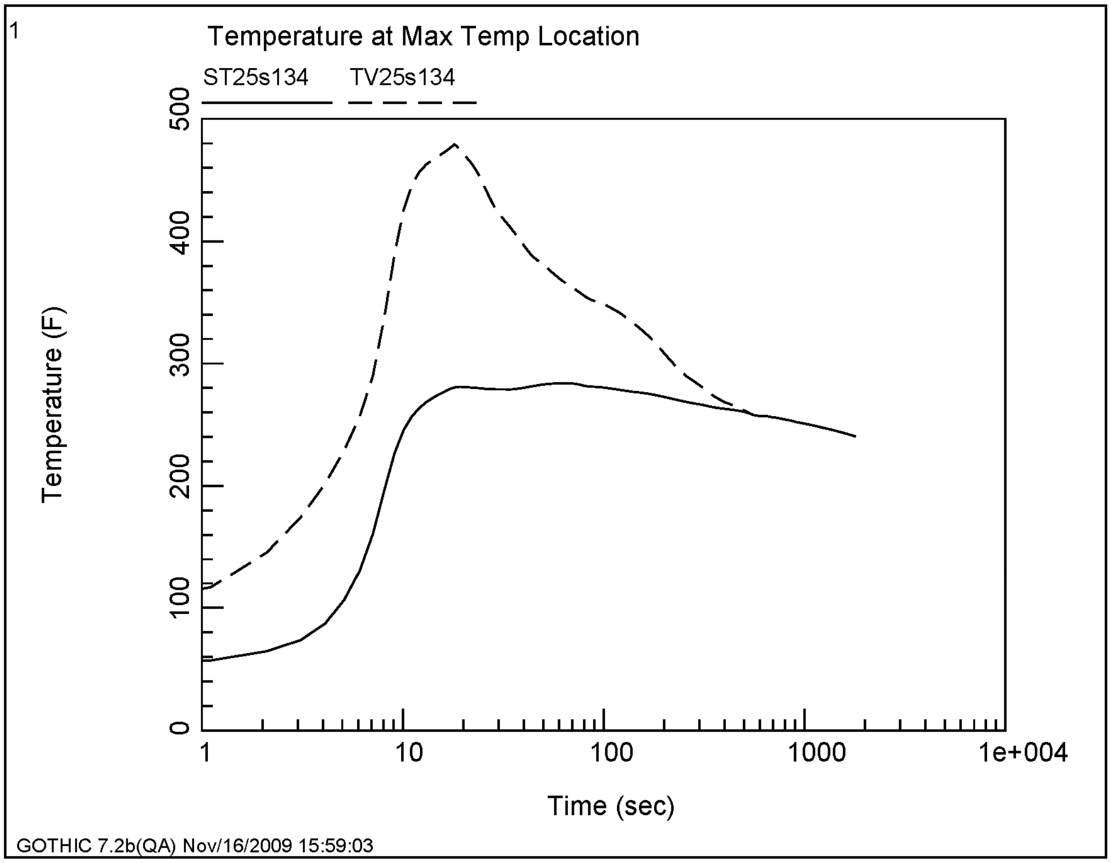


Figure 06.02.01-89-2—Pressure at Maximum Temperature Location

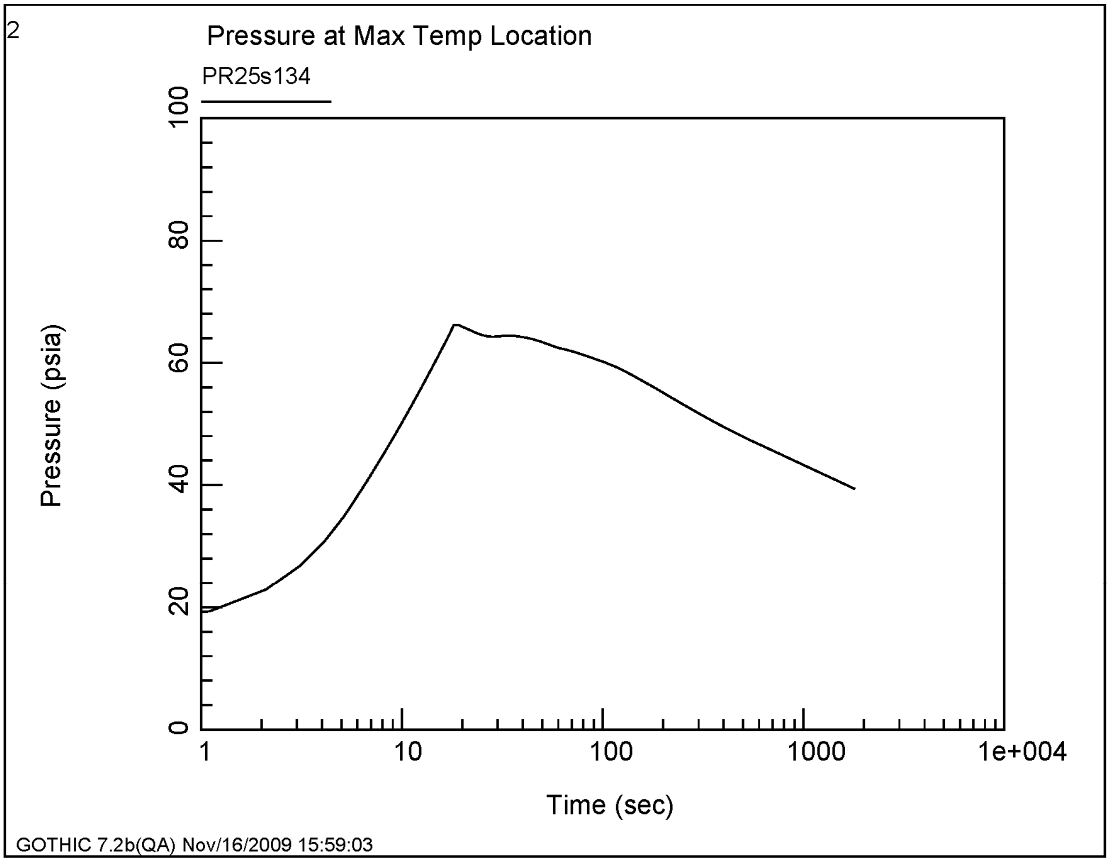


Figure 06.02.01-89-3—Temperature of Nodes 1 and 2

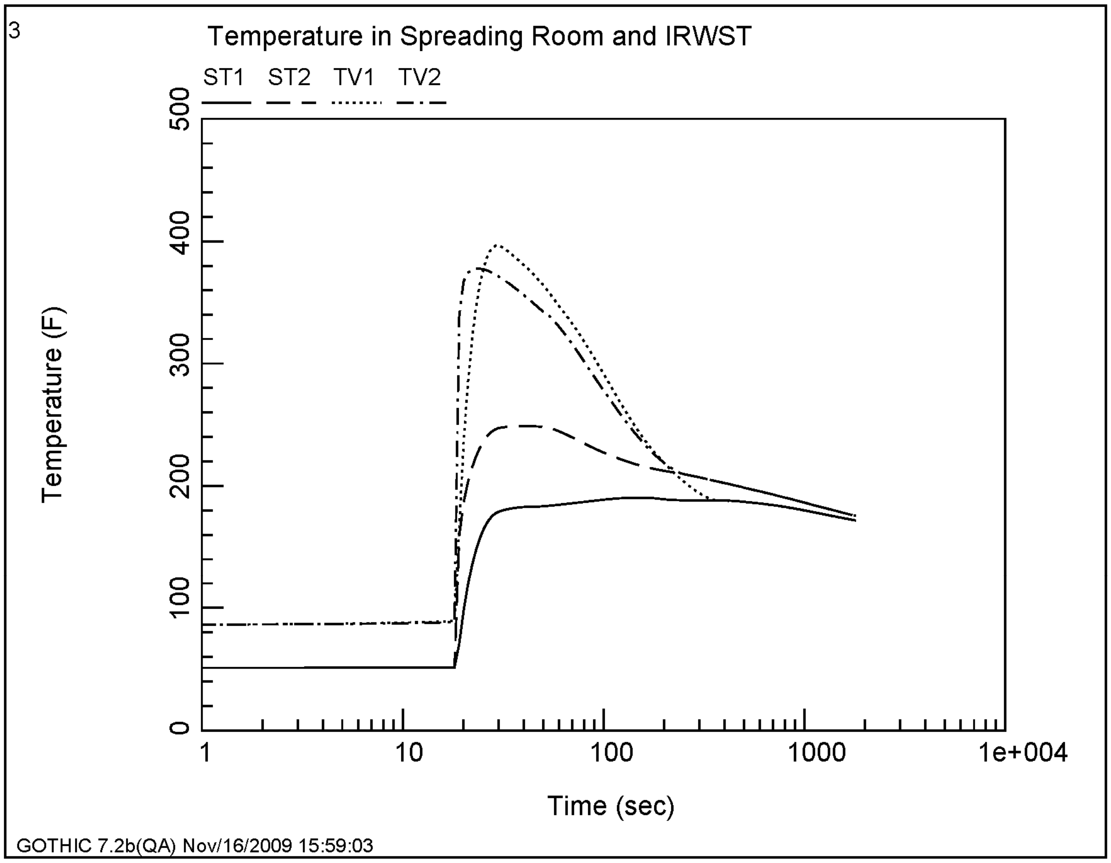


Figure 06.02.01-89-4—Temperature of Nodes 3 and 4

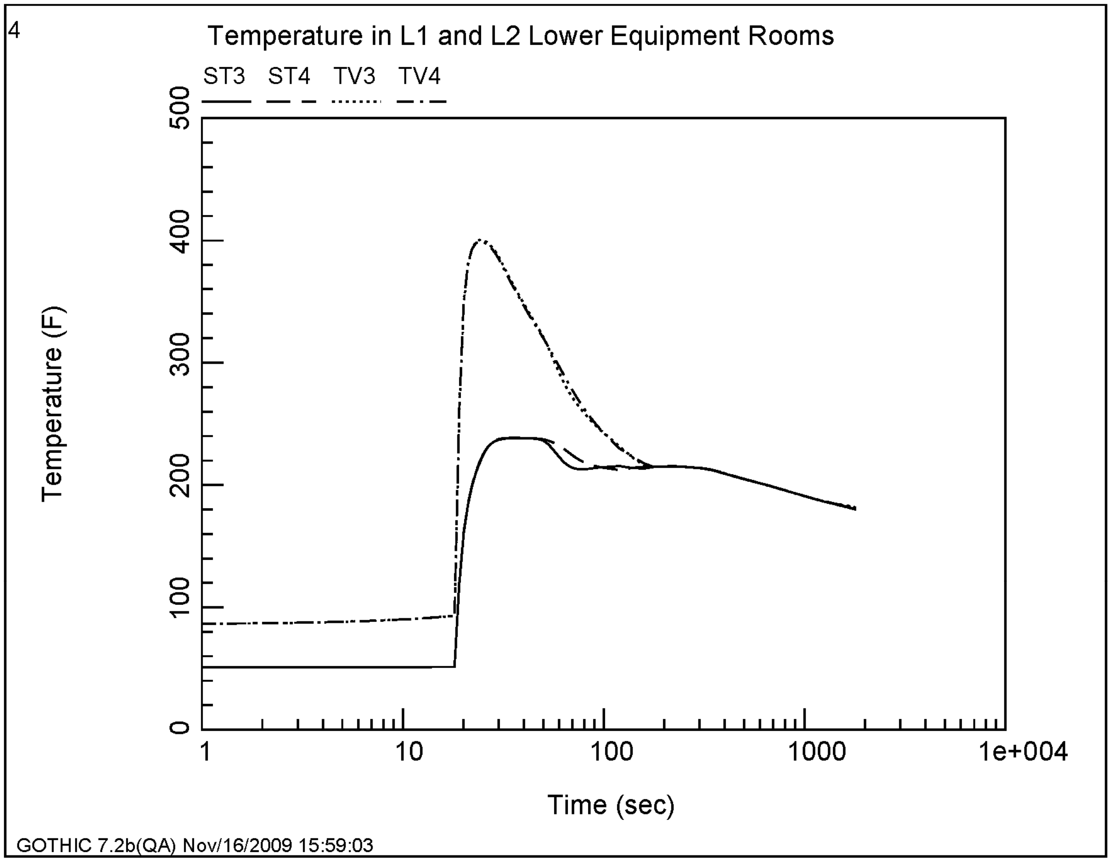


Figure 06.02.01-89-5—Temperature of Nodes 5 and 6

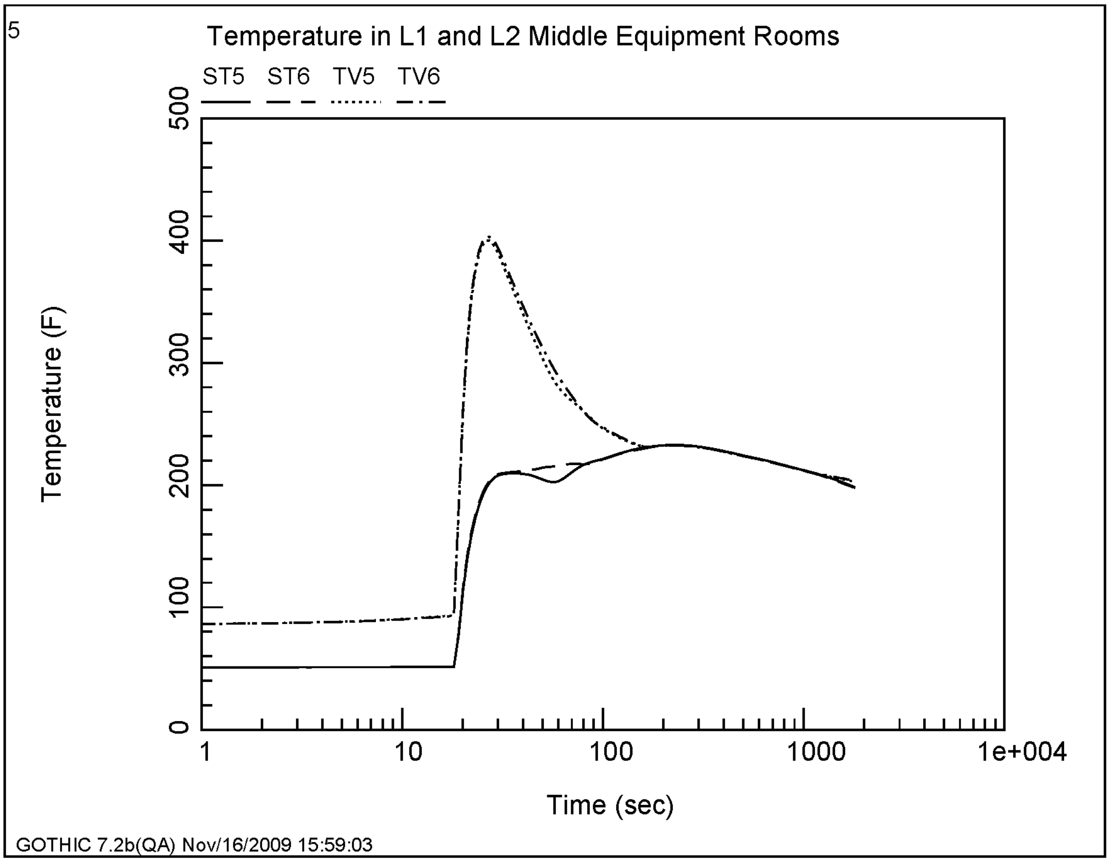


Figure 06.02.01-89-6—Temperature of Node 7

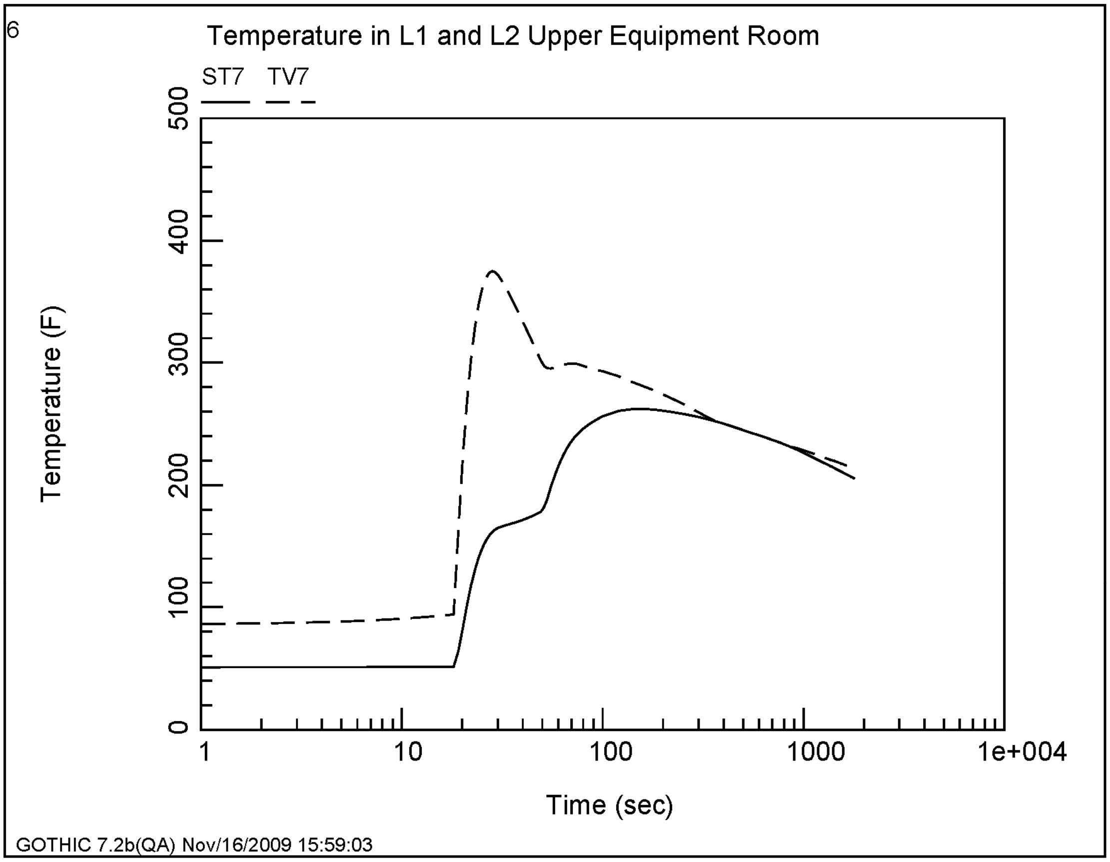


Figure 06.02.01-89-7—Temperature of Nodes 8 and 9

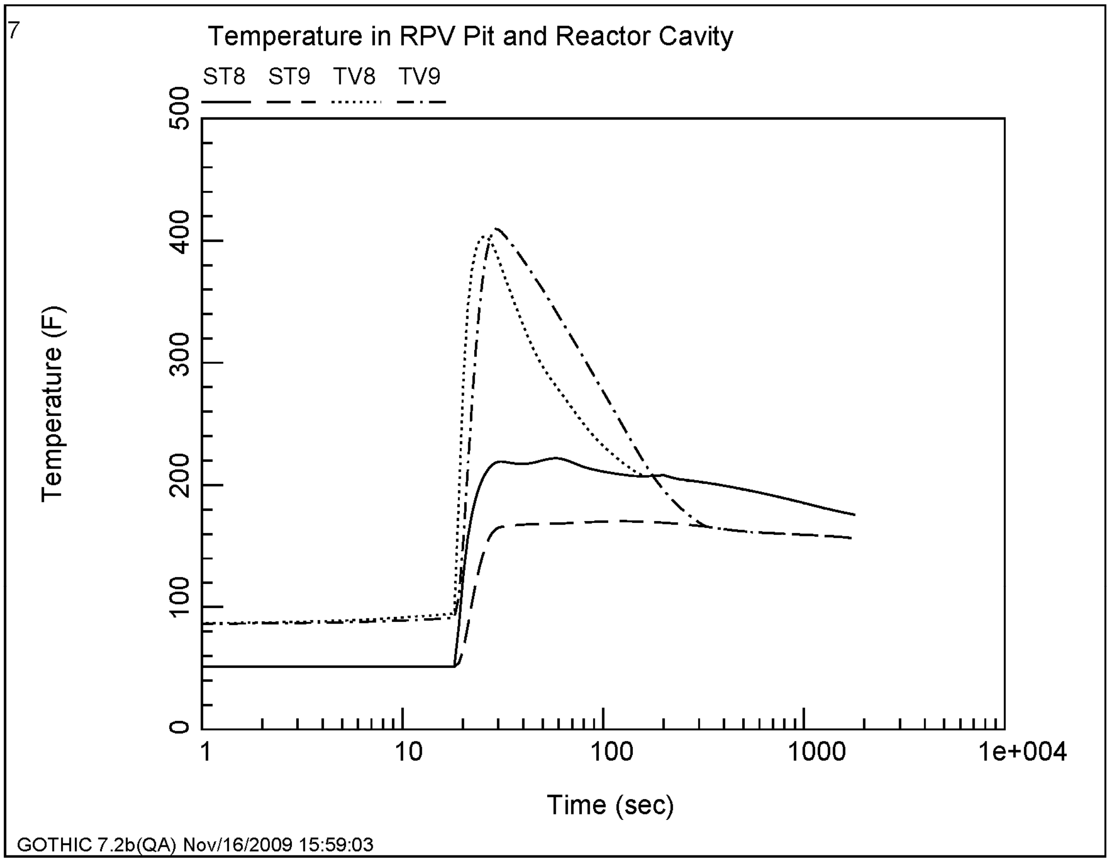


Figure 06.02.01-89-8—Temperature of Nodes 10 and 11

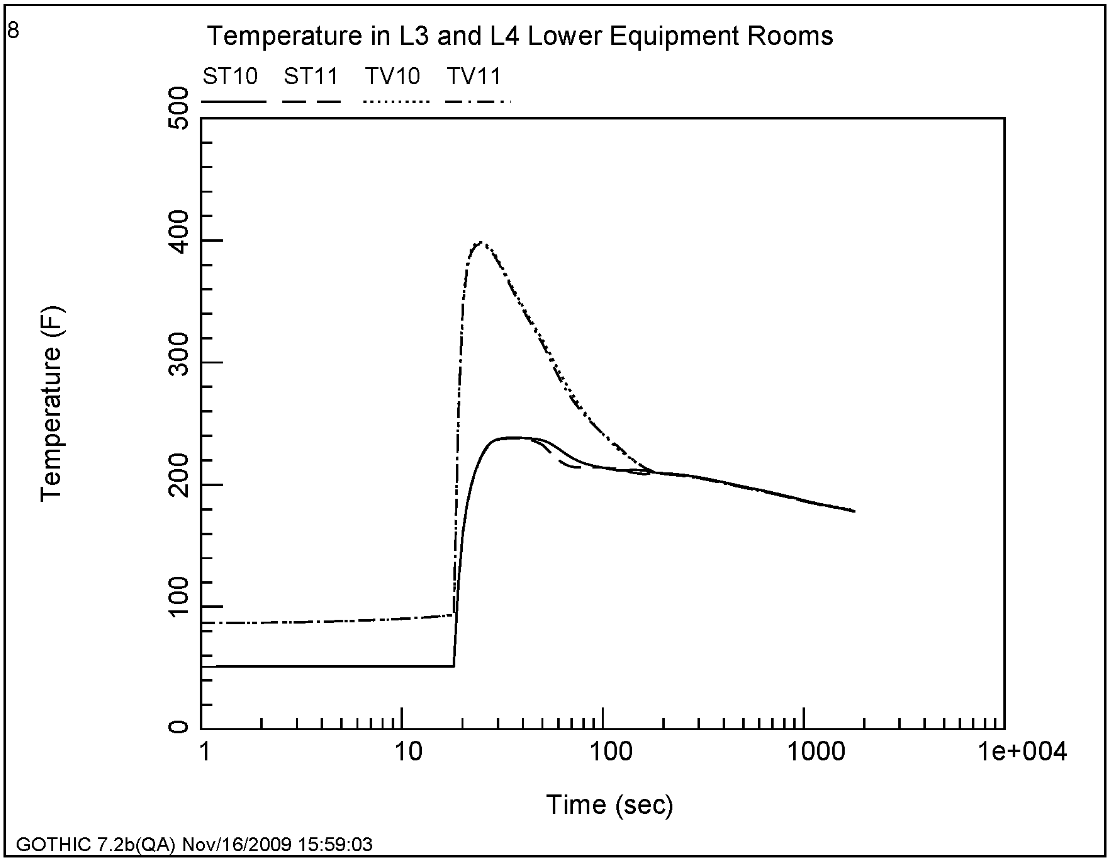


Figure 06.02.01-89-9—Temperature of Nodes 12 and 13

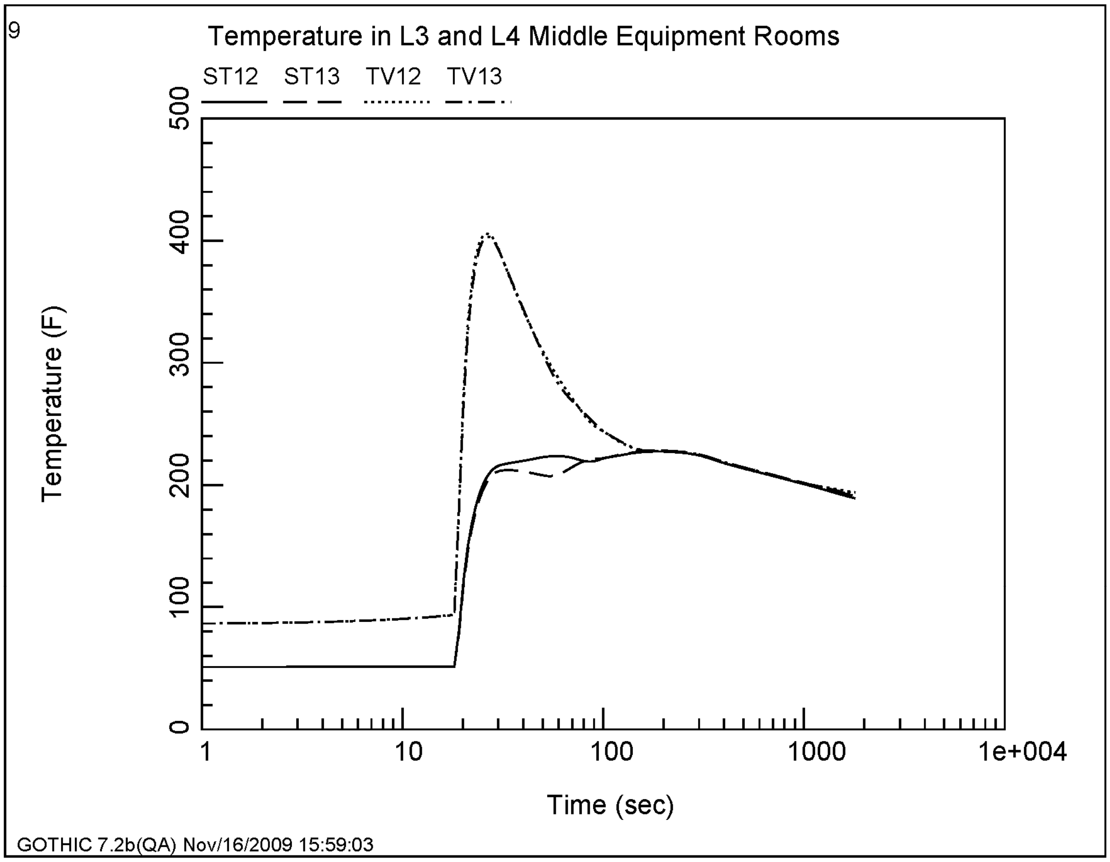


Figure 06.02.01-89-10—Temperature of Node 14

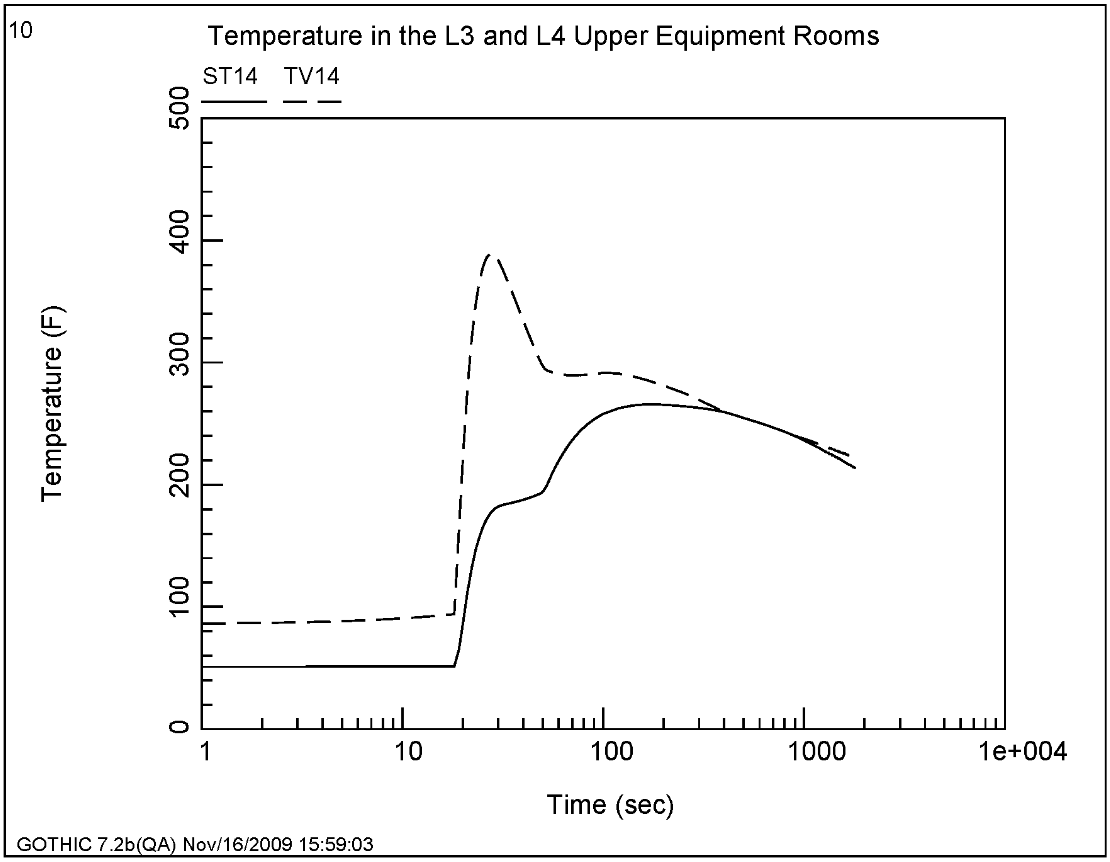


Figure 06.02.01-89-11—Temperature of Nodes 15 and 16

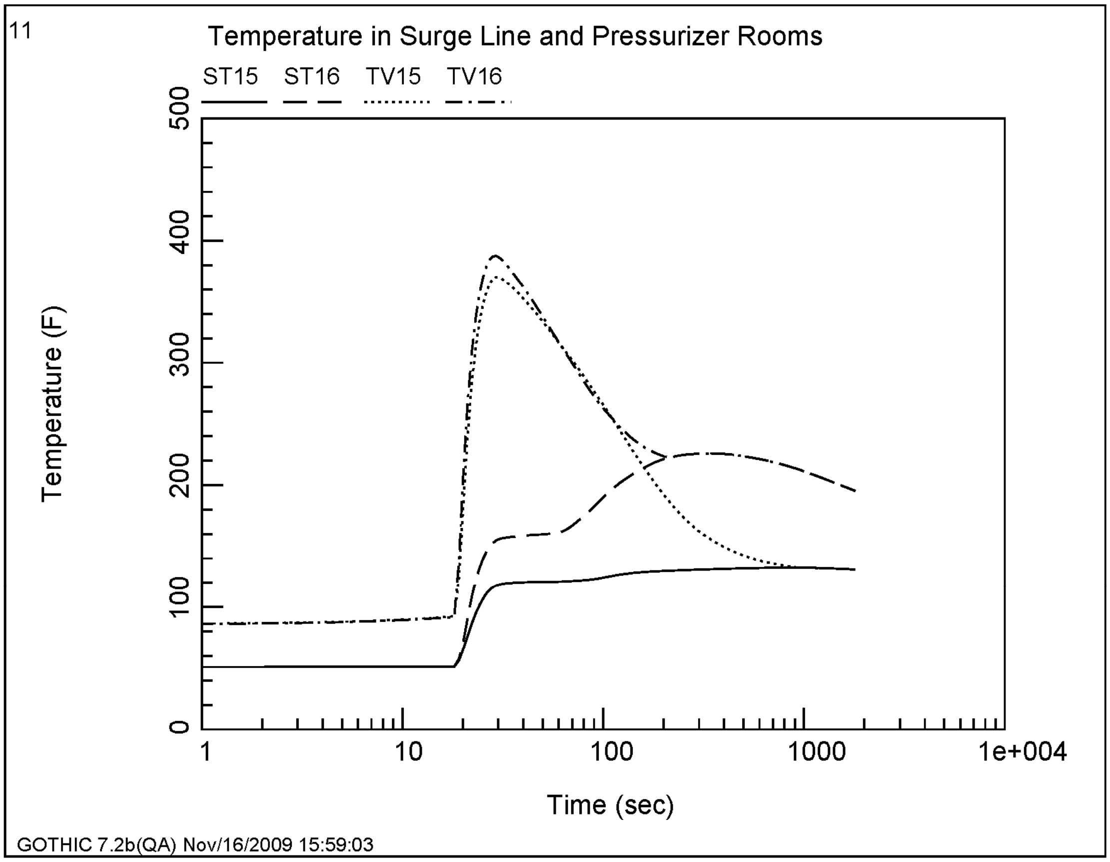


Figure 06.02.01-89-12—Temperature of Nodes 17 and 18

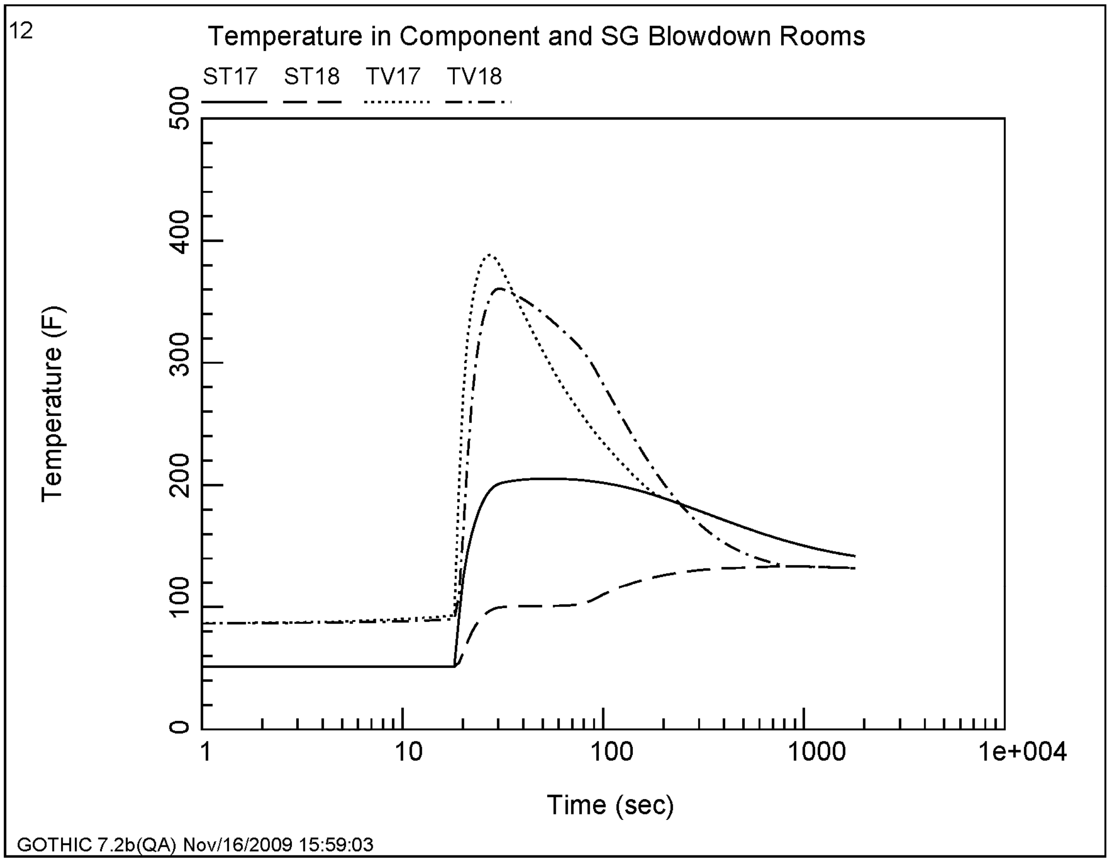


Figure 06.02.01-89-13—Temperature of Nodes 19 and 20

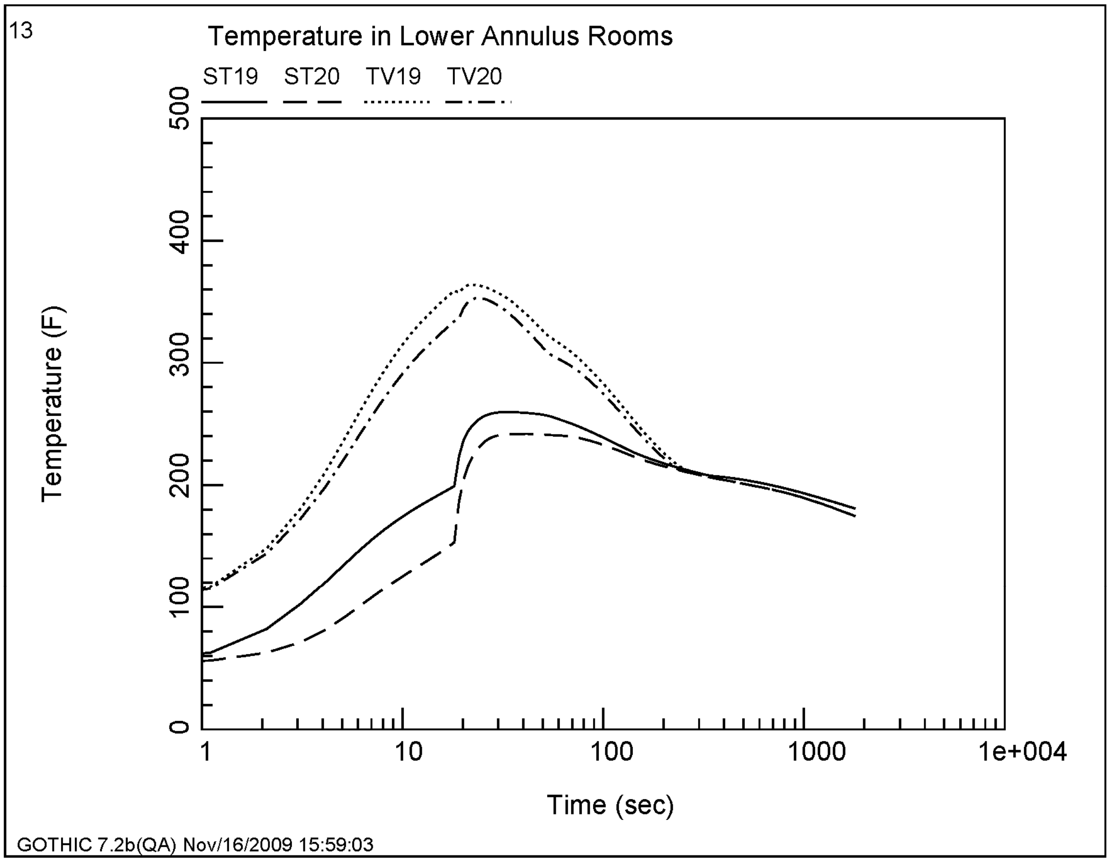


Figure 06.02.01-89-14—Temperature of Nodes 21 and 22

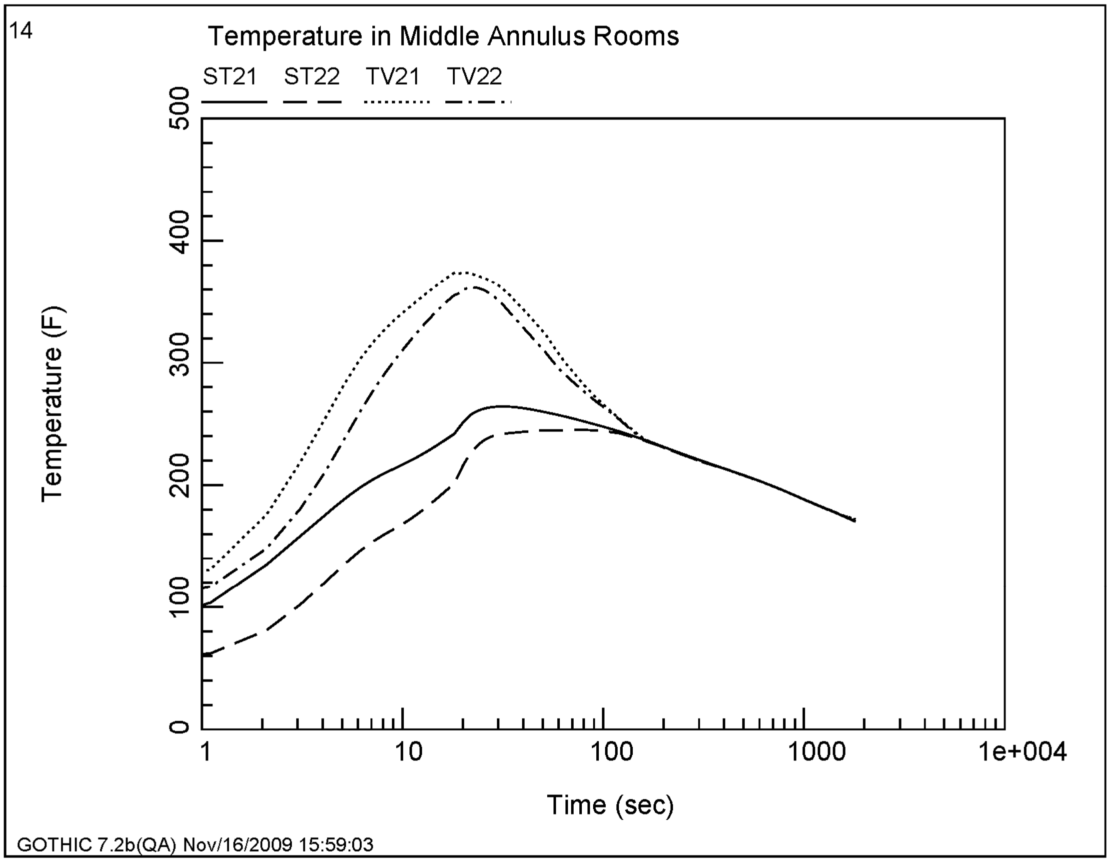


Figure 06.02.01-89-15—Temperature of Nodes 23 and 24

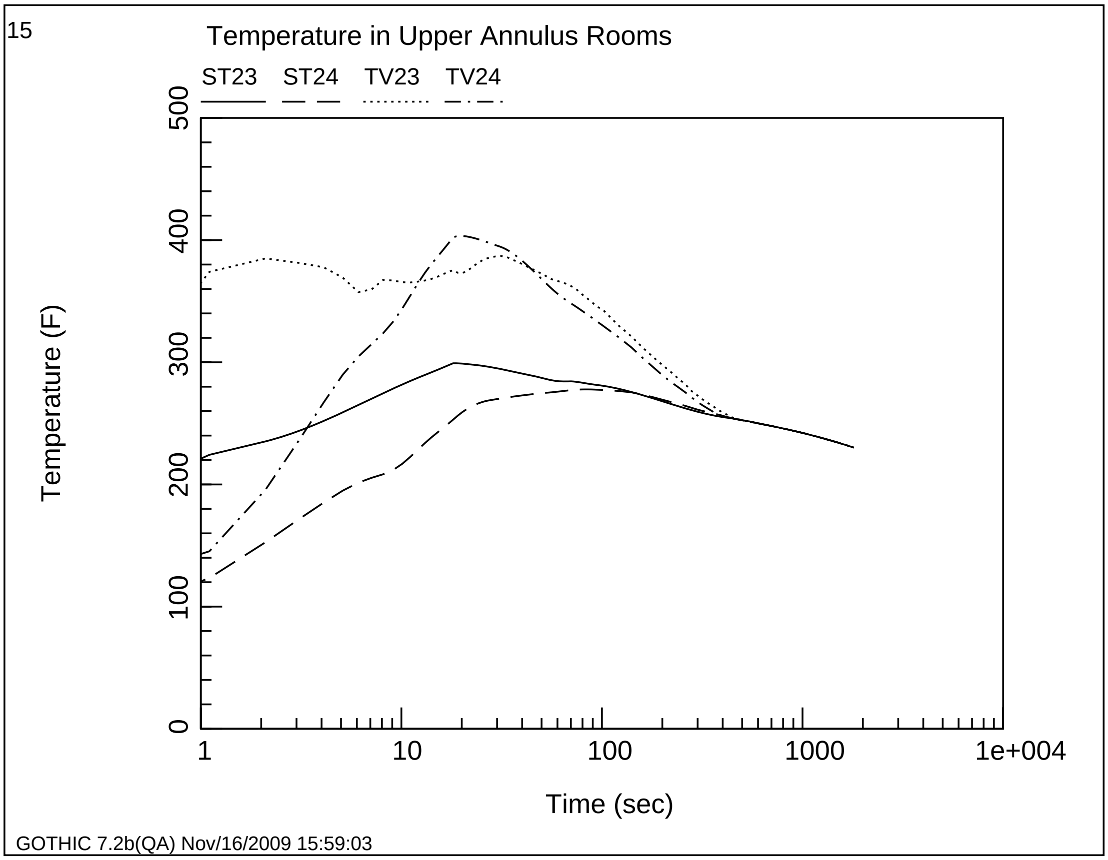


Figure 06.02.01-89-16—Temperature of Nodes 26 and 27

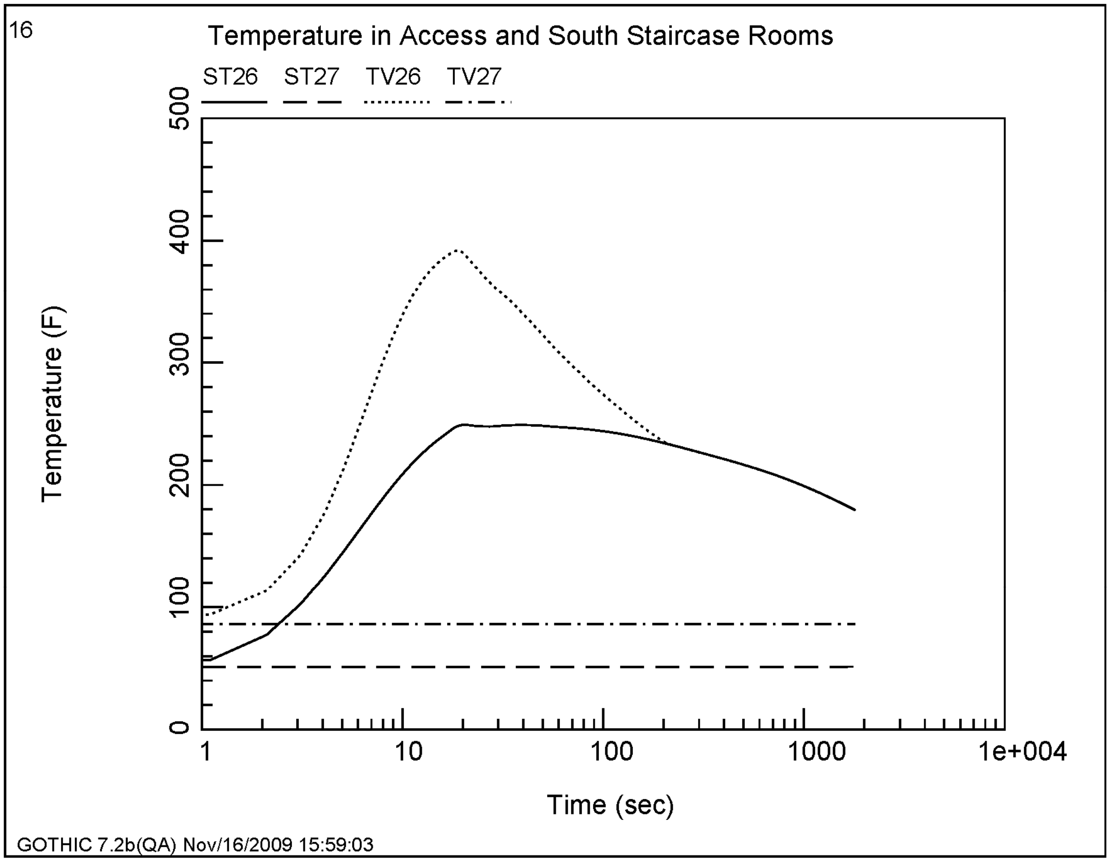


Figure 06.02.01-89-17—Temperature of Nodes 28 and 29

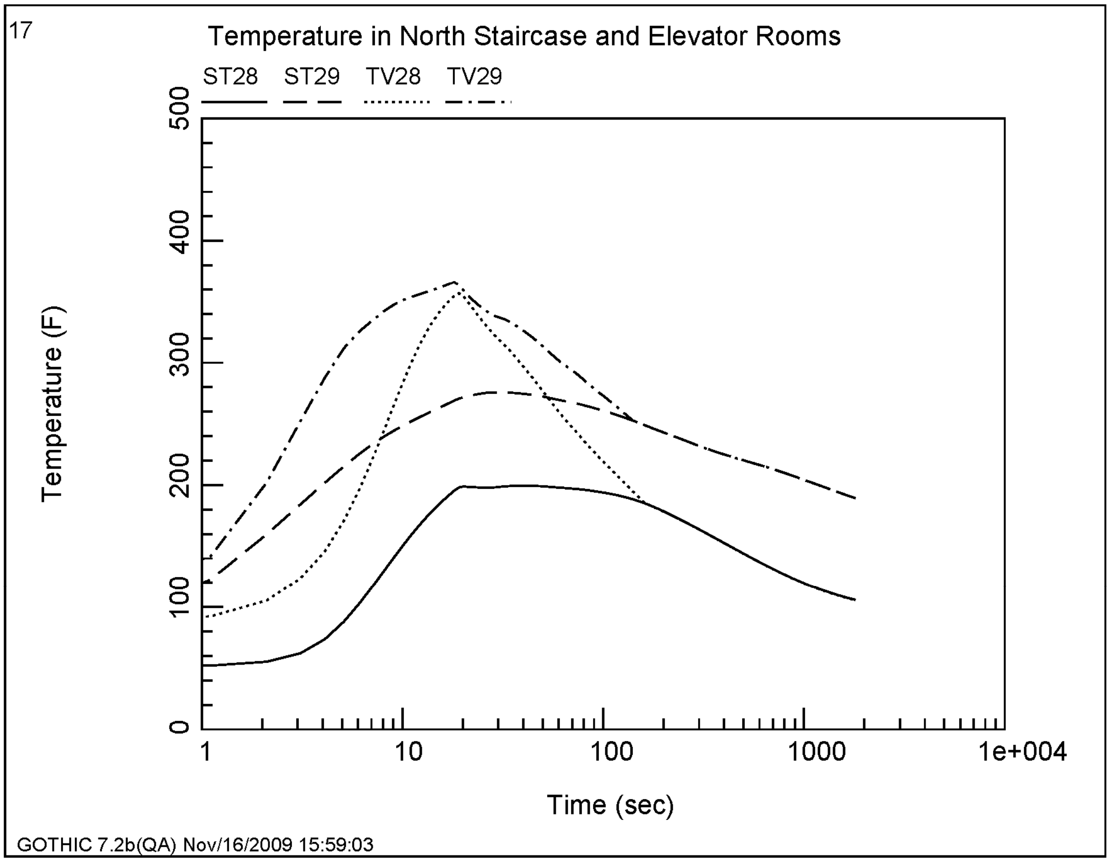


Figure 06.02.01-89-18—Temperature of Node 30

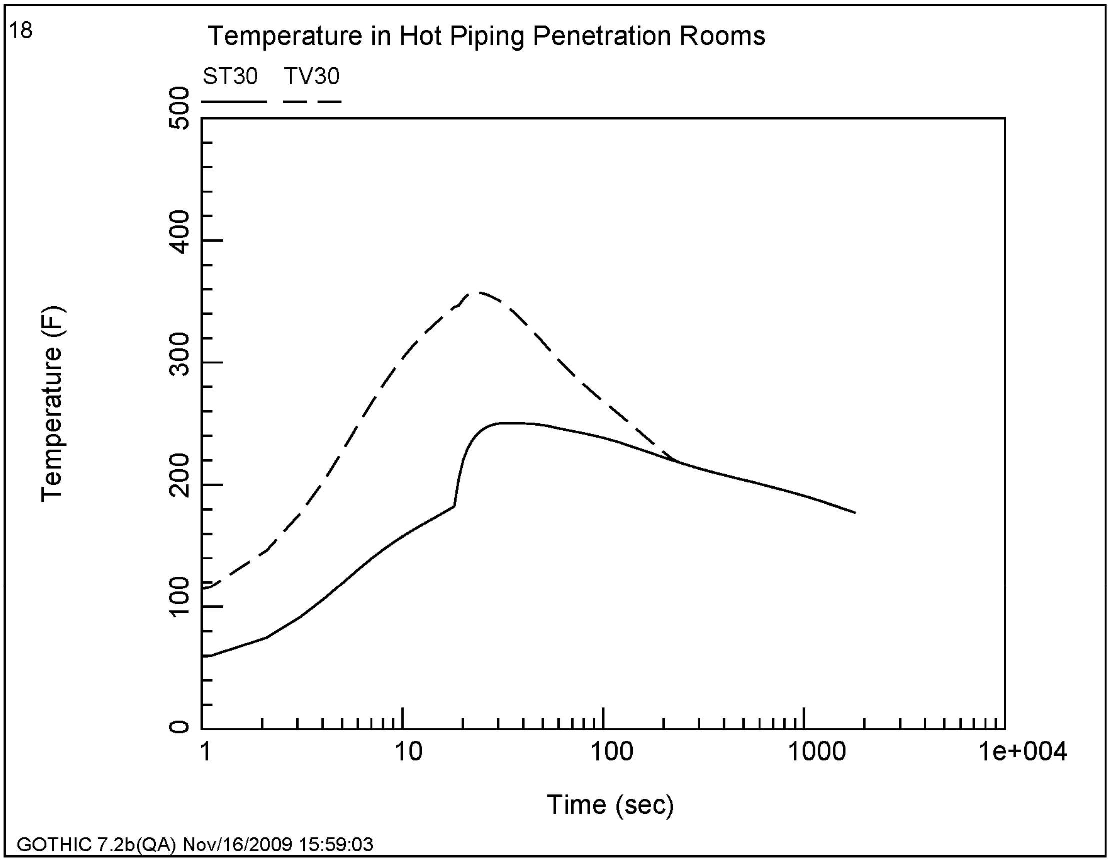


Figure 06.02.01-89-19—Temperature in the Center of the Subdivided Containment Dome at Elevations of +63.98 ft and +71.53 ft

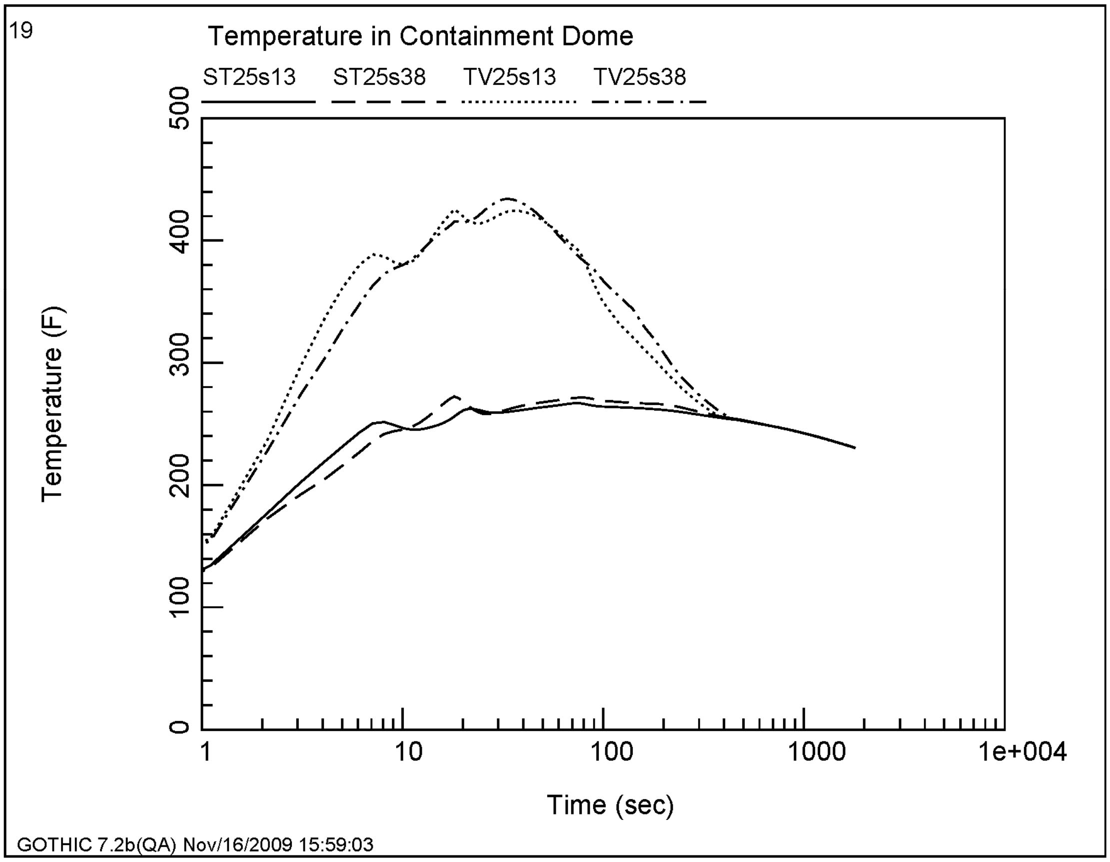


Figure 06.02.01-89-20—Temperature in the Center of the Subdivided Containment Dome at Elevations of +79.07ft and +86.29ft

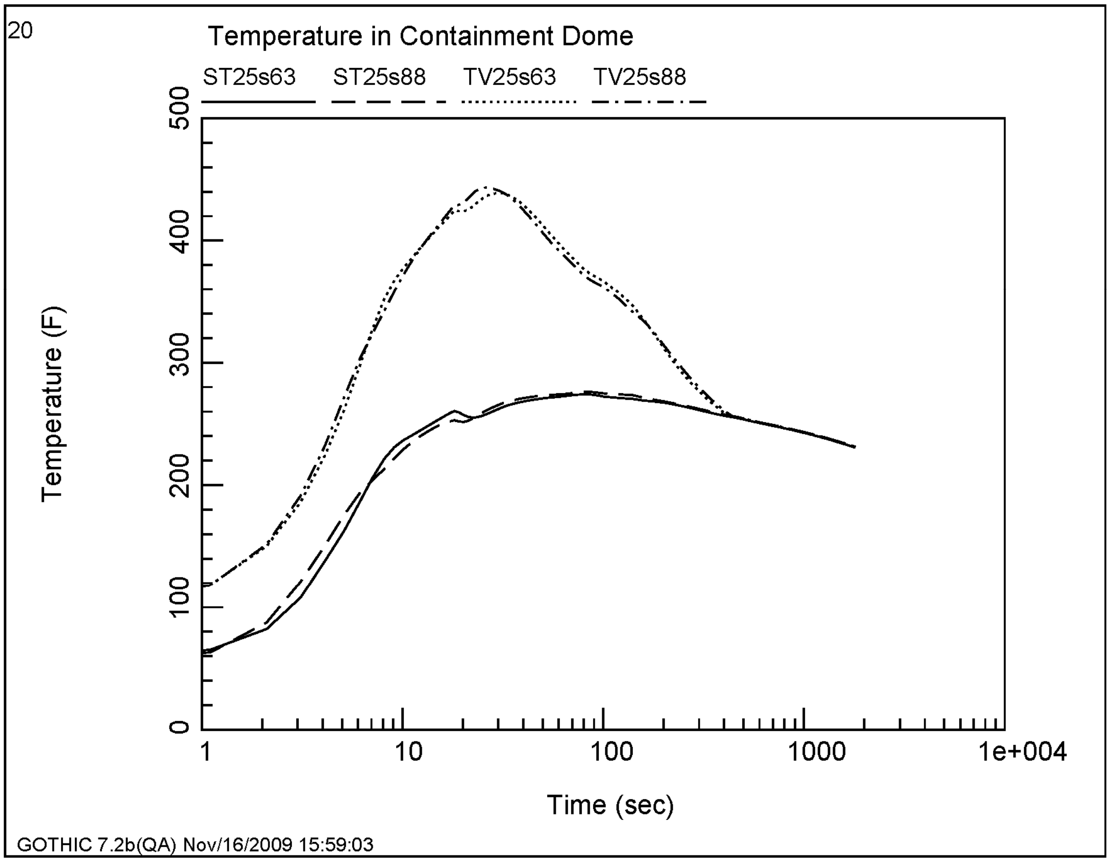


Figure 06.02.01-89-21—Temperature in the Center of the Subdivided Containment Dome at Elevations of +93.51ft and +98.59ft

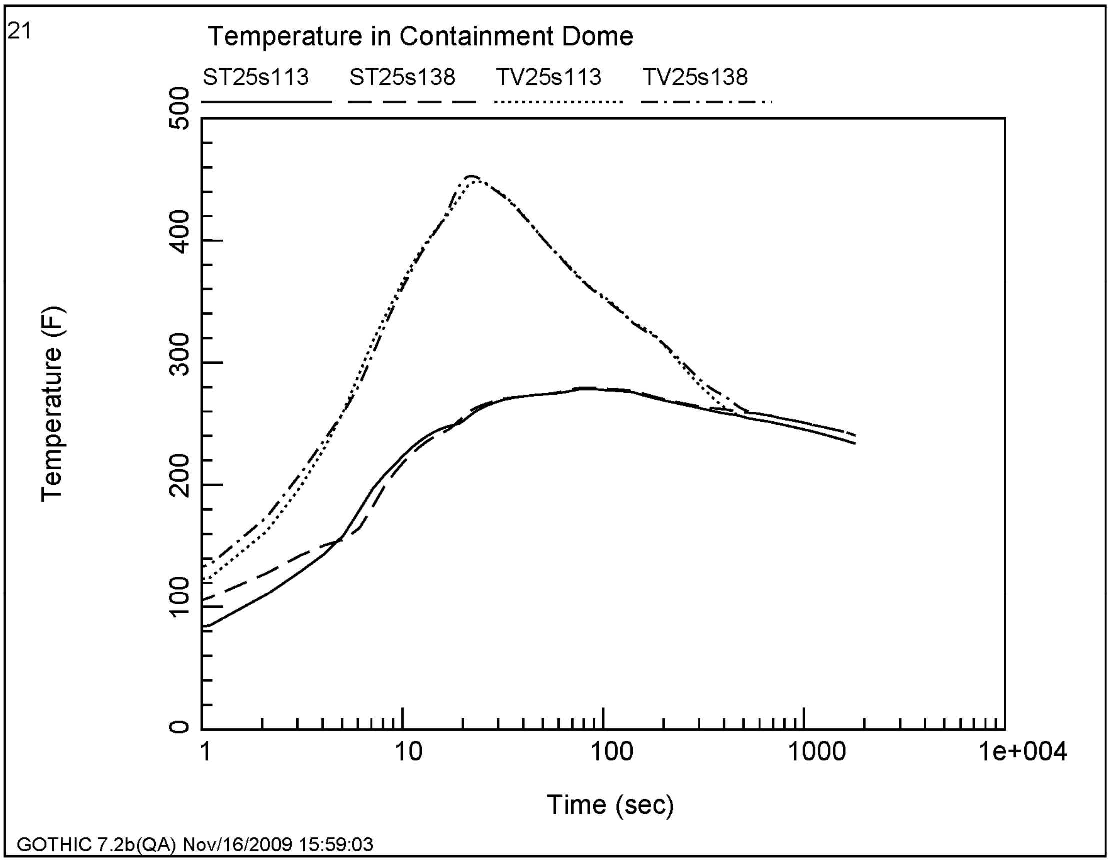


Figure 06.02.01-89-22—Temperature in the Center of the Subdivided Containment Dome at Elevations of +103.68ft and +108.76ft

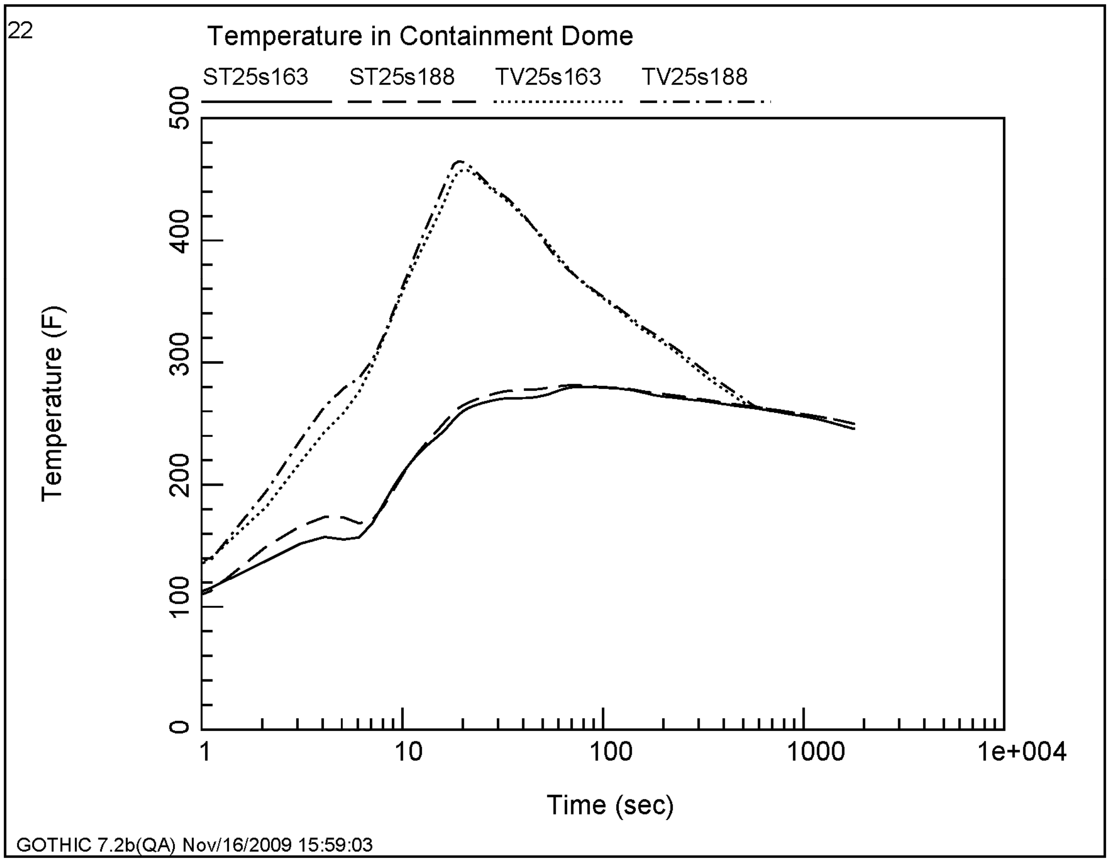


Figure 06.02.01-89-23—Temperature in the Center of the Subdivided Containment Dome at Elevations of +113.85ft and +119.90ft

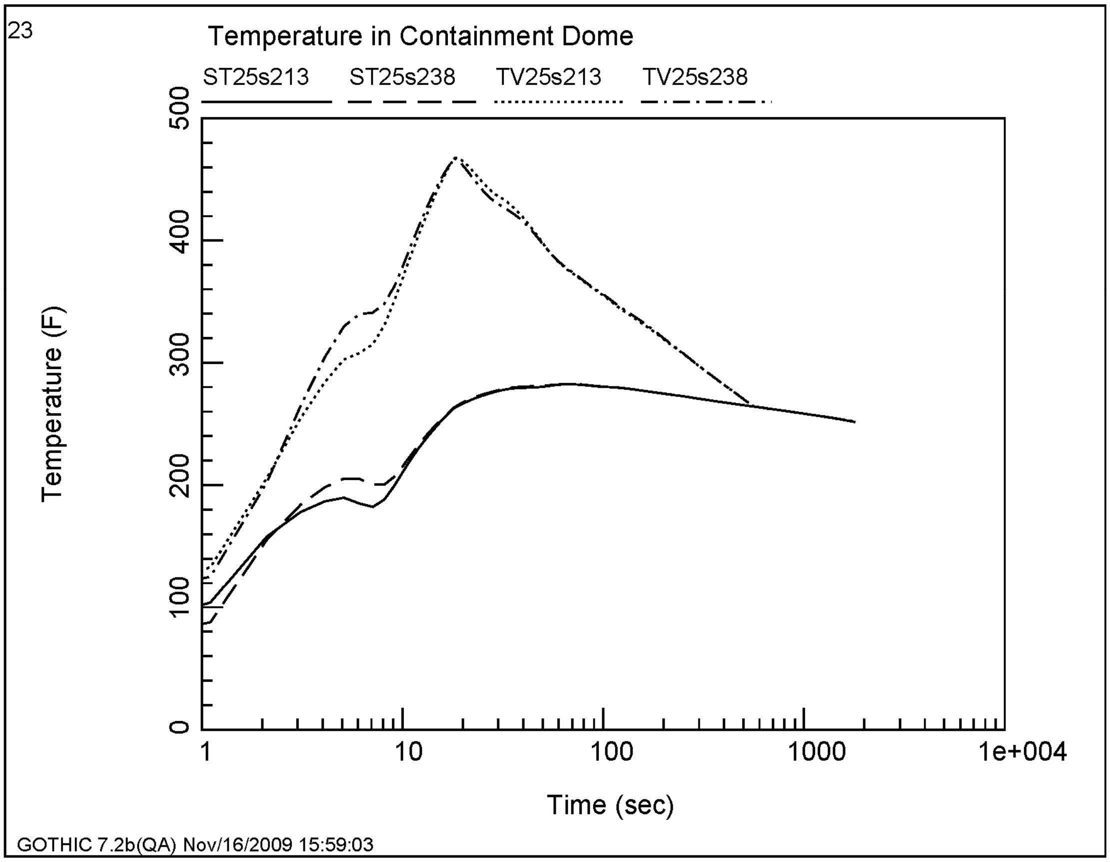


Figure 06.02.01-89-24—Temperature in the Center of the Subdivided Containment Dome at Elevations of +125.95ft and +132.00ft

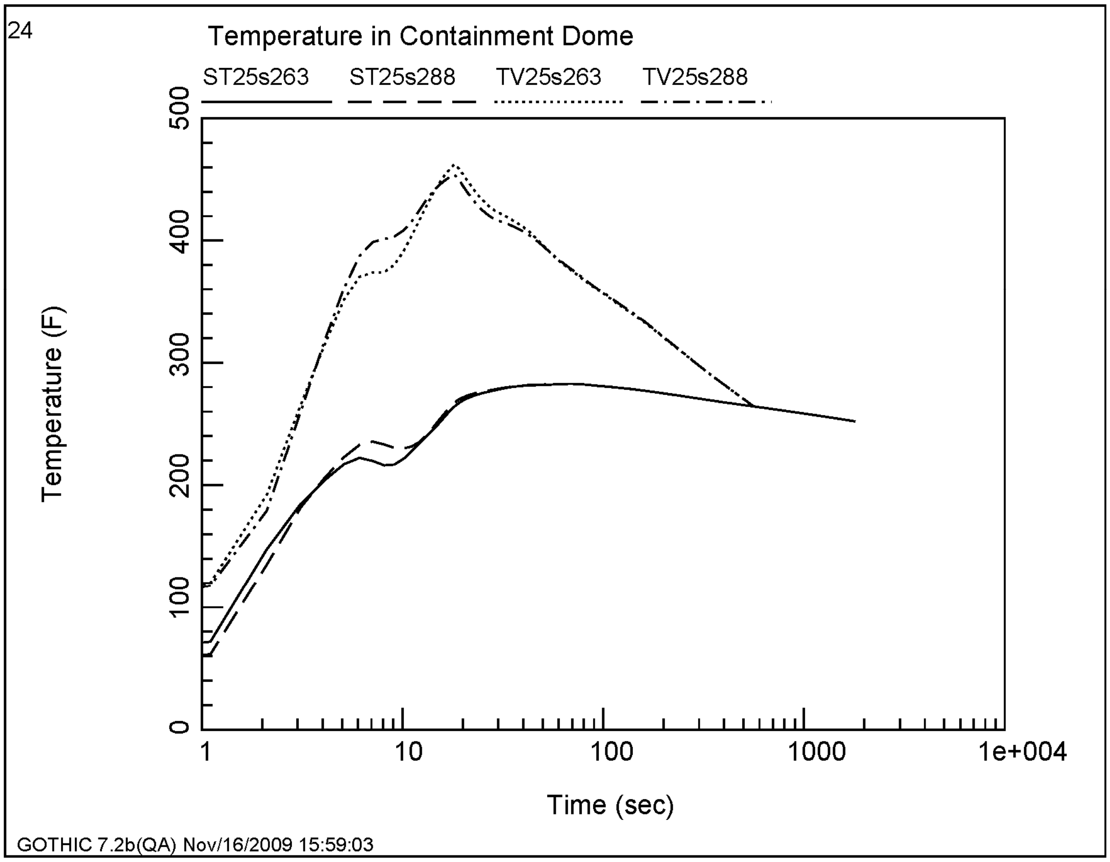


Figure 06.02.01-89-25—Temperature in the Center of the Subdivided Containment Dome at Elevations of +138.05ft and +144.10ft

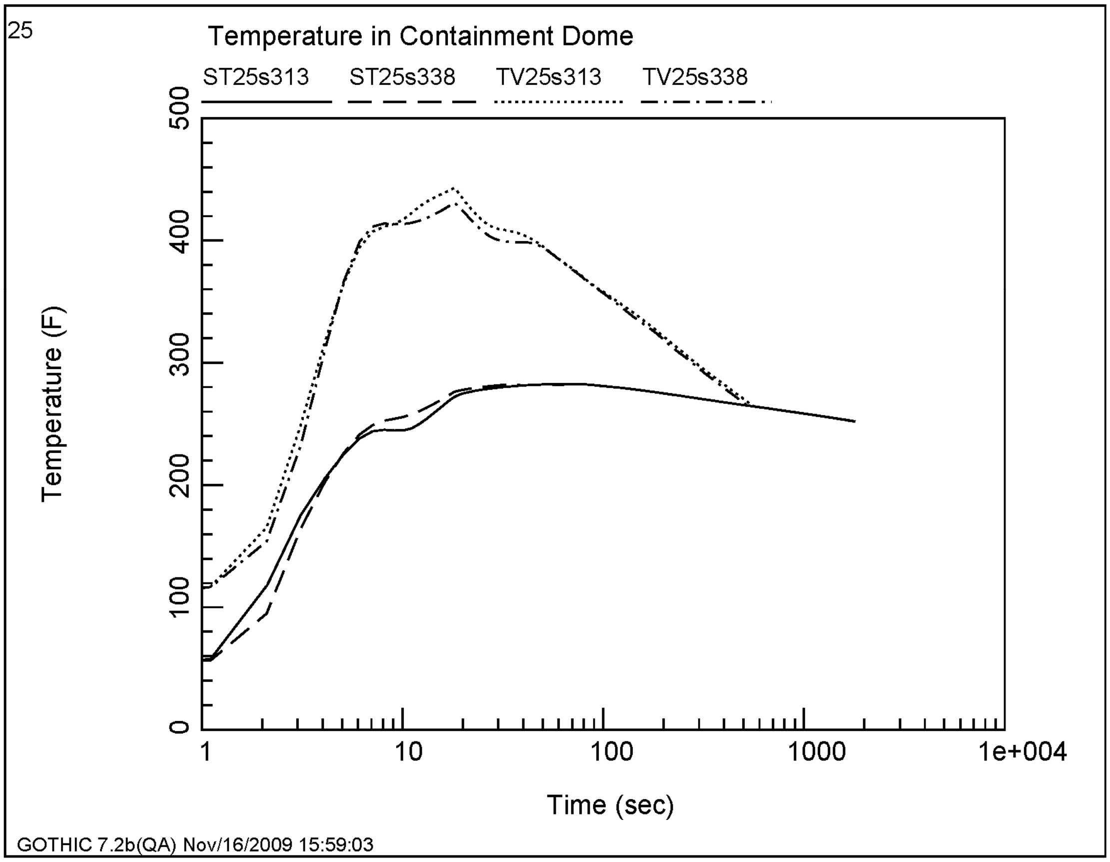


Figure 06.02.01-89-26—Temperature in the Center of the Subdivided Containment Dome at Elevations of +151.12ft and +158.14ft

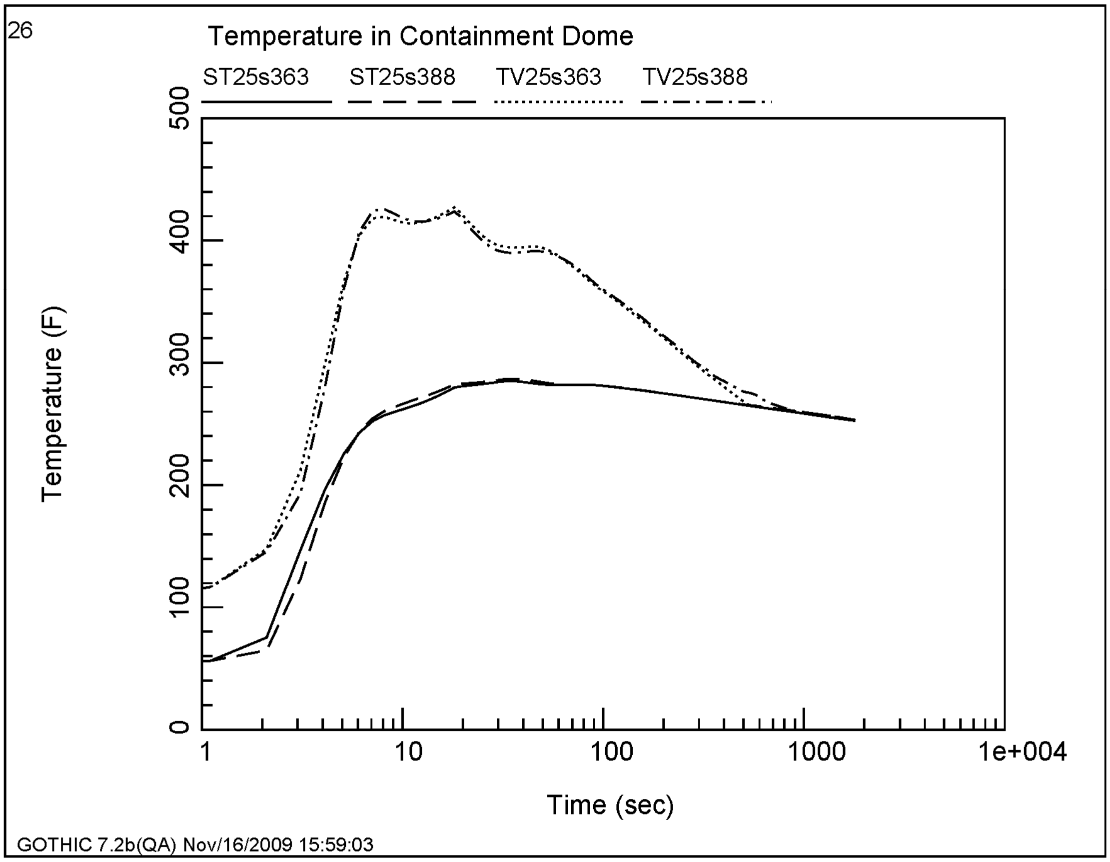


Figure 06.02.01-89-27—Temperature in the Center of the Subdivided Containment Dome at Elevations of +165.16ft and +172.99ft

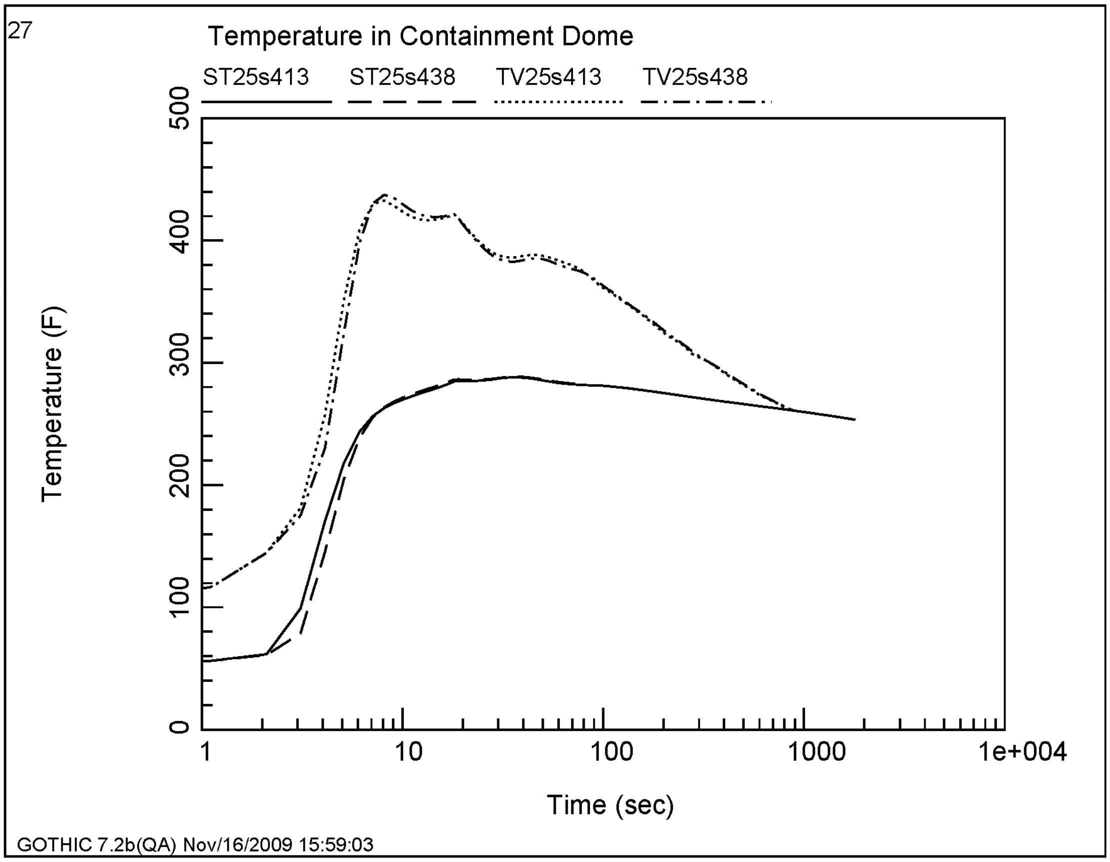


Figure 06.02.01-89-28—Temperature in the Center of the Subdivided Containment Dome at an Elevation of +180.82ft

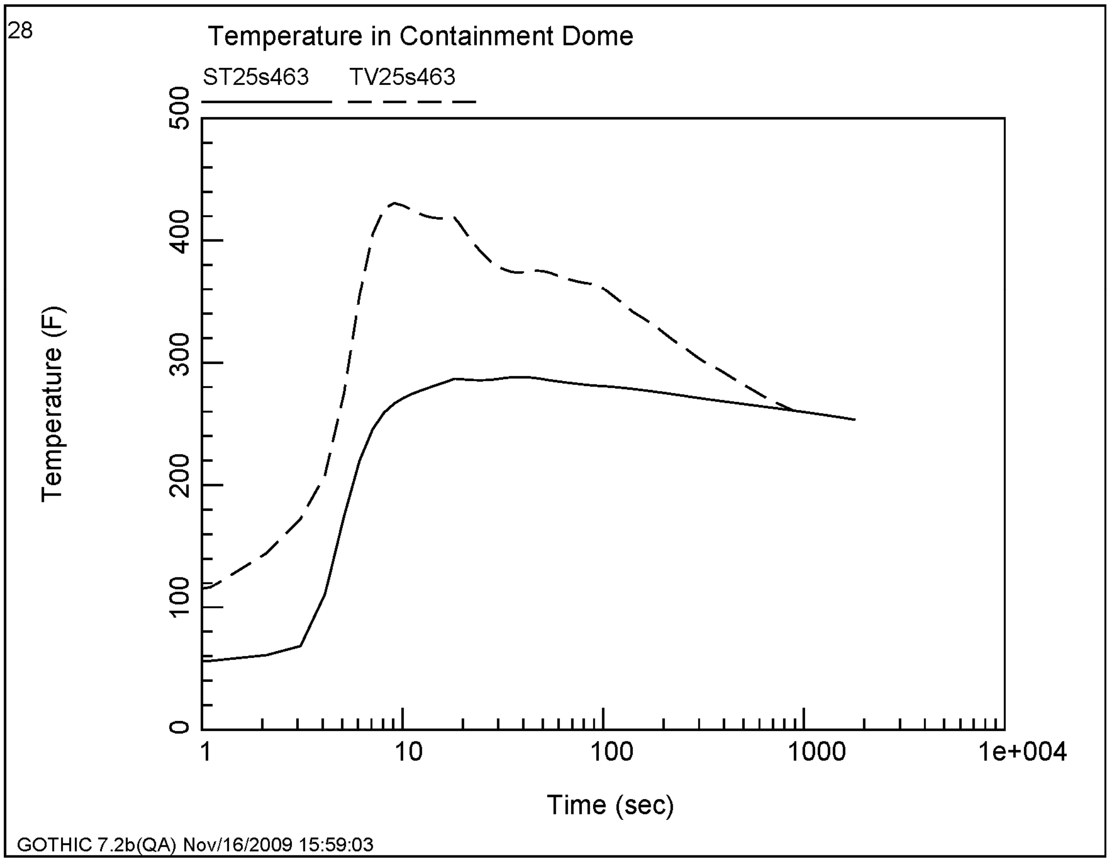


Figure 06.02.01-89-29—Temperature of Containment Wall at an Elevation of +93.51ft, Near the Location of Maximum Temperature

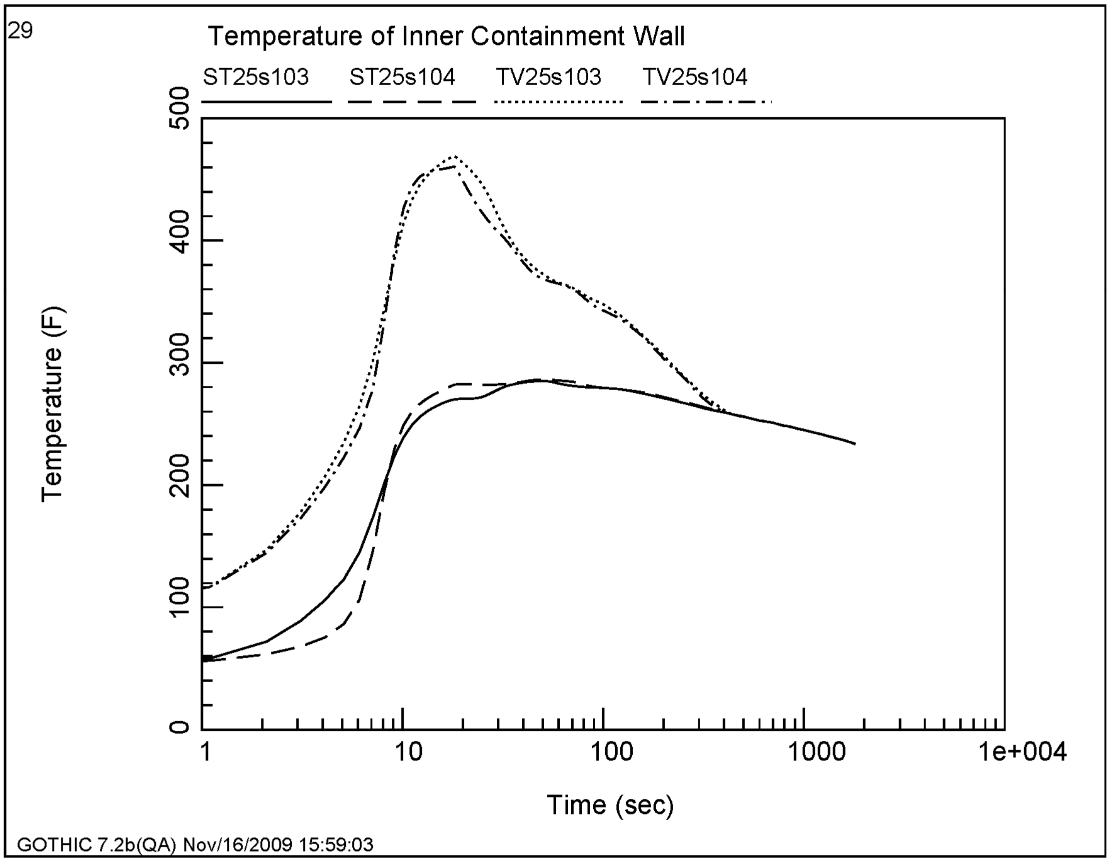


Figure 06.02.01-89-30—Temperature of Containment Wall at an Elevation of +93.51ft, near the Location of Maximum Temperature

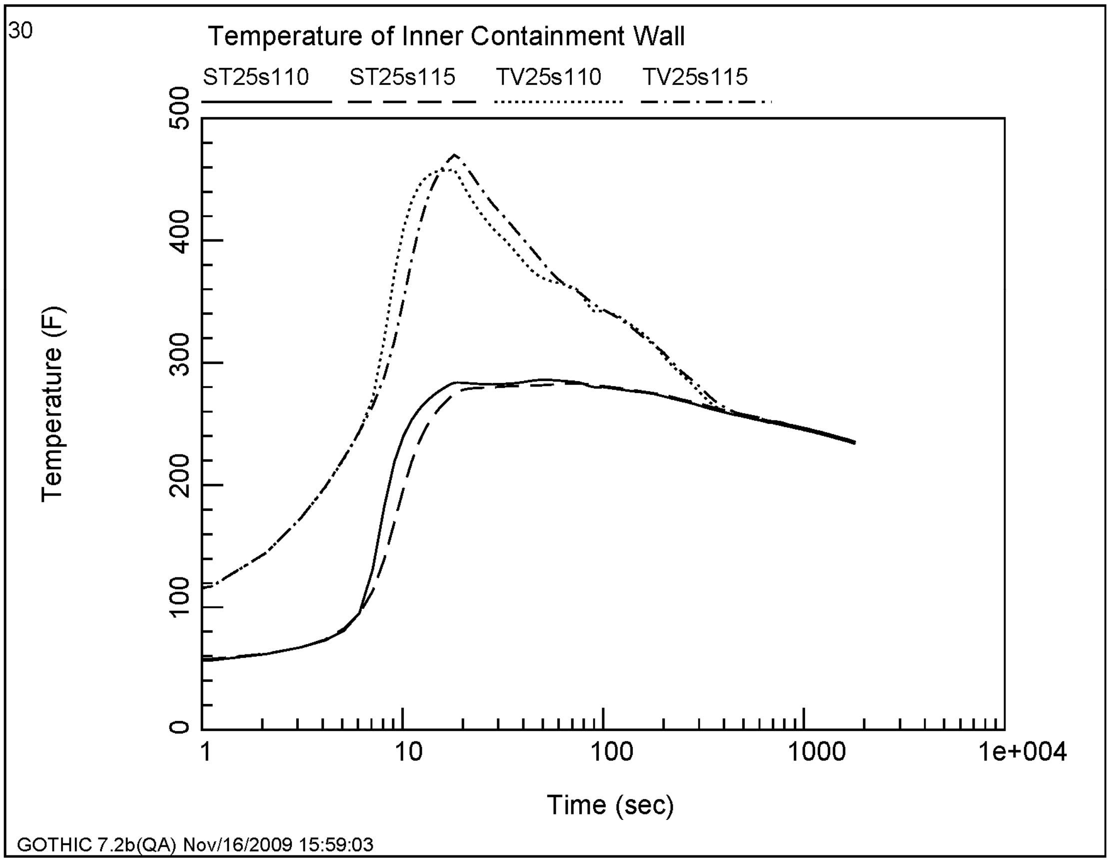


Figure 06.02.01-89-31—Temperature of Containment Wall at an Elevation of +98.59ft, near the Location of Maximum Temperature

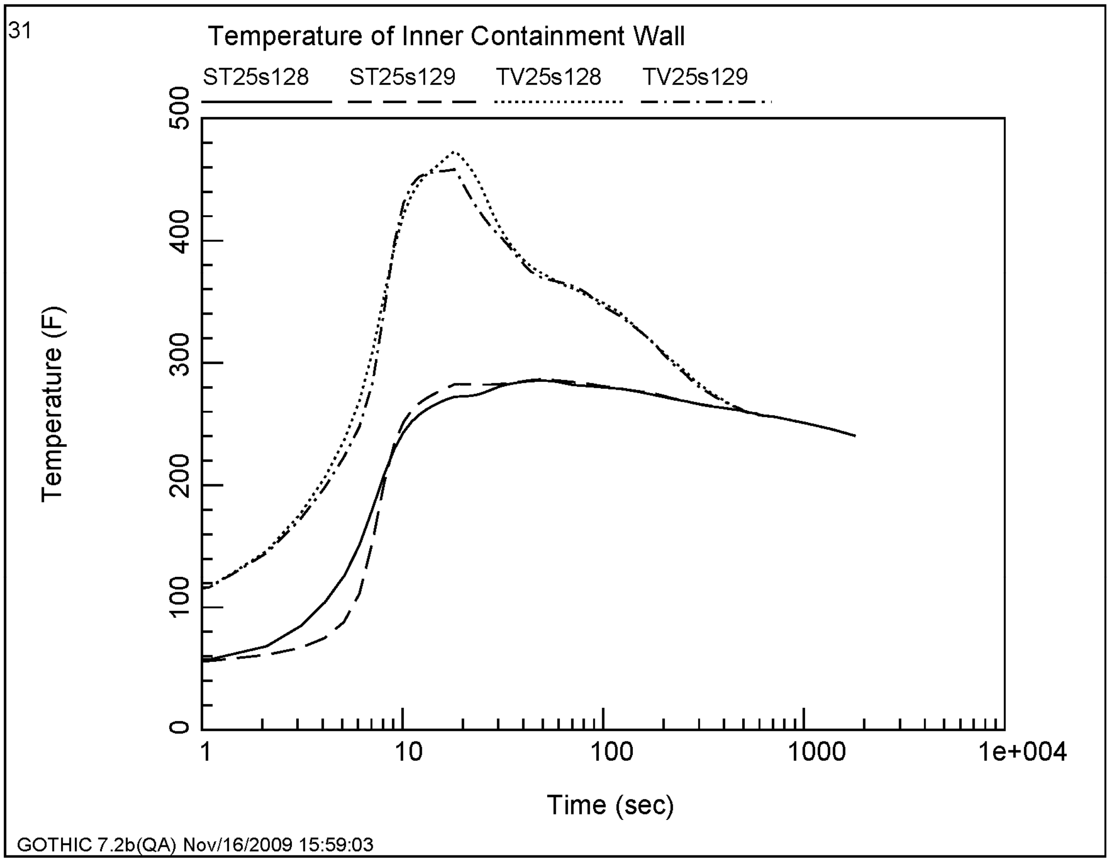


Figure 06.02.01-89-32—Temperature of Containment Wall at an Elevation of +98.59ft, near the Location of Maximum Temperature

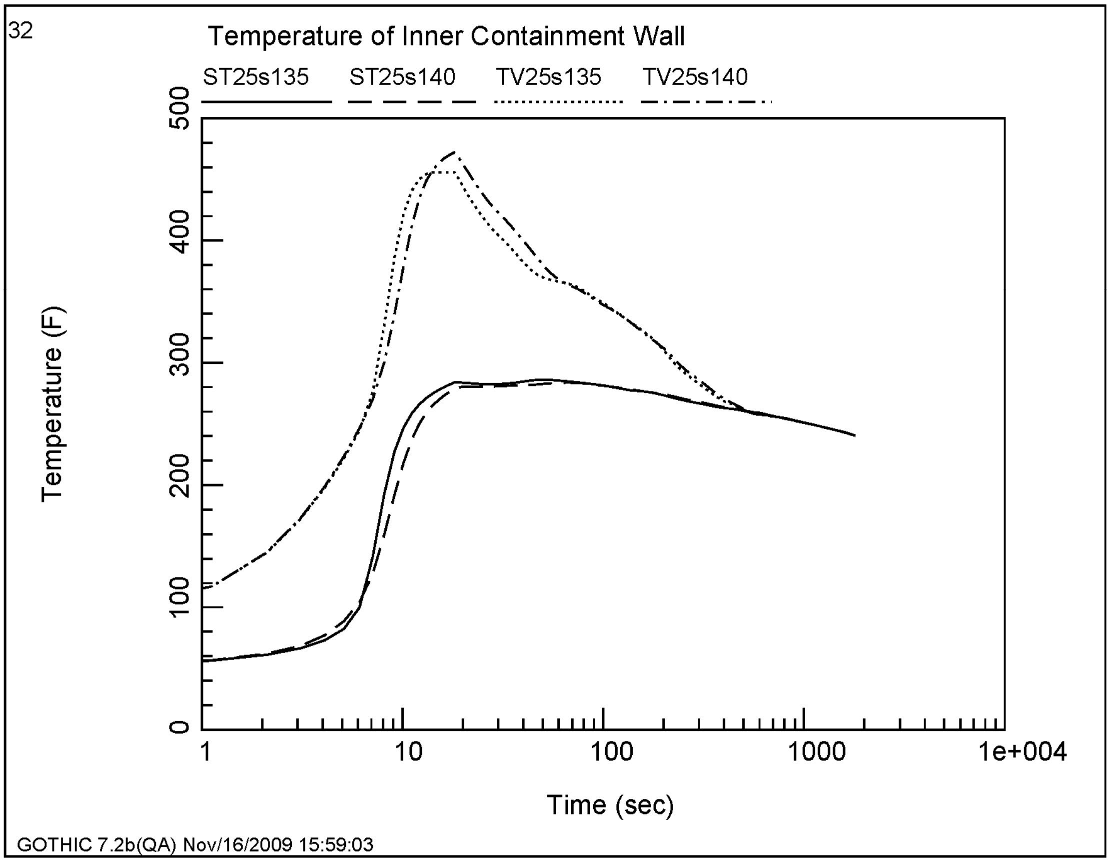


Figure 06.02.01-89-33—Temperature of Containment Wall at an Elevation of +103.68ft, near the Location of Maximum Temperature

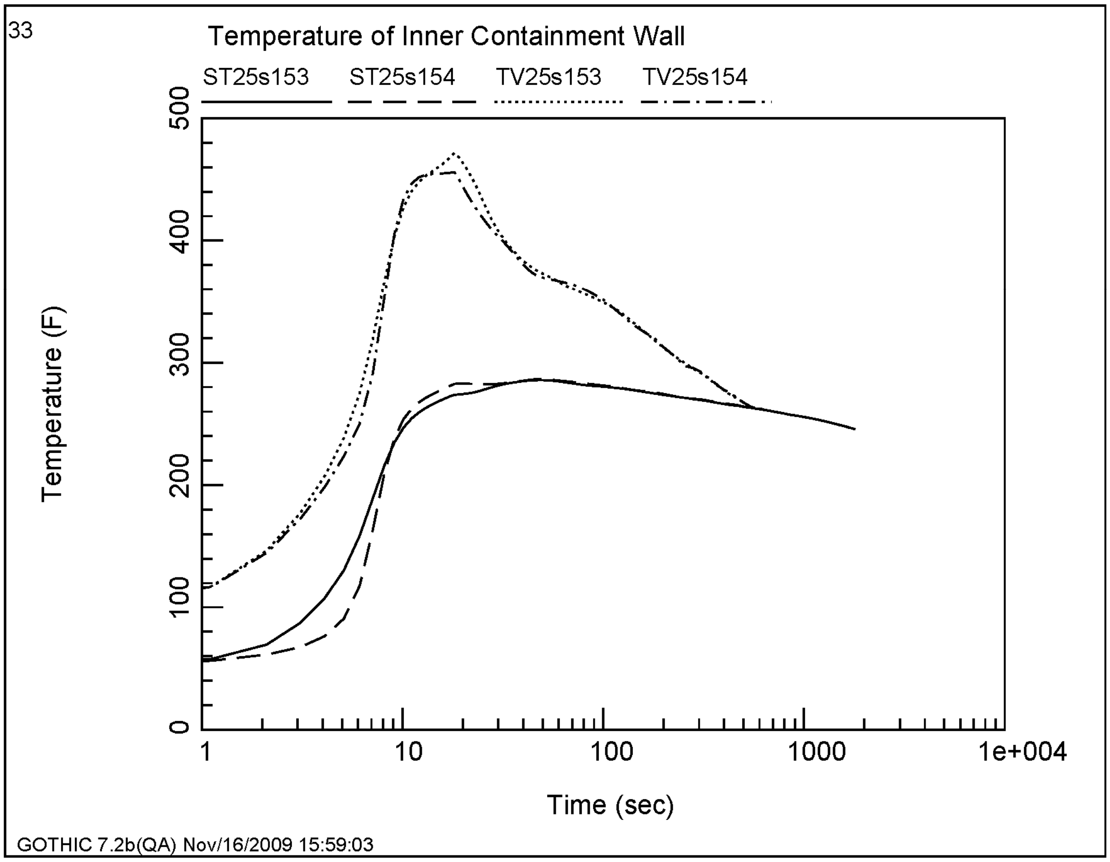


Figure 06.02.01-89-34—Temperature of Containment Wall at an Elevation of +103.68ft, near the Location of Maximum Temperature

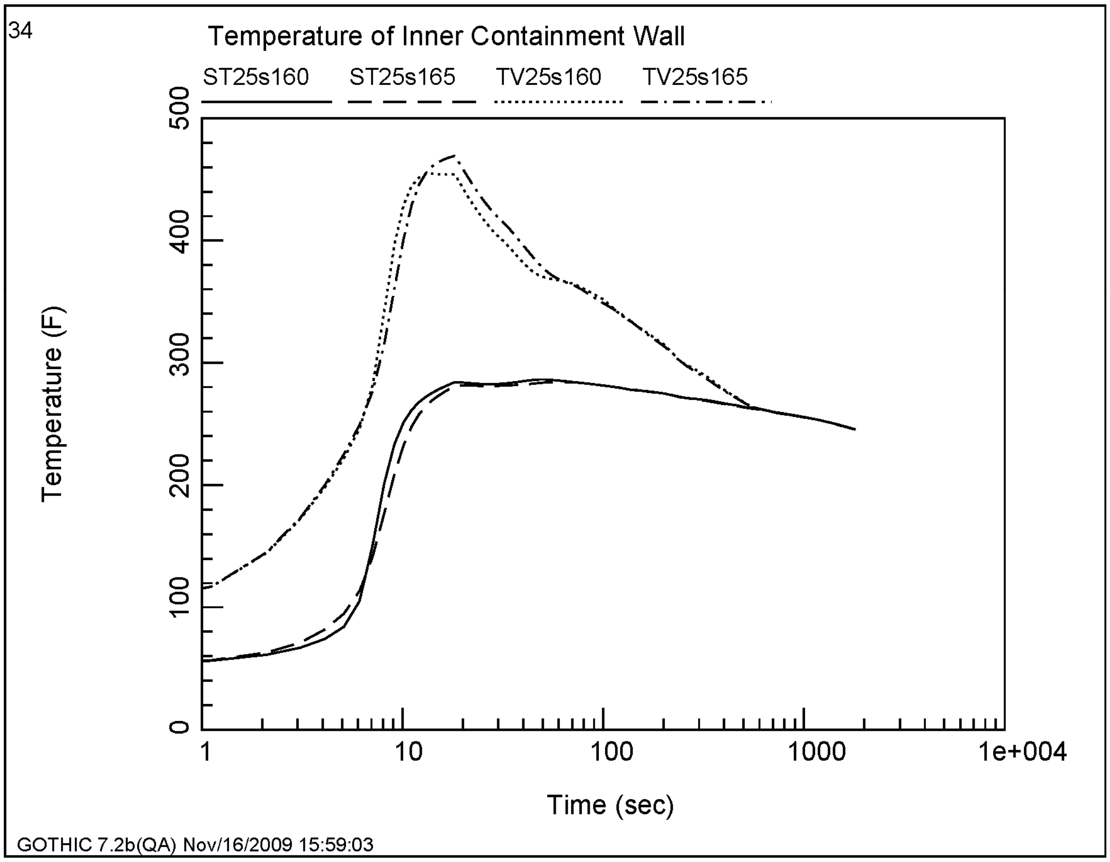


Figure 06.02.01-89-35—Temperature of Containment Wall at an Elevation of +108.76ft, near the Location of Maximum Temperature

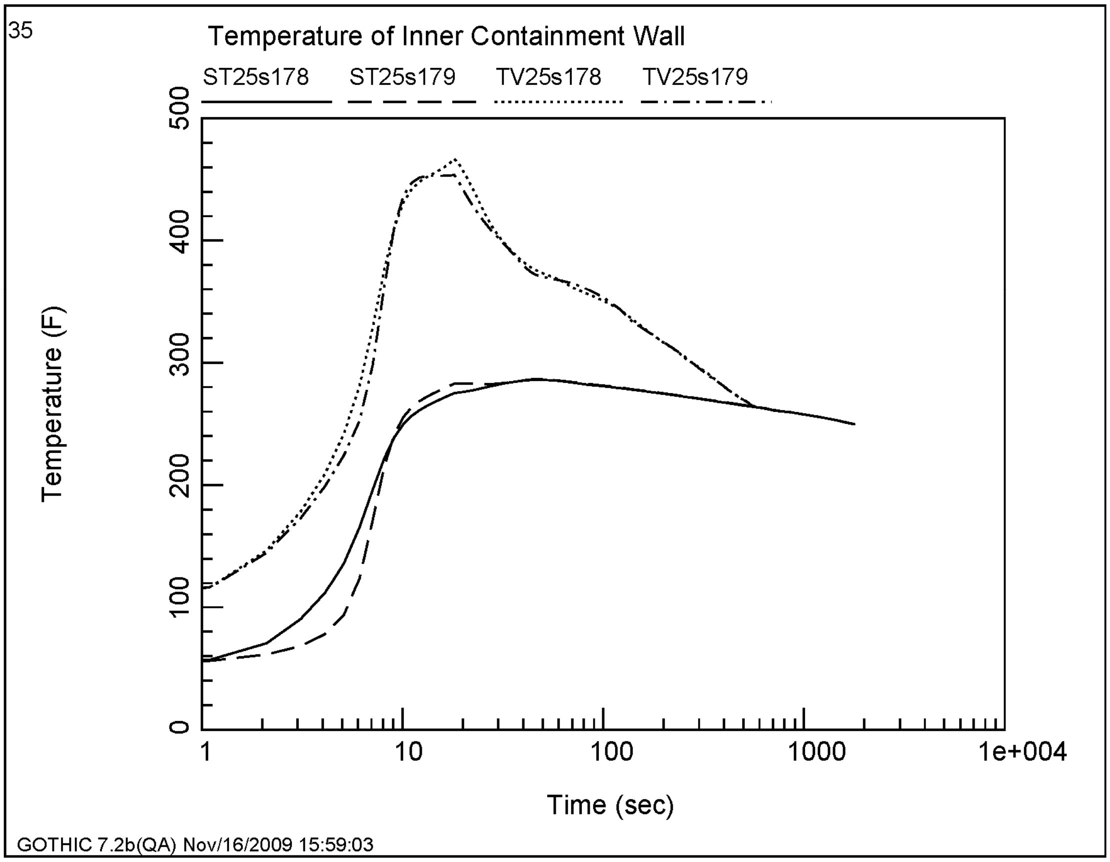
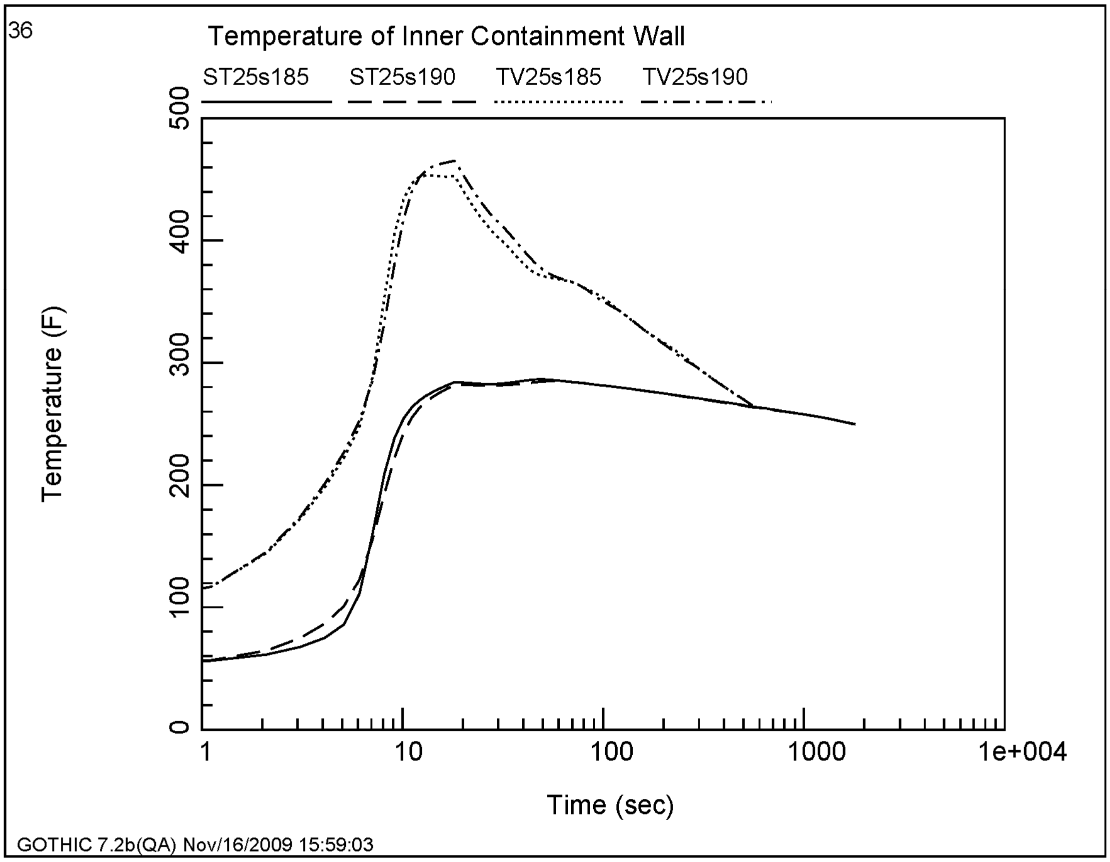


Figure 06.02.01-89-36—Temperature of Containment Wall at an Elevation of +108.76ft, near the Location of Maximum Temperature



Question 06.02.01-90:

This question is a follow-up to the February 9 and 10, 2010 audit on containment analyses. Revision 2 – Interim of the U.S. EPR FSAR lists five small break LOCA calculations performed for the U.S. EPR in Table 6.2.1-1. Provide the following information concerning these analyses.

a. Figures showing for a typical small break, the containment pressure and temperature for the duration of the analysis. Temperature curves should be included for the maximum temperature node, for the top of the dome and for the two lower annulus nodes.

b. Figures comparing the peak pressure curves and peak temperature curves of the five cases analyzed.

c. Provide the result from a postulated small break in the Accessible Space. Select one of the highest pipe elevations. Provide the same curves as requested for the typical small break case above under sub-item a.

d. Provide a discussion on the performance of the CONVECT system during small break accidents. Show that sufficient vent area exists between the two rooms of the containment. Justify opening of the foils for breaks within the Equipment Room and the Accessible Space.

Response to Question 06.02.01-90:

The containment pressure and temperature response from five small break loss of coolant accident (SBLOCA) cases are shown in U.S. EPR FSAR Tier 2, Table 6.2.1-1. Three break sizes were considered in the cold leg pump discharge (9”, 6”, and 3” breaks), and the 3” break was also analyzed in the hot leg with and without allowing rupture foils to open. Table 06.02.01-90-1 summarizes the SBLOCA cases.

a) The containment pressure and temperature response for SBLOCA are shown in Figure 06.02.01-90-1 and Figure 06.02.01-90-2, respectively. The case chosen was a 9” cold leg pump discharge (CLPD) break, which resulted in the highest peak pressure and temperature of the small breaks. The pressure curve was taken from the node in the GOTHIC model that had the highest peak pressure, which was the in-containment refueling water storage tank (IRWST) room. The pressure distribution is almost uniform throughout the containment. The difference in peak pressure between the top of the dome and the IRWST is about 0.3 psi.

The temperature curves were taken from four different nodes:

– Location of maximum peak temperature.

– Top of the dome.

– Loop 1 and 2 lower annulus rooms.

– Loop 3 and 4 lower annulus rooms.

The location of the maximum peak temperature was the subdivided cell underneath the top of the dome.

b) The containment pressure and temperature responses for the five SBLOCA cases analyzed are shown in Figure 06.02.01-90-3 and Figure 06.02.01-90-4, respectively. The pressure and temperature responses were taken from the node that observed the highest peak pressure or temperature.

For the 3" CLPD case, only the first 7000 seconds of the transient are shown. During this transient simulation, the reactor coolant system (RCS) pressure never fell below the low head safety injection (LHSI) pumps injection pressure. This condition is attributed to the 180°F/hr steam generator (SG) partial cooldown model included in the base RELAP5/MOD2-B&W deck for this analysis. The RELAP5/MOD2-B&W model did not include an additional cooldown of 90°F/hr following the completion of the automatic partial cooldown. This manual cooldown was assumed in a similar analysis, with a break of approximately 3", in support of Boron dilution/precipitation effects. The results of the SBLOCA analysis with the manual cooldown demonstrated that once LHSI is initiated, the steaming is terminated and the pressure excursion ends. The 9" and 6" breaks will bound the smaller breaks when the manual cooldown is considered.

Pressure and temperature fluctuations are noticeable in some of the cases. These fluctuations are driven by the RELAP5/MOD2-B&W mass and energy release data.

c) The RCS loops are located in the equipment space. There are lines connected to the RCS that traverse the accessible space, which could represent a potential SBLOCA location. The systems that are connected to the RCS include the residual heat removal system (RHRS), the chemical and volume control system (CVCS), the safety injection system (SIS), and the pressurizer spray and surge lines. Several of these lines are either normally isolated or have check valves that physically separate the system from the RCS, and do not need to be analyzed for a potential LOCA. Table 06.02.01-90-2 lists the major lines that are connected to the RCS. The name of the pipe that connects to the RCS and any associated check valves are also listed.

The RHRS is not active during normal operation and does not represent a plausible LOCA scenario in Modes 1 through 3. The SIS and the CVCS charging lines each contain a check valve before branching off into other areas of the Reactor Building, and thus are not analyzed for a LOCA. Breaks in the pressurizer spray and surge lines have been accounted for, but the lines do not traverse into the accessible space of the Reactor Building.

The CVCS let down line includes a check valve that is located in the accessible space and does not allow flow into the RCS. There are two motor-operated isolation valves (KBA10AA001/002) to provide the RCS isolation boundary. The motor valves isolate on a pressurizer minimum level signal or a SIS. The SIS occurs approximately 60 seconds into the transient for a SBLOCA event. If a break of the CVCS let down line occurrs in the accessible space, it would be isolated from the RCS in approximately one minute.

Because of the piping characteristics and the design safety features, a postulated small break in the accessible space does not require consideration.

d) The 3" high load line (HL) break was analyzed with and without crediting containment rupture foils to evaluate the performance of the CONVECT system in minimum size SBLOCA events. The P/T responses for both 3" HL cases are similar and demonstrate that the vent area provided by the convection foils can adequately respond to small pipe breaks. The rupture foils sensitivity was performed on breaks within the equipment room.

FSAR Impact:

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

Table 06.02.01-90-1—Summary of Small Break LOCA Cases

Break Location	Break Size	Rupture Foils	Case ID
Pump Discharge	0.5 ft^2 (9 in.)	Credited	9” CLPD
Pump Discharge	0.1963 ft^2 (6 in.)	Credited	6” CLPD
Pump Discharge	0.0491 ft^2 (3 in.)	Credited	3” CLPD
Hot Leg	0.0491 ft^2 (3 in.)	Credited	3” HL
Hot Leg	0.0491 ft^2 (3 in.)	Not Credited	3” HL (CONVECT)

Table 06.02.01-90-2—List of Major Lines Associated with the RCS

Line	Pipe Name	Check Valve
Loop 1 Residual Heat Removal	JNA10BR001	N/A
Loop 1 CVCS Letdown Line	KBA10BR001	KBA14AA012
Loop 1 Safety Injection System	JNG13BR007	JNG13AA005
Loop 2 Residual Heat Removal	JNA20BR001	N/A
Loop 2 Pressurizer Spray Line	JEF10BR102	N/A
Loop 2 CVCS Charging Line	KBA34BR022	KBA34AA020
Loop 2 Safety Injection System	JNG23BR007	JNG23AA005
Loop 3 Residual Heat Removal	JNA30BR001	N/A
Loop 3 Pressurizer Surge Line	JEC30BR004	N/A
Loop 3 Pressurizer Spray Line	JEF10BR103	N/A
Loop 3 Safety Injection System	JNG33BR007	JNG33AA005
Loop 4 Residual Heat Removal	JNA40BR001	N/A
Loop 4 CVCS Charging Line	KBA34BR023	KBA34AA021
Loop 4 Safety Injection System	JNG43BR007	JNG43AA005

Figure 06.02.01-90-1—Containment Pressure Response for a 9” CLPD Small Break LOCA

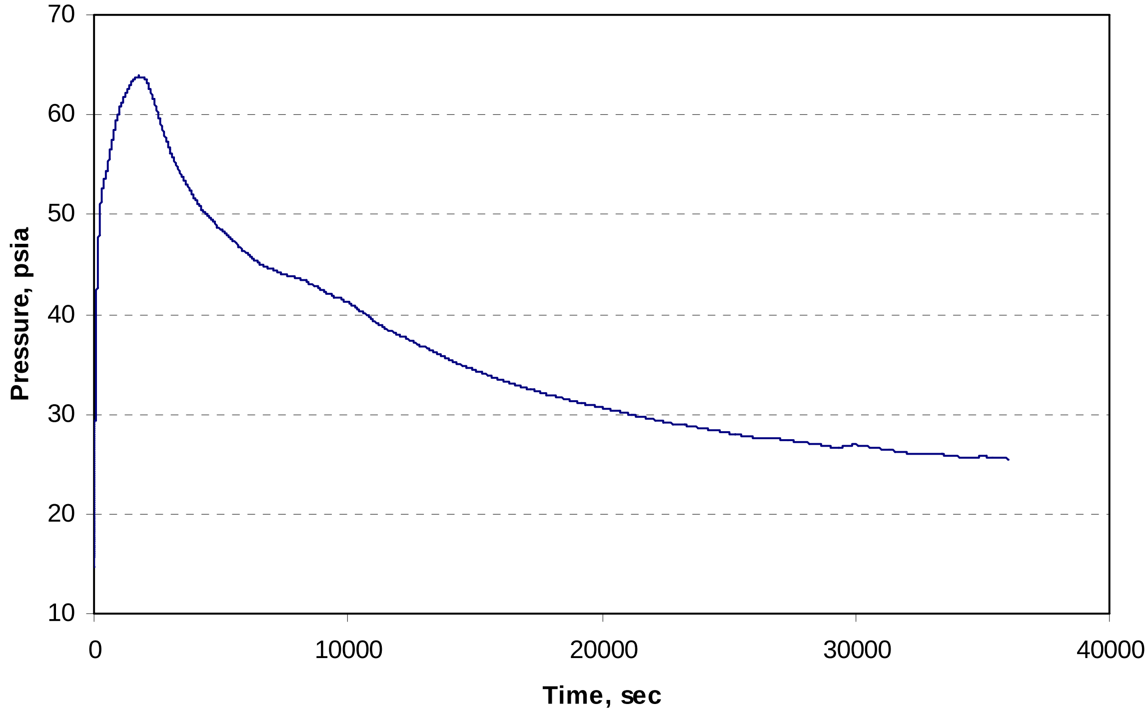


Figure 06.02.01-90-2—Containment Temperature Response for a 9" CLPD Small Break LOCA

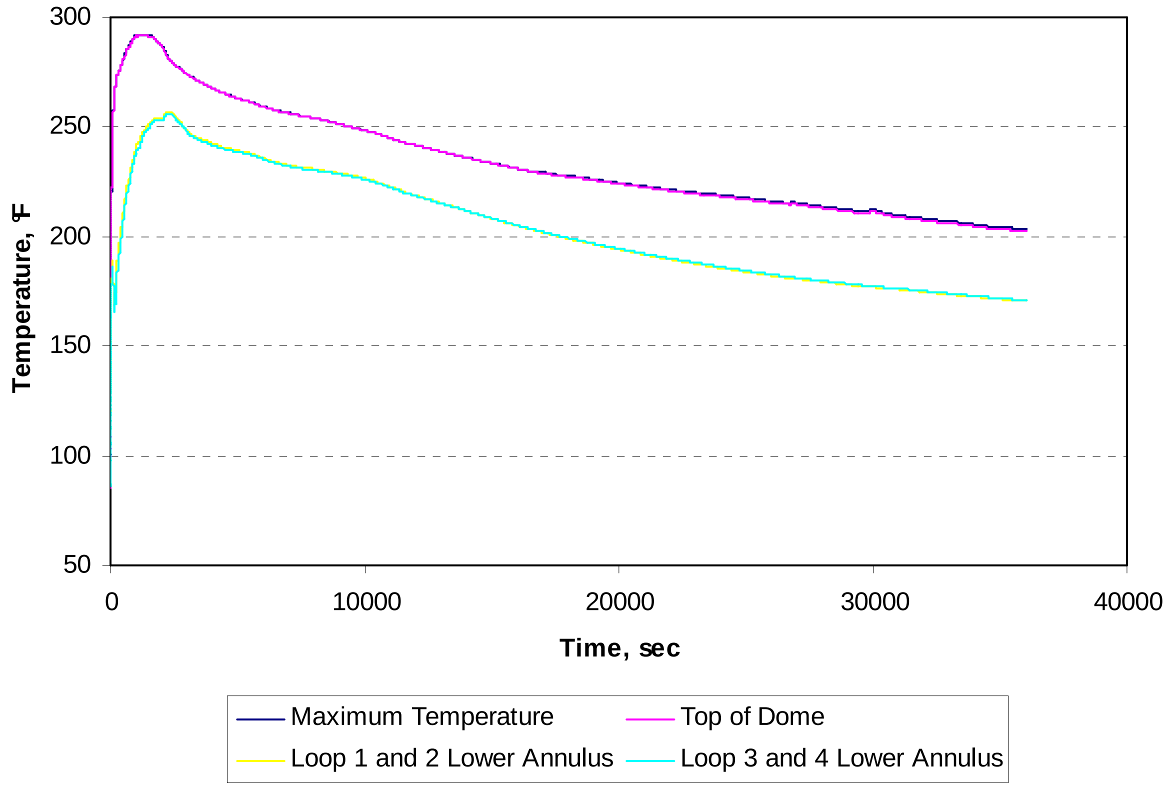


Figure 06.02.01-90-3—Containment Pressure Responses for Five Small Break LOCA Cases

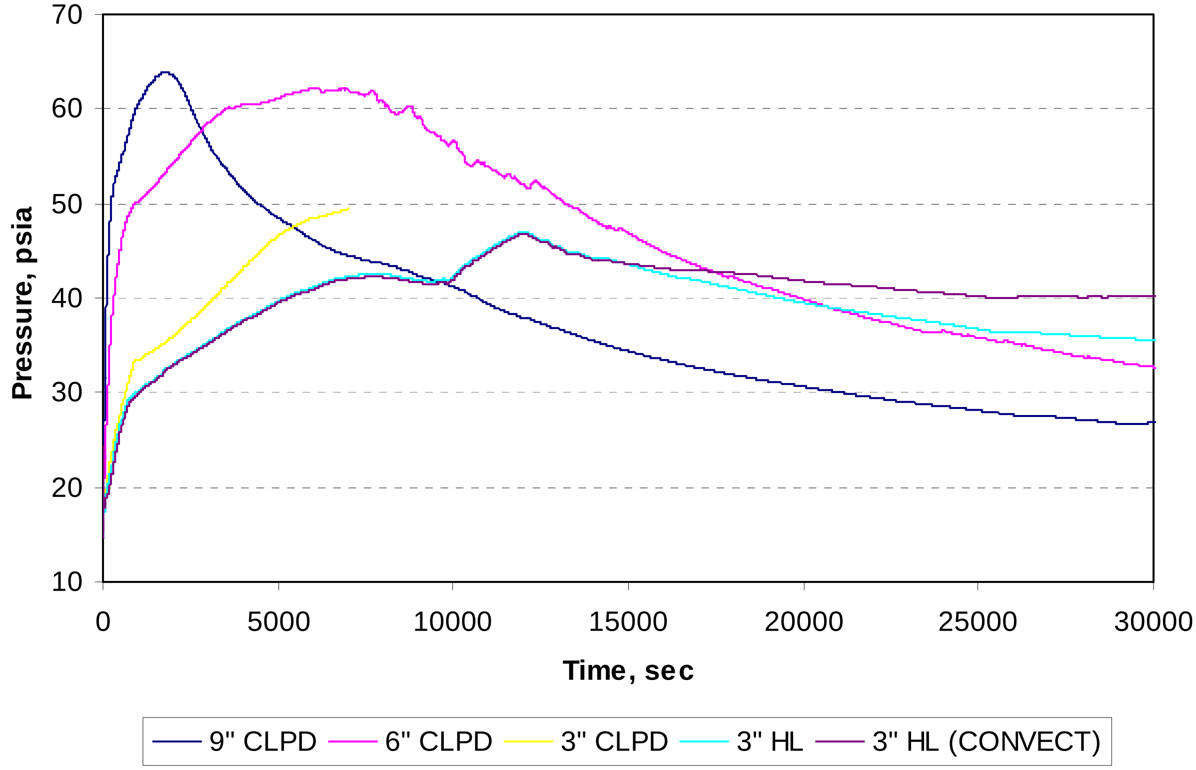


Figure 06.02.01-90-4—Containment Temperature Responses for Five Small Break LOCA Cases