Response to

Request for Additional Information No. 378(4409, 4513, 4490), Revision 2, Supplement 7

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 06.02.01-83:

1) Provide the list of references for FSAR Chapter 6.2 Interim Rev. 2. This question is a follow-up to the February 9 and 10, 2010 audit on containment analyses.

Response to Question 06.02.01-83:

The following is the current list of references in U.S. EPR FSAR Tier 2, Section 6.2.8:

1. BAW-10252(NP)-A, Revision 0, “Analysis of Containment Response to Postulated Pipe Ruptures Using GOTHIC,” Framatome ANP, September 2005.
2. BAW-10168P-A, Revision 3, “BWNT Loss-of-Coolant Accident Evaluation Model for Recirculating Steam Generator Plants – Volume I – Large Break,” B&W Nuclear Technologies, December 1996.
3. BAW-10164P-A, Revision 6, “RELAP5/ MOD2-BAW – An Advanced Computer Program for Light Water Reactor LOCA and Non-LOCA Transient Analyses,” AREVA NP Inc., June 2007.
4. NUREG-0588 "Interim Staff Position on Environmental Qualification of Safety-Related Electrical Equipment," Revision 1, U.S. Nuclear Regulatory Commission, July 1981.
5. BAW-10169P-A, “B&W Safety Analysis Methodology for Recirculating Steam Generator Plants,” B&W Fuel Company, October 1989.
6. Karwat, H., “State of the Art Report on Containment Thermal Hydraulics and Hydrogen Distribution,” NEA/CSNI, June 1999.
7. ANSI/ANS–56.2, “Containment Isolation Provisions for Fluid Systems After a LOCA,” American National Standards Institute/American Nuclear Society, 1989.
8. ANP-10268P, Revision 0, “U.S. EPR Severe Accident Evaluation,” AREVA NP Inc., October 2006.
9. ANSI N45.4, “Leakage Rate Testing of Containment Structures for Nuclear Reactors,” American National Standards Institute, 1972.
10. ANSI/ANS 56.8, “Containment System Leakage Testing Requirements,” American National Standards Institute/American Nuclear Society, 1994.
11. SRM-SECY-04-0032, “Review of Operational Programs in a Combined License Application and Generic Emergency Planning Inspections, Tests, Analyses, and Acceptance Criteria,” U.S. Nuclear Regulatory Commission, 2004.
12. ASME Boiler and Pressure Vessel Code, Section XI, “Rules for Inservice Inspection of Nuclear Power Plant Components,” The American Society of Mechanical Engineers, 2004 Edition.
13. NEI 94-01, “Industry Guideline for Implementing Performance-Based Option of 10 CFR 50, Appendix J,” Nuclear Energy Institute, 1995.
14. ASME Boiler and Pressure Vessel Code, Section III, “Rules for Construction of Nuclear Power Plant Components,” The American Society of Mechanical Engineers, 2004 Edition.

15. ANP-10299P, Revision 2, “Applicability of AREVA NP Containment Response Evaluation Methodology to the U.S. EPR for Large Break LOCA Analysis," AREVA NP Inc., December 2009.

16. Frank Kreith, “Principles of Heat Transfer,” 3rd edition, New York: Intext Educational Publishers, 1973.

FSAR Impact:

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

Question 06.02.01-85:

1) Section 8.3.2.1 of ANP-10299P contains the equations by which steam flow from the break and ECCS water spillage are calculated within the GOTHIC code for the period before HL injection. Section 8.3.2.2 contains the equations by which steam and water flow from the break and ECCS water spillage are calculated for the period after hot leg injection. These equations are implemented by input into GOTHIC by selection of appropriate boundary conditions and control variables. Using the nomenclature of ANP-10299P, provide logic diagrams showing how this is accomplished. Specify the GOTHIC outputs that were used in producing the mass and energy release Table 6.2.1-20 of the FSAR interim Rev. 2 and explain how this was accomplished. This question is a follow-up to the February 9 and 10, 2010 audit on containment analyses.

Response to Question 06.02.01-85:

Part A: GOTHIC Logic Diagrams for ECCS Model

Section 8.3.2.1 and 8.3.2.2 of ANP-10299P derive the equations for the vessel injection flow and spillage flow before and after hot leg injection. Figure 06.02.01-85-1 and Figure 06.02.01-85-2 show the GOTHIC flow diagram before and after hot leg injection. As shown in Figure 06.02.01-85-1 and 06.02.01-85-2, Node 31 represents the reactor vessel (or reactor coolant system), Node 10 represents the break room located in the L3 lower equipment area, Node 32 represents the low head safety injection (LHSI) header downstream of the residual heat removal (RHR) heat exchanger, and Node 2 represents the in-containment refueling water storage tank (IRWST).

Before hot leg injection (1200<t<3600s):

Prior to realignment of LHSI, all of the emergency core cooling system (ECCS) flow is injected into the cold legs. Since a break in the cold leg will allow most of the ECCS injection to spill out the break, GOTHIC is modeled so that the ECCS flow rate to the Vessel node is set to match the boil-off rate in the Vessel node. The ECCS water injected into the Vessel node is heated to saturation by decay heat and metal stored energy with excess energy going to boiling. The remainder of the ECCS flow bypasses the vessel and is directed to the sump without heat added.

After hot leg injection (t>3600s):

After the alignment of the LHSI to the hot legs, the reactor vessel evolves from a simple boiling pot to a self-contained circulation loop. As shown in Figure 8.4 of ANP-10299P and Figure 06.02.01-85-2, in order to model the mixing effects in the vessel, the hot leg ECCS injection is split into two paths: the vessel injection path and the vessel bypass path to the IRWST. After hot-leg injection realignment, medium head safety injection (MHSI) flow is not credited for a suction break; hence, this flow path is shut off by a trip signal.

ECCS Boundary Conditions (BC):

The boundary conditions in the GOTHIC model used to calculate the ECCS flow splits between the RCS and containment nodes are given as follows:

In the GOTHIC model, the LHSI and MHSI safety injection flows are modeled as two separate flow boundary conditions. Each of the LHSI and MHSI boundary conditions consists of two coupled boundary conditions modeling the flow splits between the reactor coolant system (RCS) injection flow and recirculation flow back to the IRWST.

The boundary conditions used to model the ECCS injection flows are discussed as follows and listed in Table 06.02.01-85-1:

Table 06.02.01-85-1 — GOTHIC Boundary Conditions used to model ECCS Injection Flows

[ ]

Table 06.02.01-85-2 — GOTHIC Forcing Functions for MHSI and LHSI Pumped Flows

[ ]

Control Variables (CV):

The GOTHIC control variables used to control ECCS vessel injection and bypass flows before and after hot-leg realignment are explained as follows:

Before hot leg injection (1200<t<3600s):

As shown in Figure 06.02.01-85-1 and Figure 8.1 of ANP-10299P, **[**

]

The fraction of total ECCS flow delivered to the Vessel node is calculated by Equation (1) of Section 8.3.2.1 in ANP-10299 as:

[ ] (1)

Since the ECCS containment recirculation flow is modeled in the GOTHIC model, $\dot{m}_{LHSI}$ and $\dot{m}_{MHSI}$ in the equation (1) are implemented as ECCS mass flows that actually reach the RCS.

The vessel steaming rate is calculated internally by GOTHIC based on Equation (2) as:

[ ] (2)

In the GOTHIC model, Equations (1) and (2) are implemented by the control variables according to the following logic:

- CV4 represents the LHSI pumped mass flow rate:

  $CV4 = Wljncc_98$

  where $Wljncc_98$ is the liquid mass flow rate of PF98.

- CV20 calculates the total ECCS mass flow rate delivered to the RCS:

[ ]

- CV32 represents the Vessel steam mass flow rate into the containment.

  $CV32 = \dot{m}_g = Wvjncc_105$

  where $Wvjncc_105$ is the steam mass flow rate of FP105 calculated by GOTHIC.

- CV33 calculates the fraction of RCS delivered ECCS flow matching the steam flow out of the Vessel node:

[ ]

Table 06.02.01-85-3 summarizes the control variables used to control the ECCS flows before the hot leg injection.

Table 06.02.01-85-3 — GOTHIC Control Variables for ECCS Flows Before Hot Leg Injection.

After hot leg injection (t>3600s):

Following the realignment of LHSI flow to the hot legs, the MHSI flow is terminated. This is done by shutting off the MHSI pumped flow represented by BC 5F via a trip flag. All the control variables used for calculating the MHSI flow split in Table 06.02.01-85-3 remain the same; however, since the pumped MHSI flow is zero, they have no effect. During this phase, the

GOTHIC mass and energy release logic model is illustrated in Figure 06.02.01-85-2. The text in the red box shows the vessel injection rate and discharge rate.

As shown in Section 8.3.2.2 of ANP-10299P, the enthalpy of mixed water in the reactor vessel upper plenum, h_{mix}, is determined using the mixing efficiency, η, defined by:

In the GOTHIC model, the control variables used to calculate the ECCS flow split between the Vessel and IRWST node are described as follows.

Control variables CV43 and CV44 are used to calculate the upper plenum mixed-liquid enthalpy, h_{mix}, as follows:

Table 06.02.01-85-4 summarizes the control variables used to control the ECCS flow after hot leg injection.

Table 06.02.01-85-4 — Control Variables for ECCS Flows after Hot Leg Injection Realignment.

Figure 06.02.01-85-1 — GOTHIC Vessel Flow before Hot Leg Injection

Figure 06.02.01-85-2 — GOTHIC Vessel Flow after Hot Leg Injection

Part B: GOTHIC Outputs Needed to Generate Mass and Energy Release Data for FSAR Table 6.2.1-20:

Table 06.02.01-85-5 lists the GOTHIC output parameters used to generate the GOTHIC mass and energy release results for U.S. EPR FSAR Tier 2, Table 6.2.1-20.

The liquid break flow in the U.S. EPR FSAR Tier 2, Table 6.2.1-20 represents only the liquid flow from the Vessel node which is at equilibrium with saturated steam ($Wljncc_105$ at hs_31). Since only this portion of the break flow is allowed to be discharged to the room above the heavy floor, in order to reduce condensation on the heavy floor and other rooms, the remainder of break liquid, which is redirected back to IRWST, is not reported in this table.

Table 06.02.01-85-5: GOTHIC Outputs for Long-term Mass and Energy Results for CLPS Break

FSAR Table 6.2.1-20	GOTHIC Output	Descriptions
Average steam mass flow	$Wlvjncc_105$	Vapor mass flow rate of FP105.
Average steam enthalpy	hs_31	Vapor enthalpy of Vessel node 31.
Average liquid mass flow	$Wljncc_105$	Liquid mass flow rate at FP105.
Average liquid enthalpy	hl_31	Liquid enthalpy of Vessel node 31.

FSAR Impact:

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

Question 06.02.01-87:

1. This question is a follow-up to the February 9 and 10, 2010 audit on containment analyses. For the postulated 0.2 ft^2 main steam line split break at zero reactor power analyzed by AREVA as described in FSAR 6.2 Rev. 2 interim, provide the following information. All plots should be extended to 2500 seconds with no more than 5 traces per figure:
   a) Tables of the mass and energy release as a function of time.
   b) The location of the break (elevation, and local subdivided cell number or lumped parameter node number)
   c) The location of the maximum atmospheric temperature (elevation, and local subdivided cell number or lumped parameter node number)
   d) Time history plots for maximum atmospheric temperature location and pressure. The atmospheric temperature plot should include both gas (vapor) and saturation temperatures.
   e) 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.
   f) 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.
   g) A time history temperature plot for the inner containment shell (sub-divided or lumped parameter node in figure) in proximity to the location of maximum atmospheric (gas) temperature

Response to Question 06.02.01-87:

a) Table 06.02.01-87-1 shows the mass and energy of the break used in the 0.2ft^2 split break case at zero reactor power.

b) The break is located in the L1 and L2 upper equipment room which is modeled by the lumped Node 7 in GOTHIC. The elevation of the break flow path is at +93.4 ft.

c) The maximum atmospheric temperature occurs in the break location, L1 and L2 upper equipment room modeled by Node 7 in GOTHIC. The upper equipment room has an elevation of +63.98 ft.

d) Figure 06.02.01-87-01 and Figure 06.02.01-87-02 show the time history atmospheric temperature and pressure plots for the location where maximum temperature occurs, Node 7.

e) Figures 06.02.01-87-03 through 06.02.01-87-17 and Figure 06.02.01-87-01 show the time history atmospheric temperature plots for nodes 1 through 30, excluding Node 25.

f) Figures 06.02.01-87-18 through 06.02.01-87-27 show the time history atmospheric temperature plots for the subdivided nodes nearest the containment centerline.

g) Figures 06.02.01-87-28 through 06.02.01-87-32 show the time history atmospheric temperature plots for the subdivided nodes of the inner containment shell in the proximity of the location of maximum atmospheric temperature, Node 7. The inner containment near the location of maximum atmospheric temperature is modeled in Node 25 as subdivided cells.

FSAR Impact:

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

Table 06.02.01-87-1: Mass and Energy Release

Time (sec)	Mass Flow (lbm/sec)	Enthalpy (BTU/lbm)
0.0000	0.00	0.00
0.0001	268.64	1195.36
0.0020	268.64	1195.36
0.0021	542.41	1196.62
1.0020	542.41	1196.62
1.0021	541.35	1197.07
2.0020	541.35	1197.07
2.0021	541.40	1196.95
3.0020	541.40	1196.95
3.0021	541.30	1197.02
4.0020	541.30	1197.02
4.0021	540.40	1197.04
5.0020	540.40	1197.04
5.0021	539.60	1197.14
6.0020	539.60	1197.14
6.0021	538.80	1197.10
7.0020	538.80	1197.10
7.0021	538.00	1197.17
8.0020	538.00	1197.17
8.0021	537.30	1197.50
9.0020	537.30	1197.50
9.0021	536.50	1197.37
10.0020	536.50	1197.37
10.0021	535.90	1197.44
11.0020	535.90	1197.44
11.0021	535.30	1197.59
12.0020	535.30	1197.59
12.0021	534.60	1197.73
13.0020	534.60	1197.73
13.0021	533.90	1197.73
14.0020	533.90	1197.73
14.0021	533.40	1197.99
15.0020	533.40	1197.99
15.0021	532.70	1197.78
16.0020	532.70	1197.78
16.0021	532.00	1198.08
17.0020	532.00	1198.08
17.0021	531.50	1197.93
18.0020	531.50	1197.93
18.0021	531.10	1197.93
19.0020	531.10	1197.93
19.0021	530.00	1197.55
20.0020	530.00	1197.55
20.0021	529.00	1198.68

Time (sec)	Mass Flow (lbm/sec)	Enthalpy (BTU/lbm)
21.0020	529.00	1198.68
21.0021	529.00	1199.62
22.0020	529.00	1199.62
22.0021	529.00	1198.30
23.0020	529.00	1198.30
23.0021	528.00	1196.97
24.0020	528.00	1196.97
24.0021	527.00	1198.10
25.0020	527.00	1198.10
25.0021	527.00	1199.43
26.0020	527.00	1199.43
26.0021	527.00	1198.67
27.0020	527.00	1198.67
27.0021	529.00	1198.67
28.0020	529.00	1198.67
28.0021	530.00	1199.24
29.0020	530.00	1199.24
29.0021	532.00	1199.81
30.0020	532.00	1199.81
30.0021	533.00	1197.72
31.0020	533.00	1197.72
31.0021	534.00	1199.43
32.0020	534.00	1199.43
32.0021	534.00	1200.76
33.0020	534.00	1200.76
33.0021	533.00	1200.00
34.0020	533.00	1200.00
34.0021	533.00	1198.86
35.0020	533.00	1198.86
35.0021	532.00	1200.19
36.0020	532.00	1200.19
36.0021	533.00	1199.05
37.0020	533.00	1199.05
37.0021	531.00	1198.09
38.0020	531.00	1198.09
38.0021	532.00	1201.72
39.0020	532.00	1201.72
39.0021	530.00	1198.28
40.0020	530.00	1198.28
40.0021	531.00	1199.62
41.0020	531.00	1199.62
41.0021	529.00	1200.96
42.0020	529.00	1200.96
42.0021	530.00	1199.81
43.0020	530.00	1199.81

Time (sec)	Mass Flow (lbm/sec)	Enthalpy (BTU/lbm)
43.0021	529.00	1199.04
44.0020	529.00	1199.04
44.0021	528.00	1200.19
45.0020	528.00	1200.19
45.0021	528.00	1201.54
46.0020	528.00	1201.54
46.0021	527.00	1200.19
47.0020	527.00	1200.19
47.0021	523.00	1199.81
48.0020	523.00	1199.81
48.0021	515.00	1200.78
49.0020	515.00	1200.78
49.0021	512.02	1200.20
50.0000	512.02	1200.20
50.0001	509.50	1201.98
52.0000	509.50	1201.98
52.0001	506.00	1201.60
54.0000	506.00	1201.60
54.0001	503.00	1202.42
56.0000	503.00	1202.42
56.0001	498.00	1202.74
58.0000	498.00	1202.74
58.0001	491.50	1203.90
60.0000	491.50	1203.90
60.0001	485.50	1202.90
62.0000	485.50	1202.90
62.0001	480.50	1203.97
64.0000	480.50	1203.97
64.0001	476.00	1205.80
66.0000	476.00	1205.80
66.0001	472.00	1205.63
68.0000	472.00	1205.63
68.0001	468.00	1204.92
70.0000	468.00	1204.92
70.0001	464.00	1206.80
72.0000	464.00	1206.80
72.0001	461.00	1206.51
74.0000	461.00	1206.51
74.0001	458.00	1207.88
76.0000	458.00	1207.88
76.0001	455.00	1207.04
78.0000	455.00	1207.04
78.0001	452.00	1208.76
80.0000	452.00	1208.76
80.0001	449.00	1208.25

Time (sec)	Mass Flow (lbm/sec)	Enthalpy (BTU/lbm)
82.0000	449.00	1208.25
82.0001	446.50	1207.96
84.0000	446.50	1207.96
84.0001	444.00	1209.03
86.0000	444.00	1209.03
86.0001	441.50	1210.34
88.0000	441.50	1210.34
88.0001	438.50	1208.90
90.0000	438.50	1208.90
90.0001	436.50	1210.46
92.0000	436.50	1210.46
92.0001	433.50	1210.75
94.0000	433.50	1210.75
94.0001	431.50	1209.76
96.0000	431.50	1209.76
96.0001	428.50	1211.70
98.0000	428.50	1211.70
98.0001	427.00	1211.16
100.0000	427.00	1211.16
100.0001	422.60	1210.95
105.0000	422.60	1210.95
105.0001	417.60	1212.59
110.0000	417.60	1212.59
110.0001	412.60	1212.05
115.0000	412.60	1212.05
115.0001	408.00	1213.38
120.0000	408.00	1213.38
120.0001	403.60	1213.58
125.0000	403.60	1213.58
125.0001	399.00	1214.08
130.0000	399.00	1214.08
130.0001	394.60	1213.92
135.0000	394.60	1213.92
135.0001	390.60	1214.78
140.0000	390.60	1214.78
140.0001	386.00	1215.36
145.0000	386.00	1215.36
145.0001	381.60	1215.52
150.0000	381.60	1215.52
150.0001	377.80	1215.78
155.0000	377.80	1215.78
155.0001	374.20	1216.73
160.0000	374.20	1216.73
160.0001	371.00	1216.50
165.0000	371.00	1216.50

Time (sec)	Mass Flow (lbm/sec)	Enthalpy (BTU/lbm)
165.0001	367.80	1216.64
170.0000	367.80	1216.64
170.0001	364.60	1217.89
175.0000	364.60	1217.89
175.0001	361.40	1217.31
180.0000	361.40	1217.31
180.0001	358.40	1218.14
185.0000	358.40	1218.14
185.0001	355.60	1218.22
190.0000	355.60	1218.22
190.0001	352.60	1218.38
195.0000	352.60	1218.38
195.0001	350.00	1218.29
200.0000	350.00	1218.29
200.0001	347.00	1219.02
205.0000	347.00	1219.02
205.0001	344.60	1219.51
210.0000	344.60	1219.51
210.0001	341.80	1218.71
215.0000	341.80	1218.71
215.0001	339.20	1219.93
220.0000	339.20	1219.93
220.0001	336.80	1219.71
225.0000	336.80	1219.71
225.0001	334.40	1219.50
230.0000	334.40	1219.50
230.0001	331.80	1220.61
235.0000	331.80	1220.61
235.0001	329.60	1220.27
240.0000	329.60	1220.27
240.0001	327.20	1220.66
245.0000	327.20	1220.66
245.0001	325.00	1220.92
250.0000	325.00	1220.92
250.0001	322.40	1220.84
255.0000	322.40	1220.84
255.0001	320.20	1220.49
260.0000	320.20	1220.49
260.0001	317.80	1221.52
265.0000	317.80	1221.52
265.0001	315.60	1222.43
270.0000	315.60	1222.43
270.0001	313.80	1221.16
275.0000	313.80	1221.16
275.0001	311.60	1222.08

Time (sec)	Mass Flow (lbm/sec)	Enthalpy (BTU/lbm)
280.0000	311.60	1222.08
280.0001	310.00	1222.72
285.0000	310.00	1222.72
285.0001	307.80	1221.43
290.0000	307.80	1221.43
290.0001	306.20	1222.88
295.0000	306.20	1222.88
295.0001	304.20	1222.22
300.0000	304.20	1222.22
300.0001	302.20	1222.88
305.0000	302.20	1222.88
305.0001	300.60	1222.89
310.0000	300.60	1222.89
310.0001	298.80	1222.89
315.0000	298.80	1222.89
315.0001	297.20	1222.75
320.0000	297.20	1222.75
320.0001	295.40	1223.58
325.0000	295.40	1223.58
325.0001	293.60	1222.60
330.0000	293.60	1222.60
330.0001	292.00	1223.29
335.0000	292.00	1223.29
335.0001	290.40	1223.83
340.0000	290.40	1223.83
340.0001	288.80	1223.68
345.0000	288.80	1223.68
345.0001	287.20	1224.39
350.0000	287.20	1224.39
350.0001	285.40	1223.39
355.0000	285.40	1223.39
355.0001	284.00	1223.94
360.0000	284.00	1223.94
360.0001	282.40	1224.50
365.0000	282.40	1224.50
365.0001	280.80	1224.36
370.0000	280.80	1224.36
370.0001	279.20	1224.93
375.0000	279.20	1224.93
375.0001	277.80	1224.62
380.0000	277.80	1224.62
380.0001	276.20	1225.20
385.0000	276.20	1225.20
385.0001	274.80	1224.89
390.0000	274.80	1224.89

Time (sec)	Mass Flow (lbm/sec)	Enthalpy (BTU/lbm)
390.0001	273.40	1225.48
395.0000	273.40	1225.48
395.0001	271.80	1224.26
400.0000	271.80	1224.26
400.0001	270.40	1226.50
405.0000	270.40	1226.50
405.0001	268.80	1225.28
410.0000	268.80	1225.28
410.0001	267.60	1224.96
415.0000	267.60	1224.96
415.0001	266.20	1225.39
420.0000	266.20	1225.39
420.0001	264.80	1225.83
425.0000	264.80	1225.83
425.0001	263.40	1226.27
430.0000	263.40	1226.27
430.0001	262.00	1225.95
435.0000	262.00	1225.95
435.0001	260.80	1226.23
440.0000	260.80	1226.23
440.0001	259.40	1225.91
445.0000	259.40	1225.91
445.0001	258.00	1227.13
450.0000	258.00	1227.13
450.0001	257.00	1225.86
455.0000	257.00	1225.86
455.0001	255.60	1226.92
460.0000	255.60	1226.92
460.0001	254.20	1225.63
465.0000	254.20	1225.63
465.0001	253.20	1227.67
470.0000	253.20	1227.67
470.0001	251.80	1225.40
475.0000	251.80	1225.40
475.0001	250.60	1227.45
480.0000	250.60	1227.45
480.0001	249.40	1226.94
485.0000	249.40	1226.94
485.0001	248.20	1226.43
490.0000	248.20	1226.43
490.0001	247.00	1227.53
495.0000	247.00	1227.53
495.0001	245.80	1227.01
500.0000	245.80	1227.01
500.0001	242.70	1227.24

Time (sec)	Mass Flow (lbm/sec)	Enthalpy (BTU/lbm)
520.0000	242.70	1227.24
520.0001	237.70	1227.81
540.0000	237.70	1227.81
540.0001	232.85	1228.26
560.0000	232.85	1228.26
560.0001	228.40	1228.33
580.0000	228.40	1228.33
580.0001	224.05	1228.74
600.0000	224.05	1228.74
600.0001	219.80	1229.35
620.0000	219.80	1229.35
620.0001	215.65	1229.02
640.0000	215.65	1229.02
640.0001	211.75	1229.52
660.0000	211.75	1229.52
660.0001	208.05	1229.75
680.0000	208.05	1229.75
680.0001	204.40	1229.94
700.0000	204.40	1229.94
700.0001	200.90	1229.97
720.0000	200.90	1229.97
720.0001	197.50	1230.18
740.0000	197.50	1230.18
740.0001	194.20	1230.43
760.0000	194.20	1230.43
760.0001	191.20	1230.39
780.0000	191.20	1230.39
780.0001	188.20	1230.54
800.0000	188.20	1230.54
800.0001	185.25	1230.77
820.0000	185.25	1230.77
820.0001	182.35	1230.60
840.0000	182.35	1230.60
840.0001	179.40	1231.05
860.0000	179.40	1231.05
860.0001	176.50	1231.16
880.0000	176.50	1231.16
880.0001	173.65	1231.21
900.0000	173.65	1231.21
900.0001	170.85	1231.49
920.0000	170.85	1231.49
920.0001	168.20	1231.57
940.0000	168.20	1231.57
940.0001	165.60	1231.28
960.0000	165.60	1231.28

Time (sec)	Mass Flow (lbm/sec)	Enthalpy (BTU/lbm)
960.0001	163.05	1231.52
980.0000	163.05	1231.52
980.0001	160.55	1231.78
1000.0000	160.55	1231.78
1000.0001	157.95	1231.65
1020.0000	157.95	1231.65
1020.0001	155.50	1231.83
1040.0000	155.50	1231.83
1040.0001	153.60	1231.45
1060.0000	153.60	1231.45
1060.0001	156.80	1230.55
1080.0000	156.80	1230.55
1080.0001	160.10	1230.48
1100.0000	160.10	1230.48
1100.0001	161.55	1229.96
1120.0000	161.55	1229.96
1120.0001	162.00	1229.63
1140.0000	162.00	1229.63
1140.0001	161.85	1229.53
1160.0000	161.85	1229.53
1160.0001	161.55	1229.34
1180.0000	161.55	1229.34
1180.0001	161.35	1229.93
1200.0000	161.35	1229.93
1200.0001	161.35	1230.01
1220.0000	161.35	1230.01
1220.0001	161.30	1229.63
1240.0000	161.30	1229.63
1240.0001	161.05	1230.36
1260.0000	161.05	1230.36
1260.0001	160.90	1230.27
1280.0000	160.90	1230.27
1280.0001	160.85	1230.96
1300.0000	160.85	1230.96
1300.0001	160.85	1230.65
1320.0000	160.85	1230.65
1320.0001	160.75	1231.10
1340.0000	160.75	1231.10
1340.0001	160.70	1230.86
1360.0000	160.70	1230.86
1360.0001	160.55	1231.08
1380.0000	160.55	1231.08
1380.0001	160.30	1231.44
1400.0000	160.30	1231.44
1400.0001	160.15	1231.73

Time (sec)	Mass Flow (lbm/sec)	Enthalpy (BTU/lbm)
1420.0000	160.15	1231.73
1420.0001	159.65	1231.37
1440.0000	159.65	1231.37
1440.0001	159.05	1232.32
1460.0000	159.05	1232.32
1460.0001	158.40	1232.64
1480.0000	158.40	1232.64
1480.0001	157.60	1232.87
1500.0000	157.60	1232.87
1500.0001	156.65	1233.32
1520.0000	156.65	1233.32
1520.0001	156.05	1233.26
1540.0000	156.05	1233.26
1540.0001	155.50	1233.76
1560.0000	155.50	1233.76
1560.0001	154.85	1234.42
1580.0000	154.85	1234.42
1580.0001	153.80	1235.05
1600.0000	153.80	1235.05
1600.0001	152.65	1235.83
1620.0000	152.65	1235.83
1620.0001	152.55	1236.39
1640.0000	152.55	1236.39
1640.0001	152.20	1235.47
1660.0000	152.20	1235.47
1660.0001	151.55	1236.56
1680.0000	151.55	1236.56
1680.0001	150.35	1237.45
1700.0000	150.35	1237.45
1700.0001	149.55	1238.46
1720.0000	149.55	1238.46
1720.0001	149.60	1237.89
1740.0000	149.60	1237.89
1740.0001	148.75	1238.32
1760.0000	148.75	1238.32
1760.0001	147.15	1239.55
1780.0000	147.15	1239.55
1780.0001	144.70	1240.50
1800.0000	144.70	1240.50
1800.0001	144.85	1240.59
1820.0000	144.85	1240.59
1820.0001	145.55	1240.55
1840.0000	145.55	1240.55
1840.0001	142.75	1241.25
1860.0000	142.75	1241.25

Time (sec)	Mass Flow (lbm/sec)	Enthalpy (BTU/lbm)
1860.0001	139.70	1244.09
1880.0000	139.70	1244.09
1880.0001	134.80	1246.66
1900.0000	134.80	1246.66
1900.0001	127.60	1249.22
1920.0000	127.60	1249.22
1920.0001	117.20	1255.12
1940.0000	117.20	1255.12
1940.0001	104.95	1256.79
1960.0000	104.95	1256.79
1960.0001	92.90	1263.19
1980.0000	92.90	1263.19
1980.0001	75.10	1268.97
2000.0000	75.10	1268.97
2000.0001	60.35	1270.92
2020.0000	60.35	1270.92
2020.0001	48.60	1275.72
2040.0000	48.60	1275.72
2040.0001	39.20	1279.34
2060.0000	39.20	1279.34
2060.0001	31.65	1282.78
2080.0000	31.65	1282.78
2080.0001	25.60	1285.16
2100.0000	25.60	1285.16
2100.0001	20.80	1289.16
2120.0000	20.80	1289.16
2120.0001	16.85	1290.80
2140.0000	16.85	1290.80
2140.0001	13.65	1291.97
2160.0000	13.65	1291.97
2160.0001	11.45	1288.21
2180.0000	11.45	1288.21
2180.0001	12.00	1292.89
2200.0000	12.00	1292.89
2200.0001	12.45	1284.00
2220.0000	12.45	1284.00
2220.0001	15.20	1276.32
2240.0000	15.20	1276.32
2240.0001	11.10	1288.29
2260.0000	11.10	1288.29
2260.0001	10.55	1293.84
2280.0000	10.55	1293.84
2280.0001	11.05	1285.07
2300.0000	11.05	1285.07
2300.0001	10.45	1287.08

Time (sec)	Mass Flow (lbm/sec)	Enthalpy (BTU/lbm)
2320.0000	10.45	1287.08
2320.0001	11.30	1287.61
2340.0000	11.30	1287.61
2340.0001	12.15	1280.99
2360.0000	12.15	1280.99
2360.0001	8.90	1292.13
2380.0000	8.90	1292.13
2380.0001	10.75	1282.41
2400.0000	10.75	1282.41
2400.0001	9.30	1279.57
2420.0000	9.30	1279.57
2420.0001	7.55	1291.39
2440.0000	7.55	1291.39
2440.0001	5.40	1296.30
2460.0000	5.40	1296.30
2460.0001	3.45	1275.36
2480.0000	3.45	1275.36
2480.0001	1.90	1315.79
2500.0000	1.90	1315.79
2500.0001	1.11	1250.00
2507.2000	1.11	1250.00

Figure 06.02.01-87-01 — Temperature in L1 and L2 Upper Equipment Room

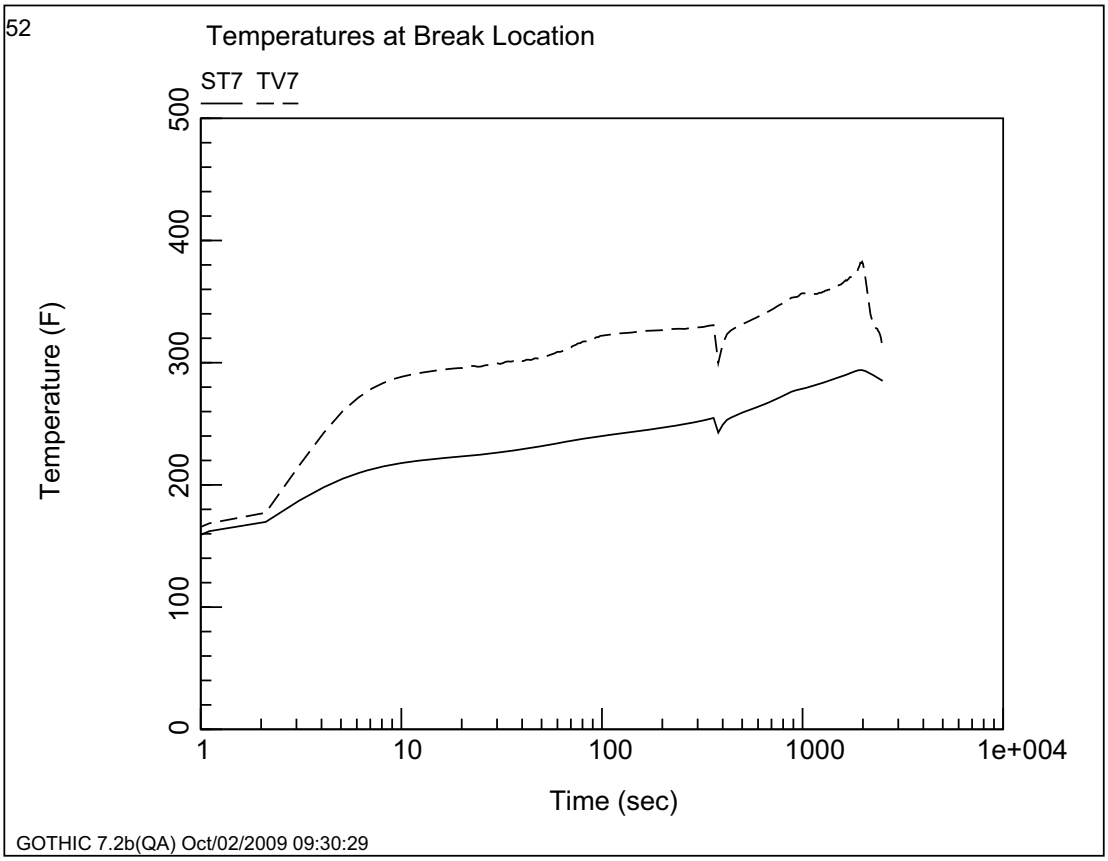


Figure 06.02.01-87-02 — Pressure in L1 and L2 Equipment Room

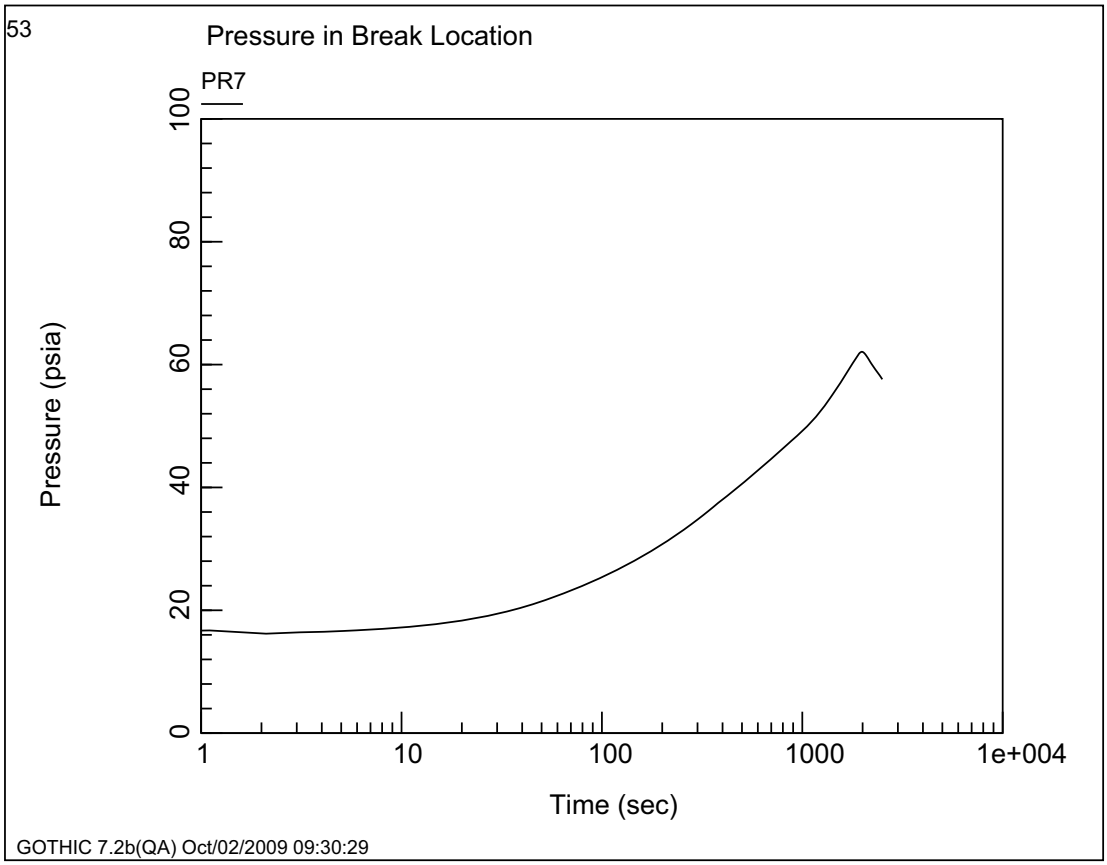


Figure 06.02.01-87-03 — Temperatures of Nodes 1 and 2

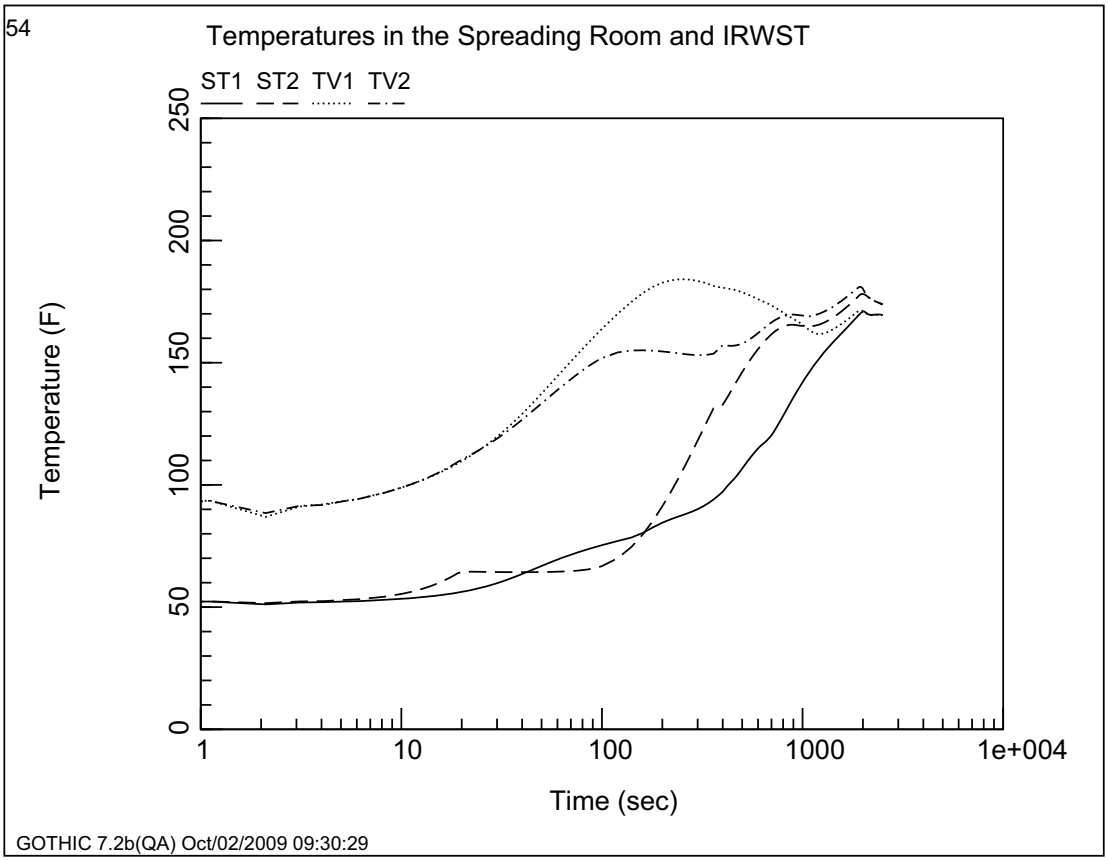


Figure 06.02.01-87-04 — Temperatures of Nodes 3 and 4

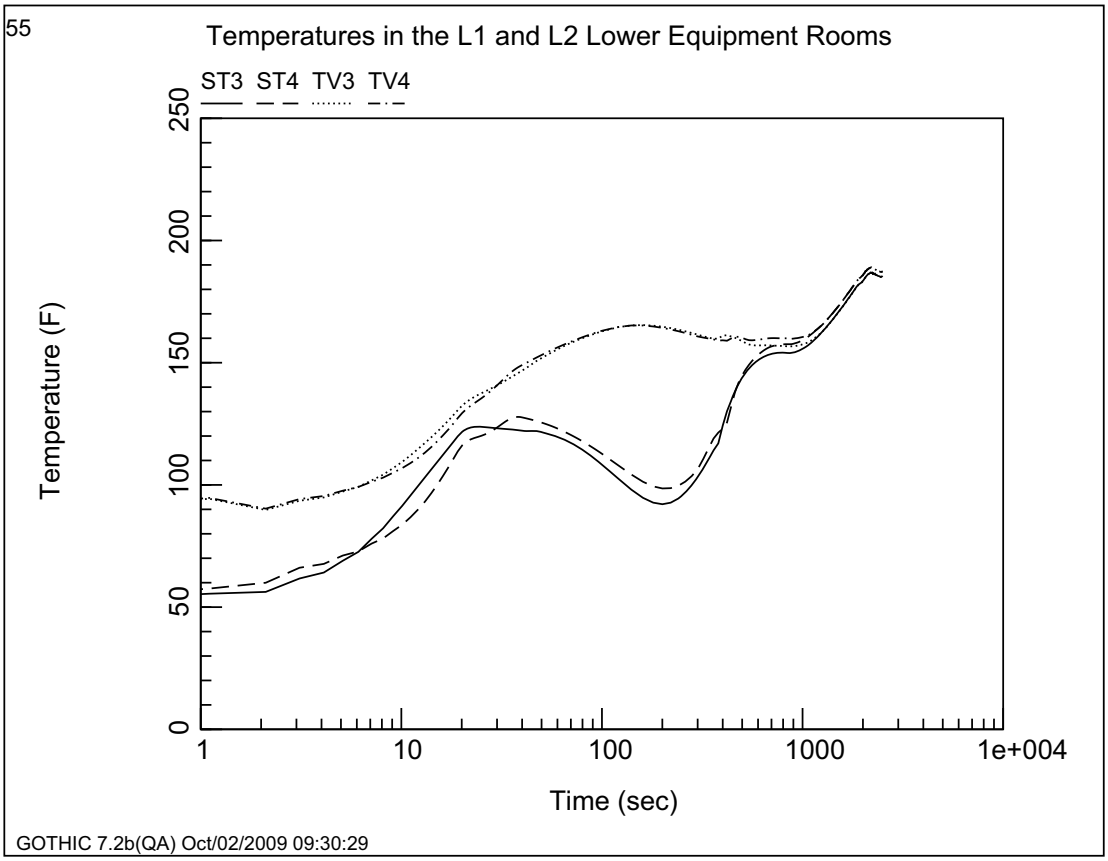


Figure 06.02.01-87-05 — Temperatures of Nodes 5 and 6

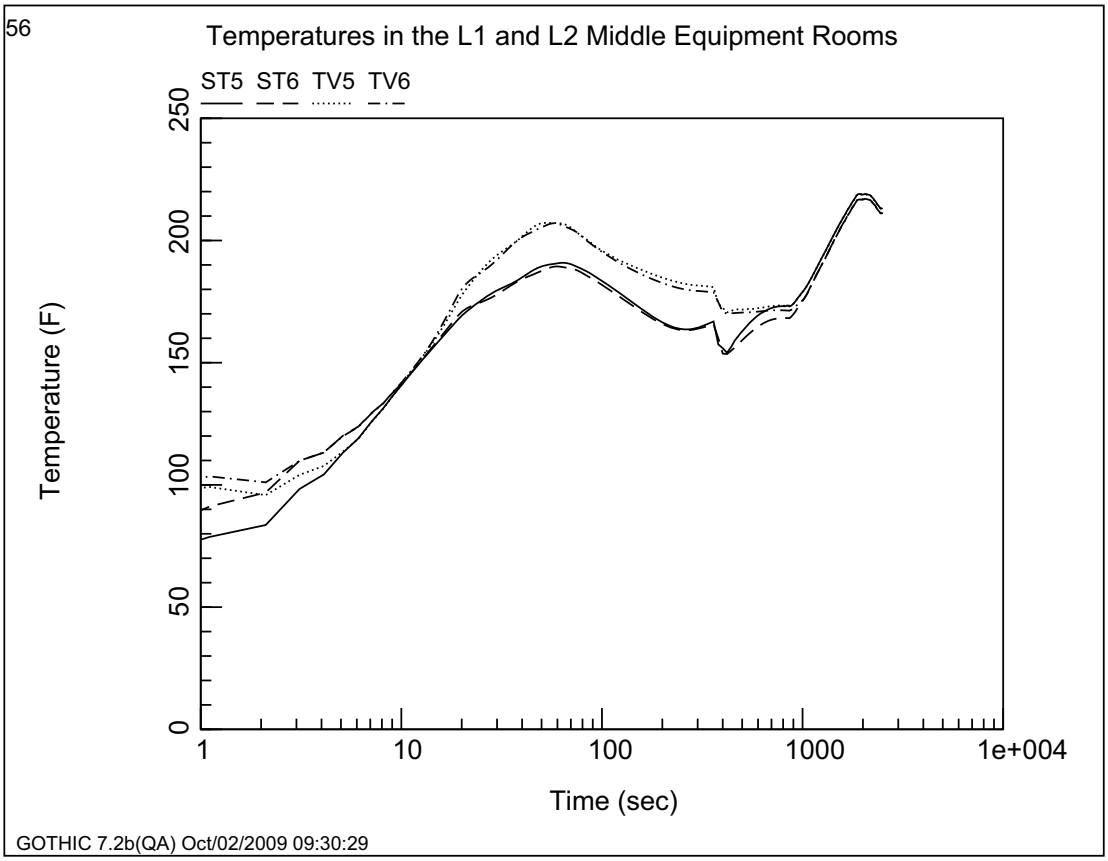


Figure 06.02.01-87-06 — Temperatures of Nodes 8 and 9

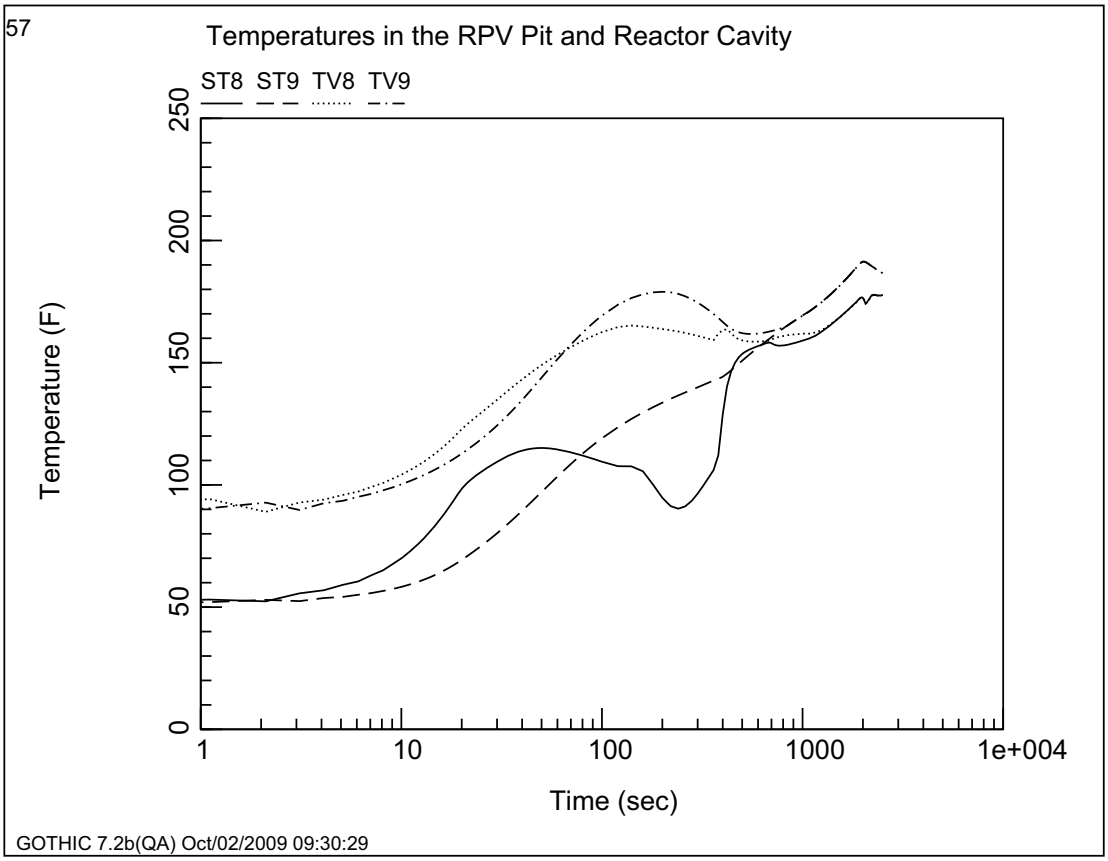


Figure 06.02.01-87-07 — Temperatures of Nodes 10 and 11

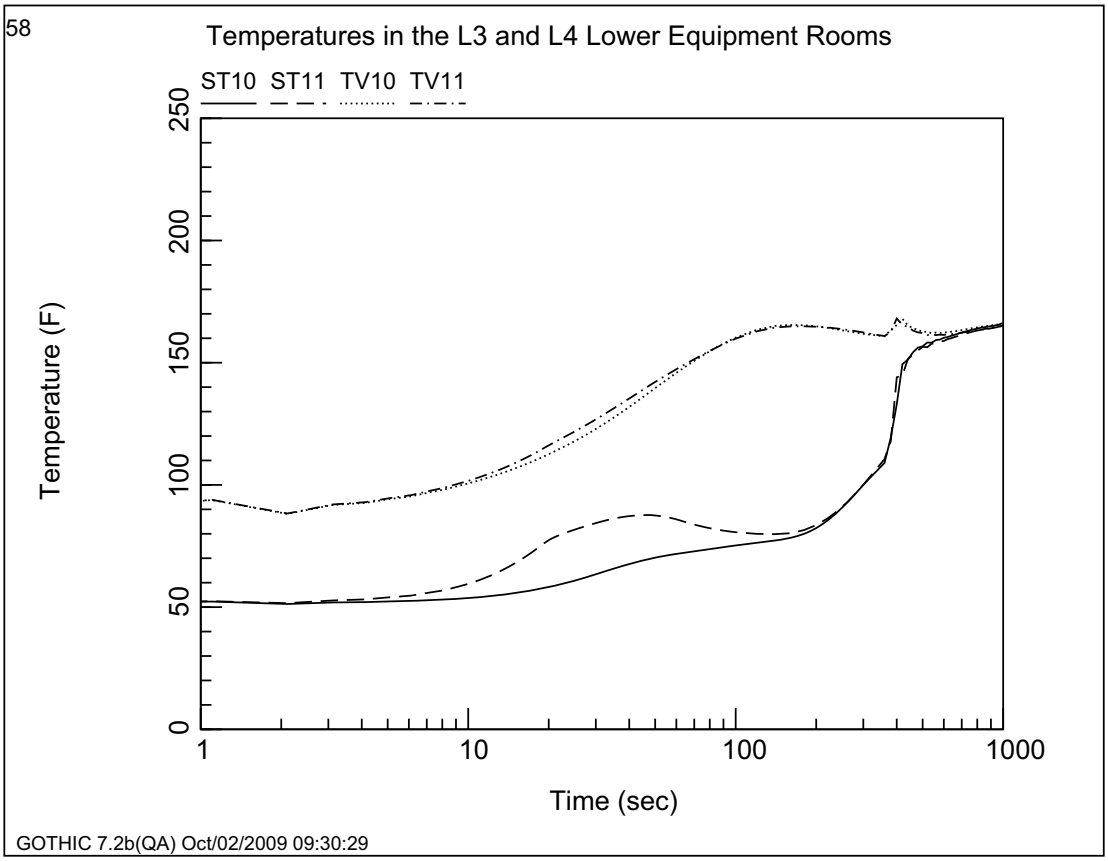


Figure 06.02.01-87-08 — Temperatures of Nodes 12 and 13

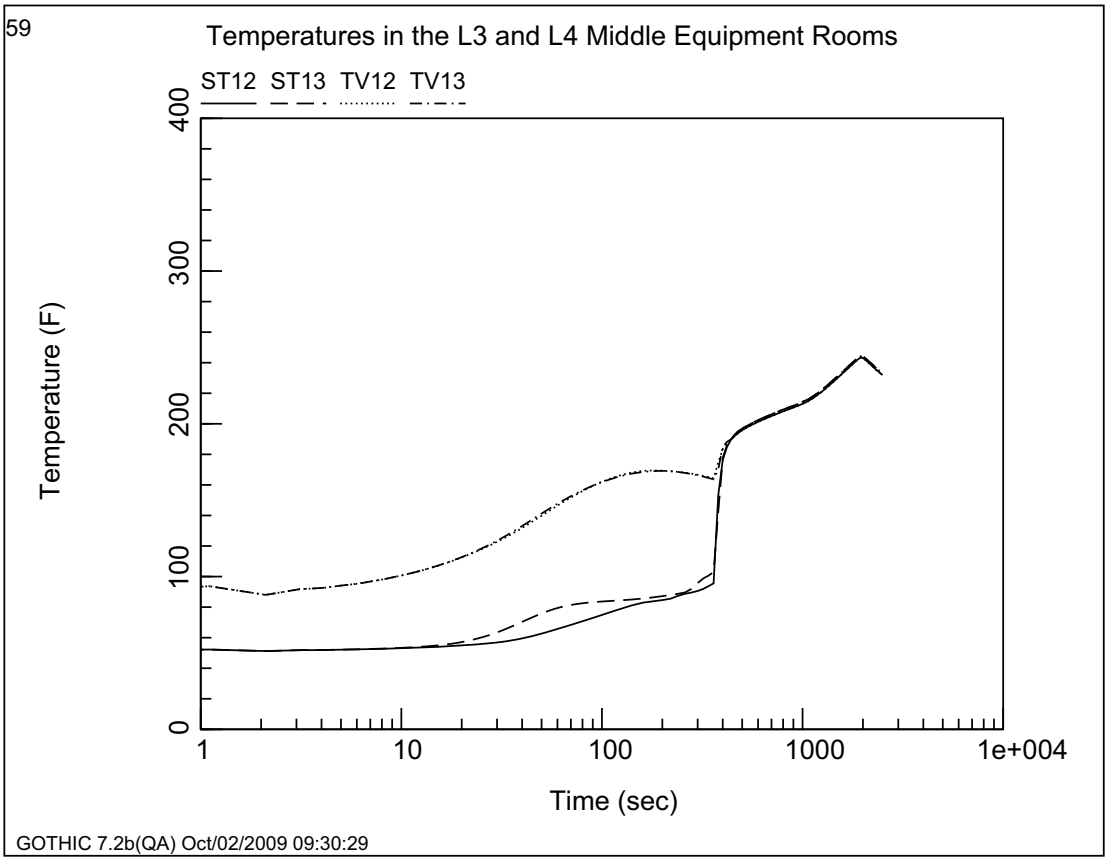


Figure 06.02.01-87-09 — Temperatures of Node 14

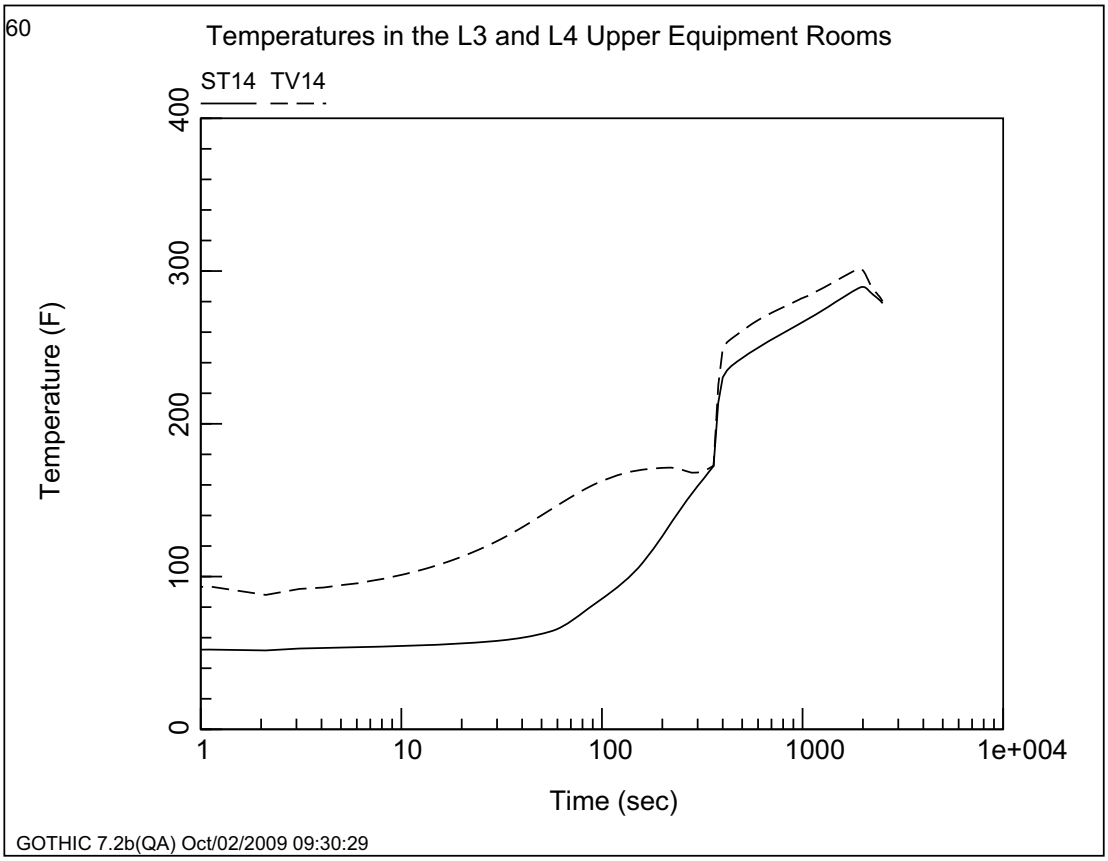


Figure 06.02.01-87-10 — Temperatures of Nodes 15 and 16

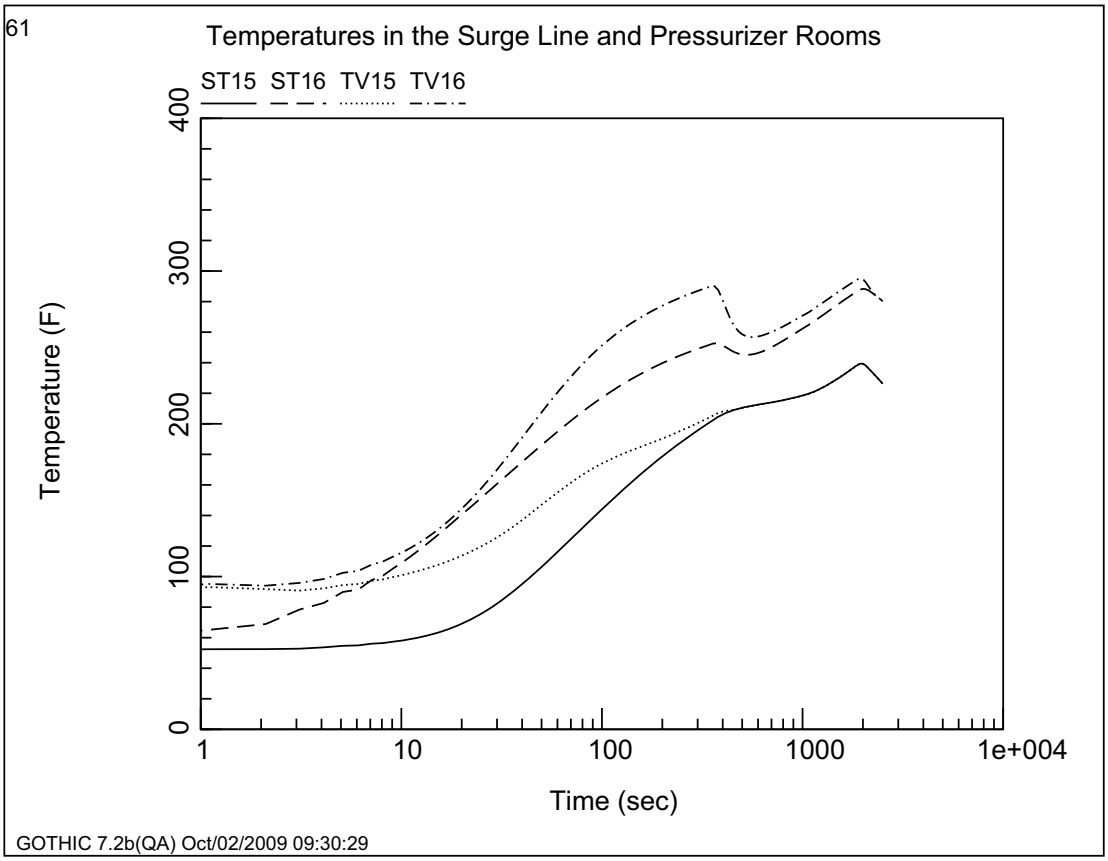


Figure 06.02.01-87-11 — Temperatures of Nodes 17 and 18

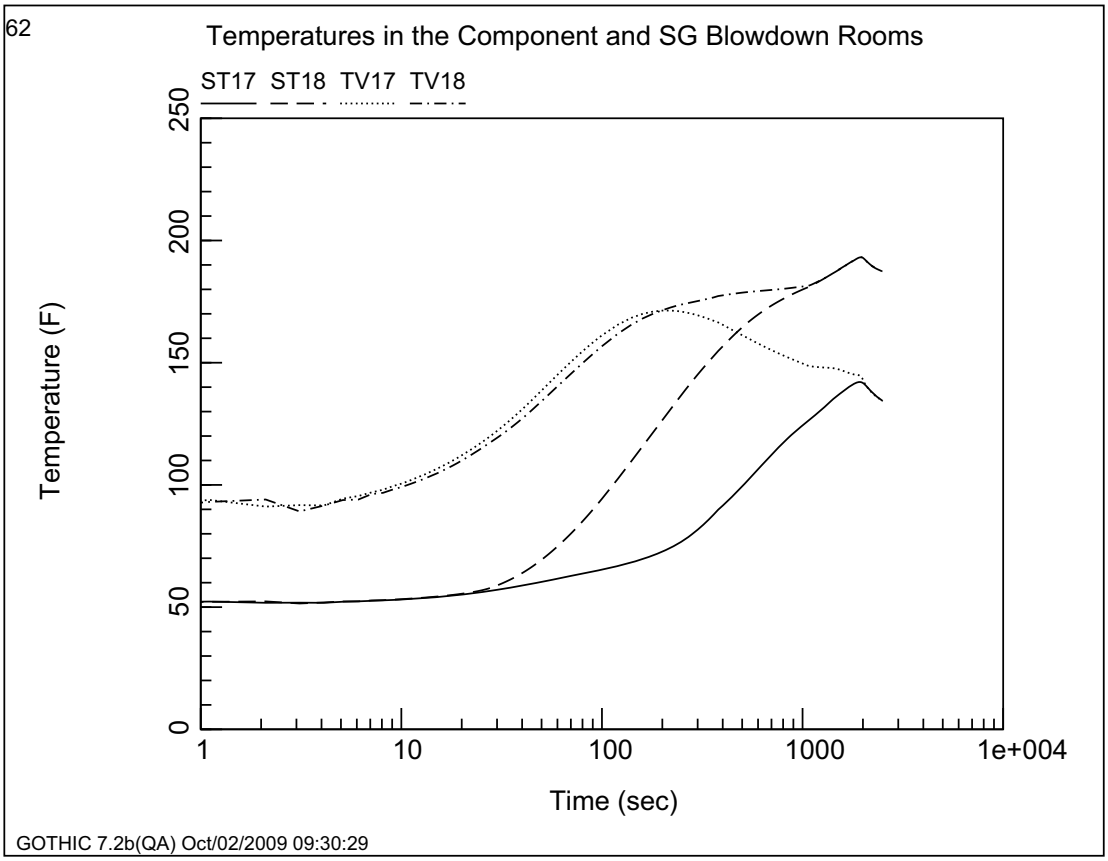


Figure 06.02.01-87-12 — Temperatures of Nodes 19 and 20

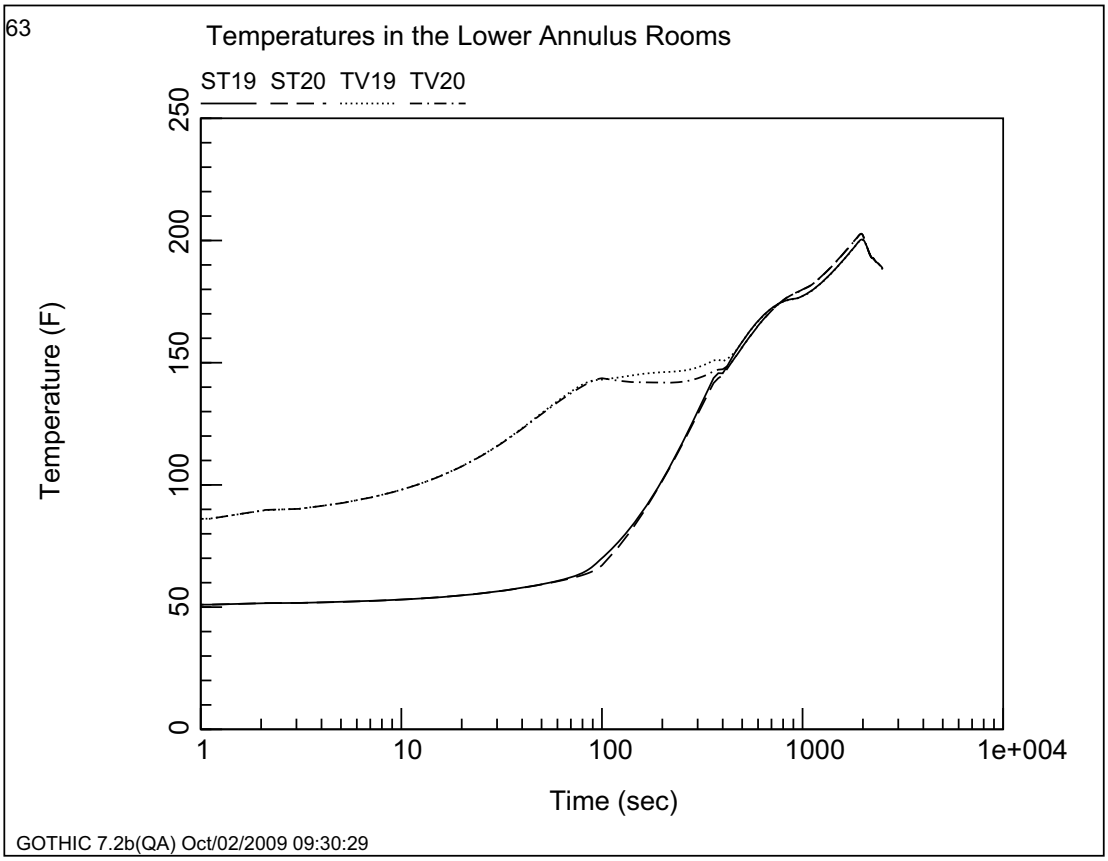


Figure 06.02.01-87-13 — Temperatures of Nodes 21 and 22

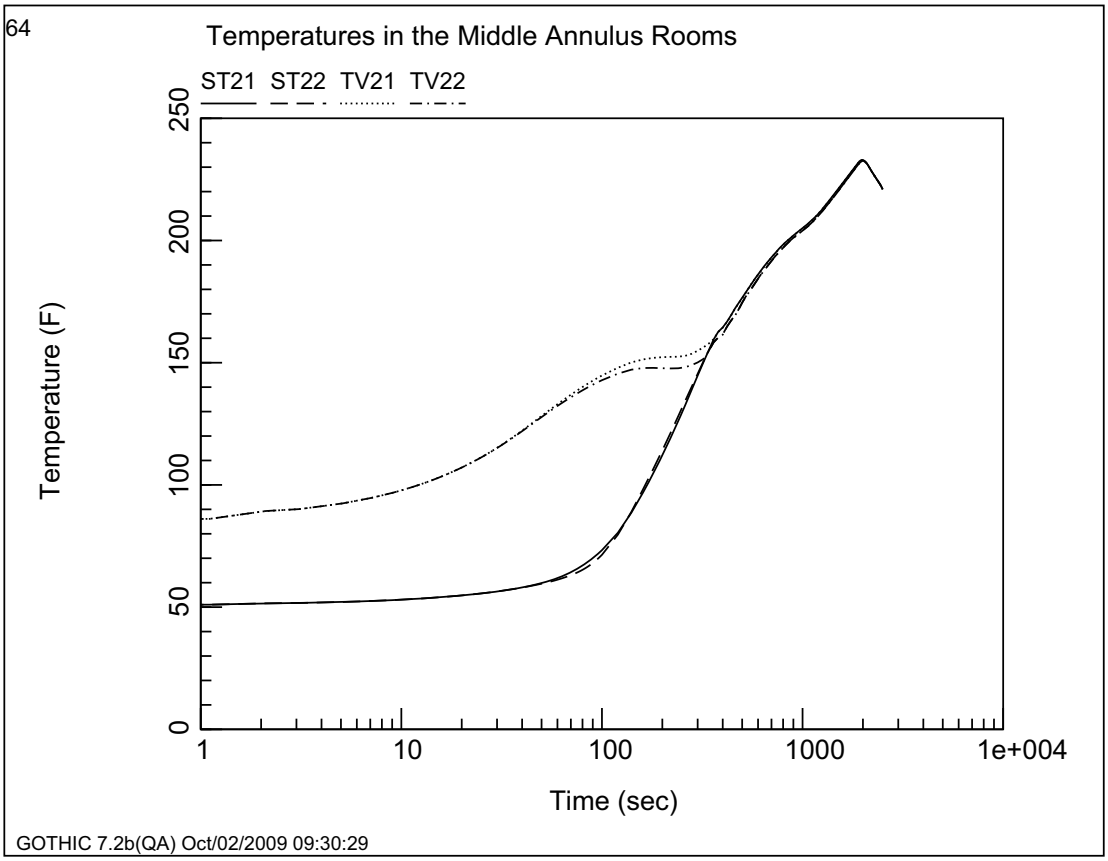


Figure 06.02.01-87-14 — Temperatures of Nodes 23 and 24

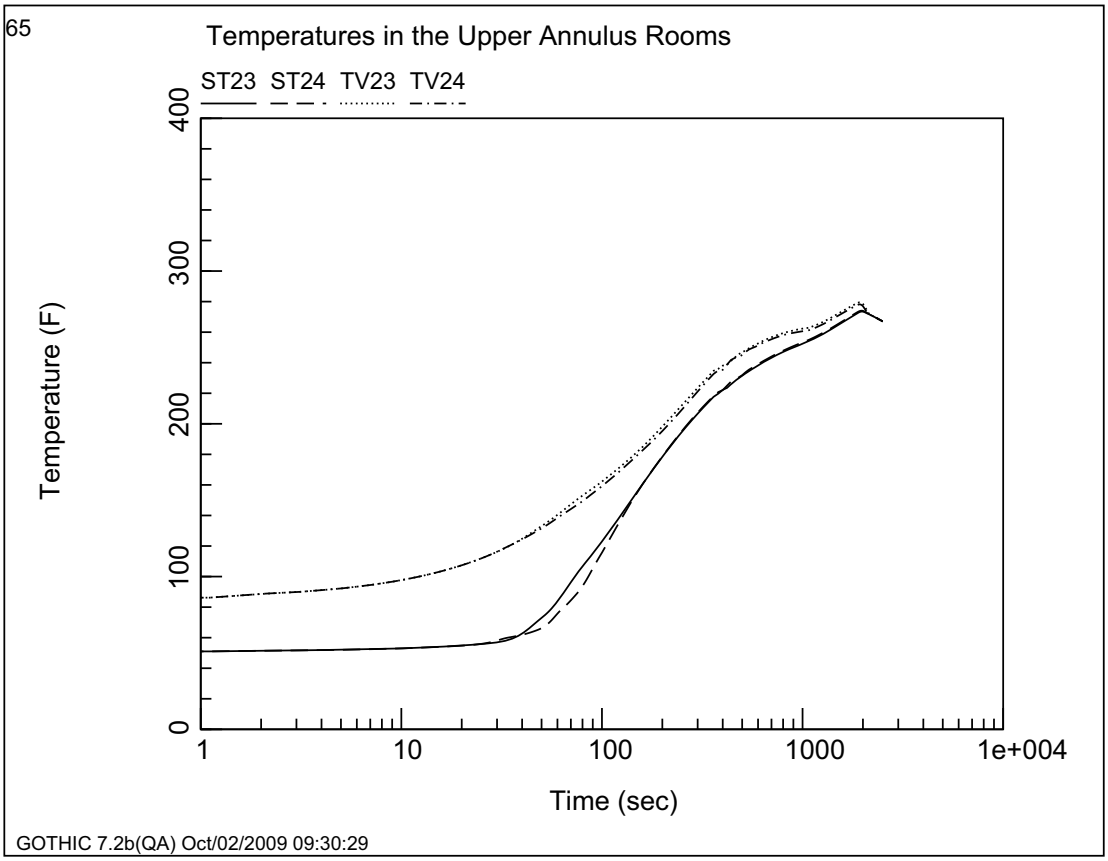


Figure 06.02.01-87-15 — Temperatures of Nodes 26 and 27

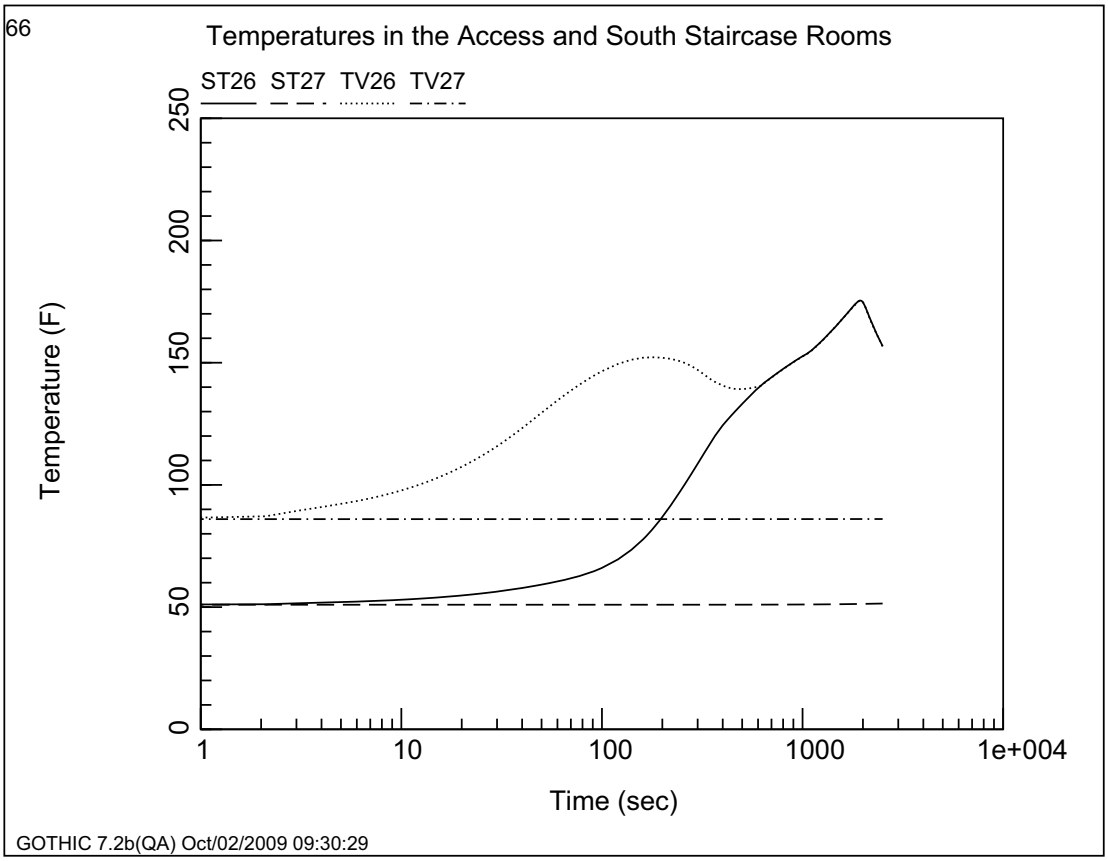


Figure 06.02.01-87-16 — Temperatures of Nodes 28 and 29

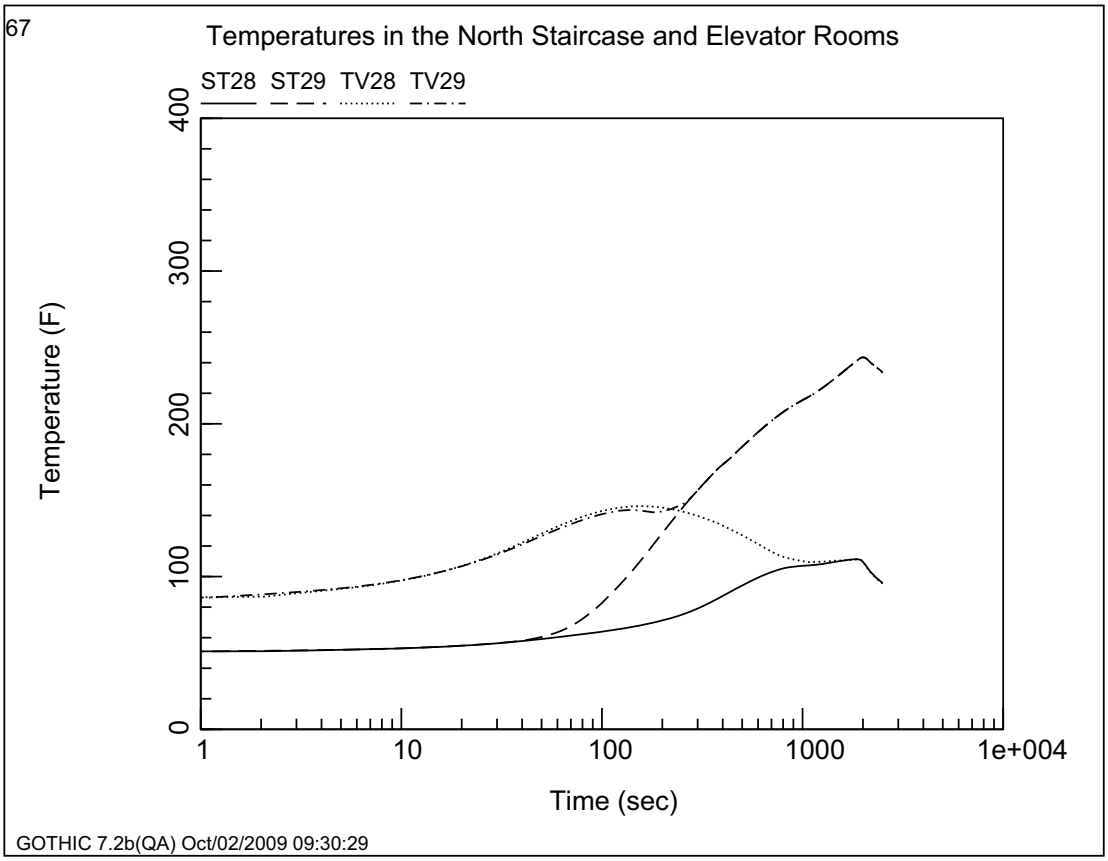


Figure 06.02.01-87-17 — Temperatures of Node 30

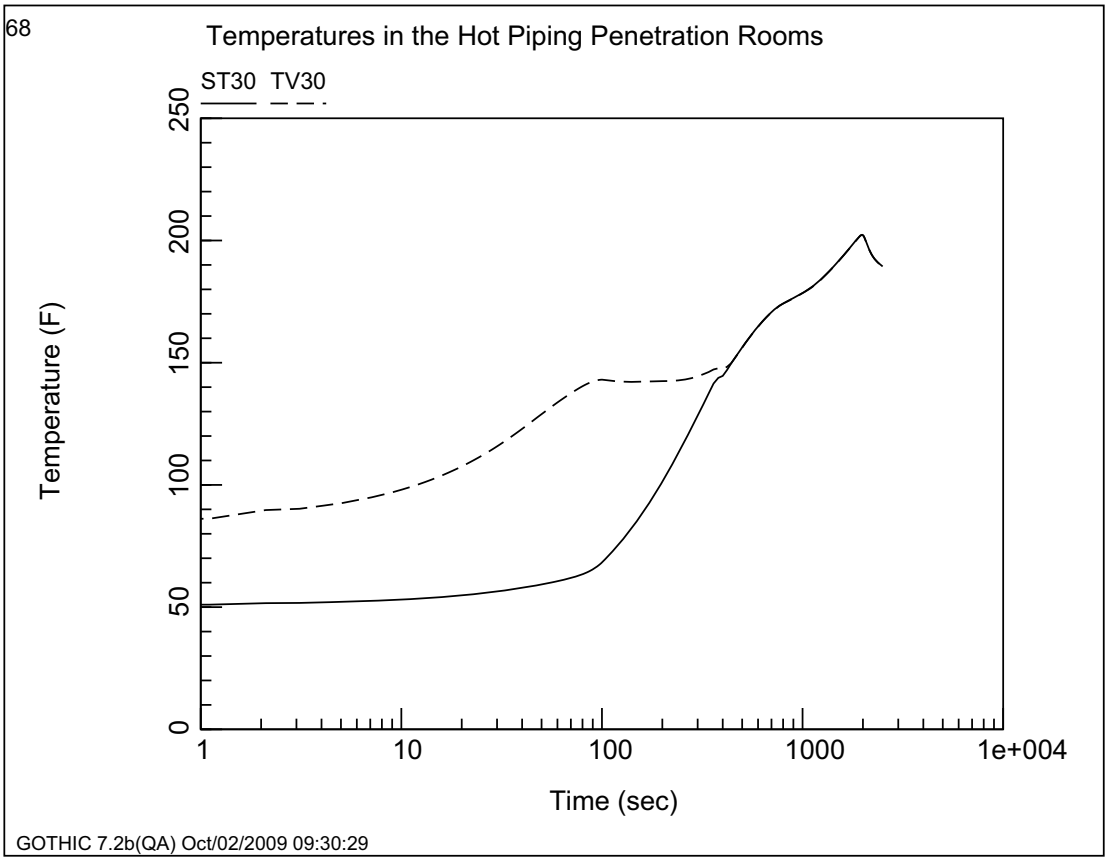


Figure 06.02.01-87-18 — Temperatures in the Center of the Subdivided Containment Dome at Elevations of +63.98 ft and +71.53 ft

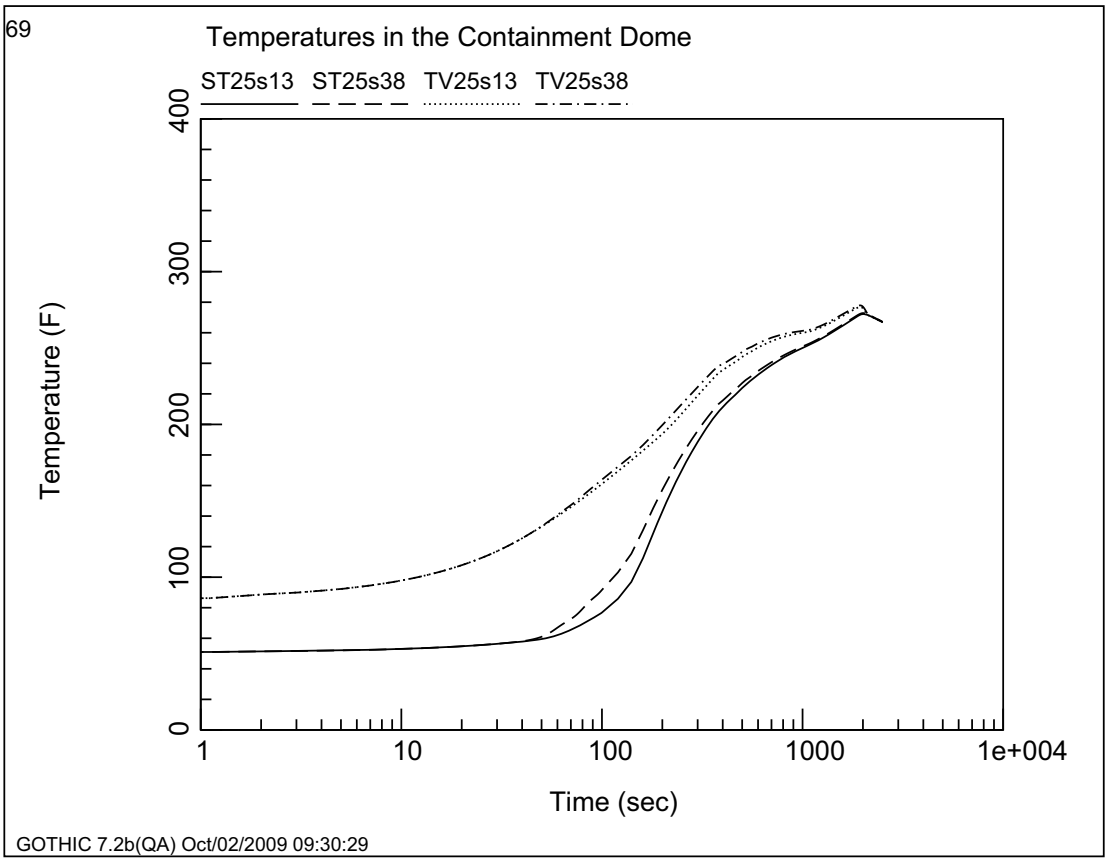


Figure 06.02.01-87-19 — Temperatures in the Center of the Subdivided Containment Dome at Elevations of +79.07ft and +86.29ft

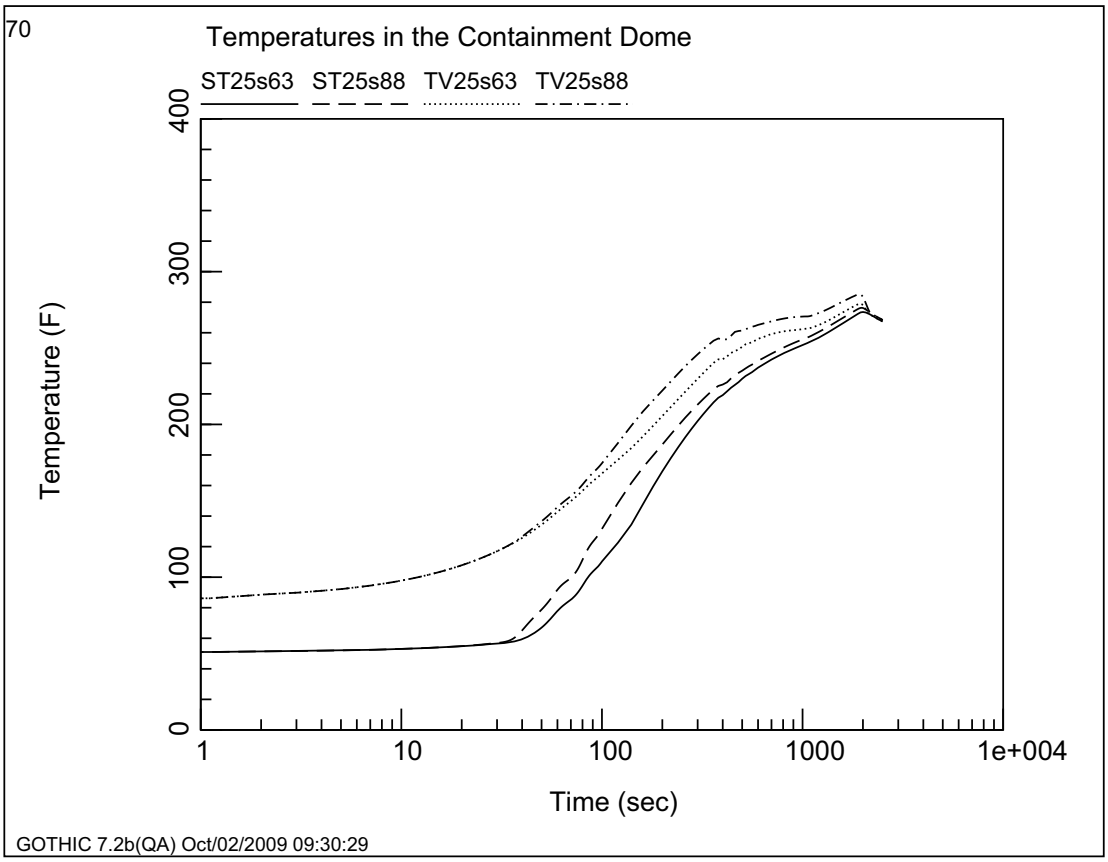


Figure 06.02.01-87-20 — Temperatures in the Center of the Subdivided Containment Dome at Elevations of +93.51ft and +98.59ft

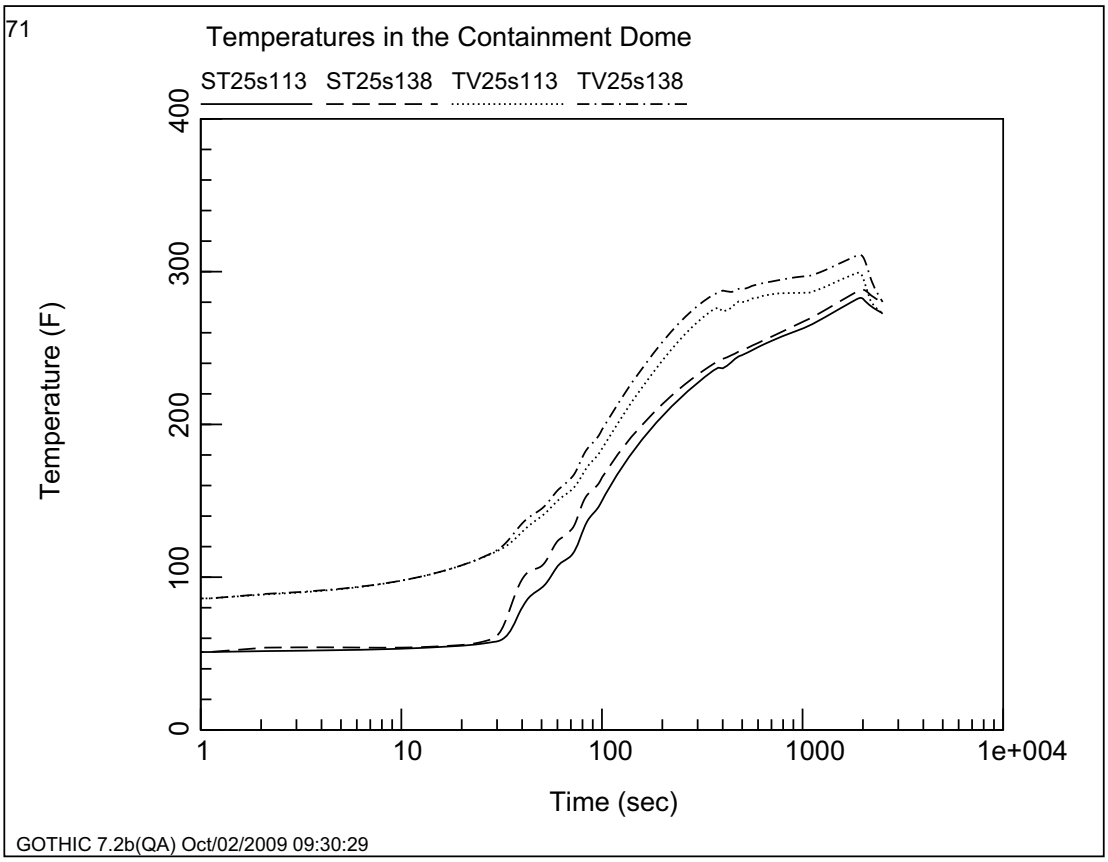


Figure 06.02.01-87-21 — Temperatures in the Center of the Subdivided Containment Dome at Elevations of +103.68ft and +108.76ft

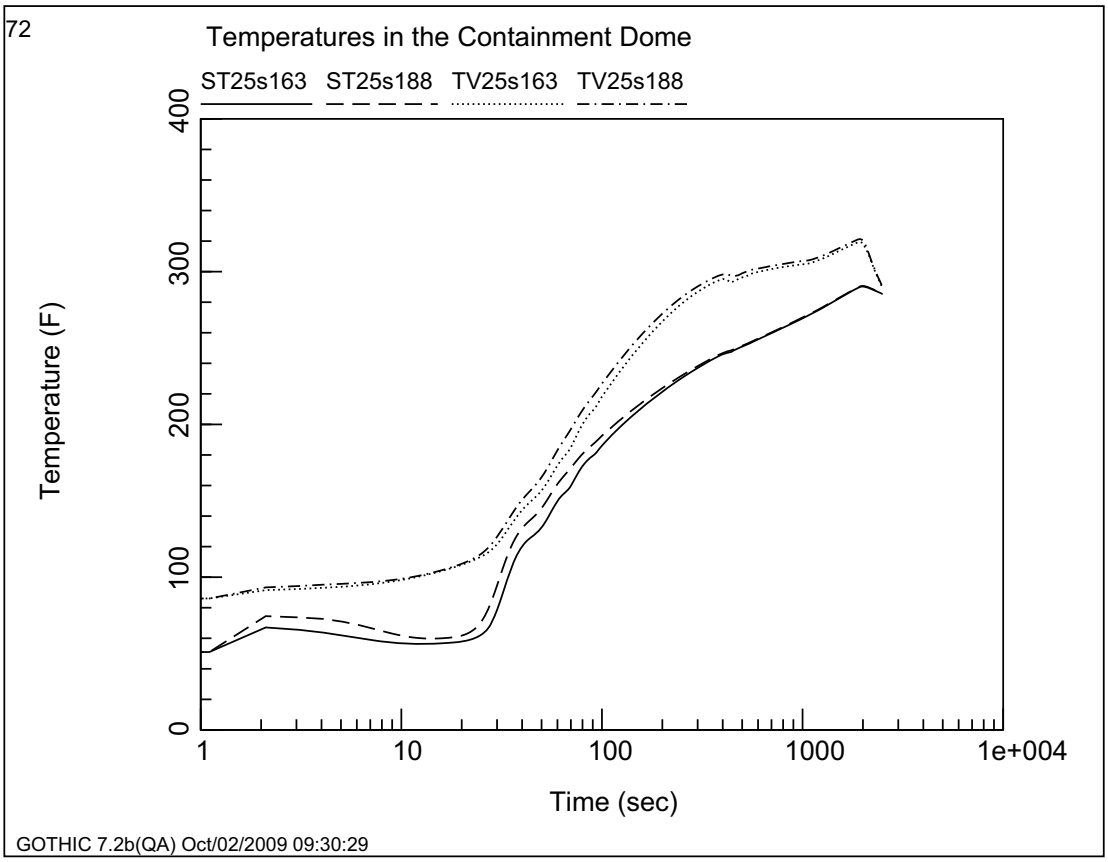


Figure 06.02.01-87-22 — Temperatures in the Center of the Subdivided Containment Dome at Elevations of +113.85ft and +119.90ft

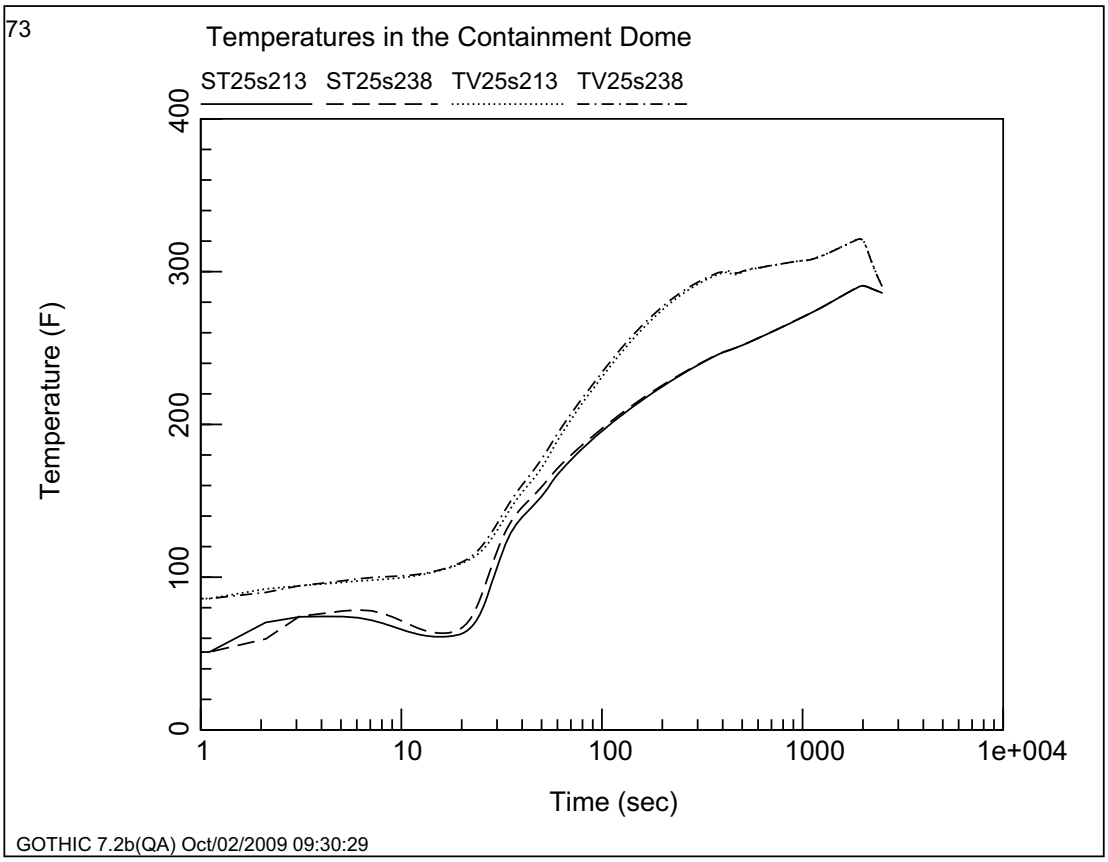


Figure 06.02.01-87-23 — Temperatures in the Center of the Subdivided Containment Dome at Elevations of +125.95ft and +132.00ft

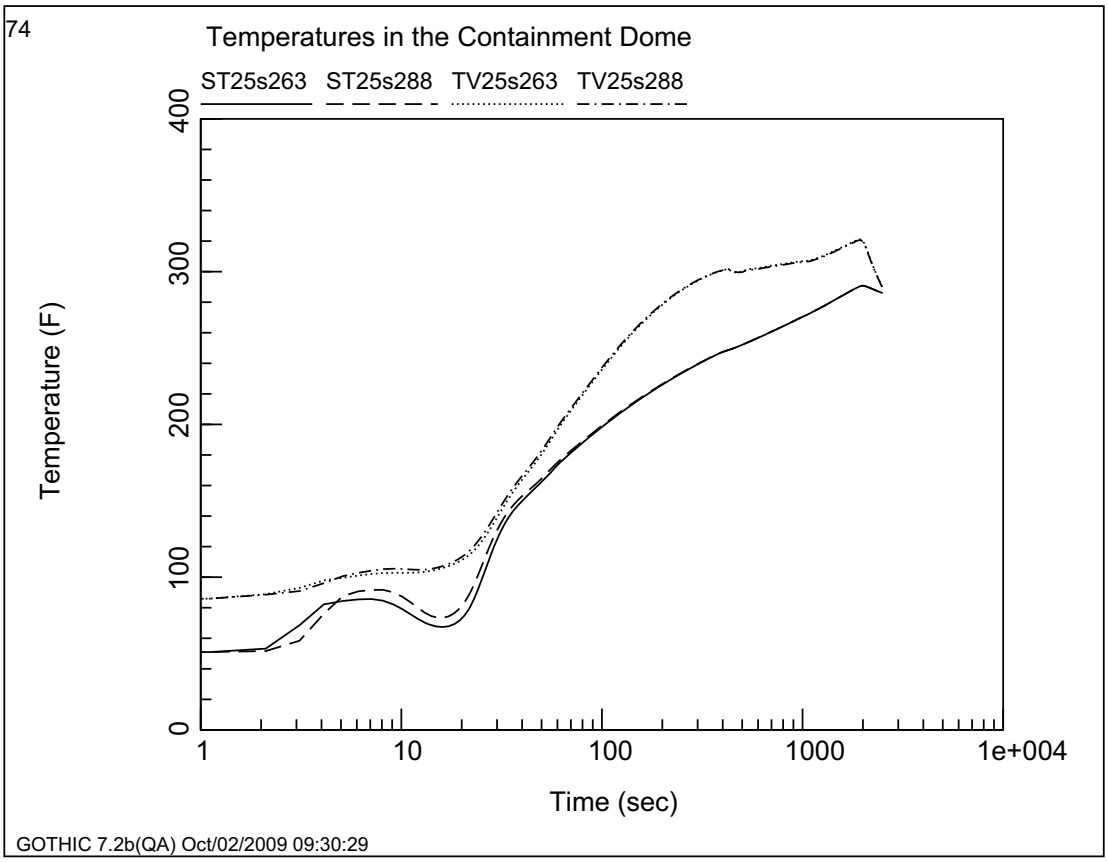


Figure 06.02.01-87-24 — Temperatures in the Center of the Subdivided Containment Dome at Elevations of +138.05ft and +144.10ft

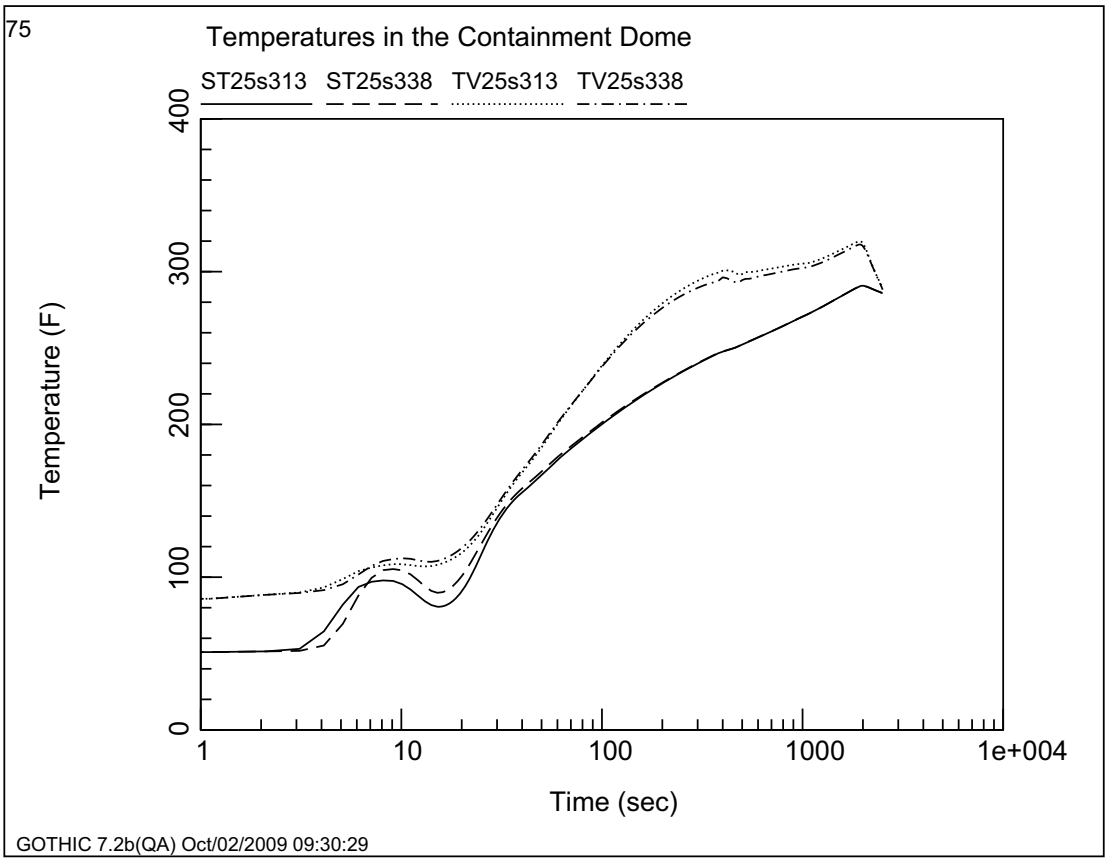


Figure 06.02.01-87-25 — Temperatures in the Center of the Subdivided Containment Dome at Elevations of +151.12ft and +158.14ft

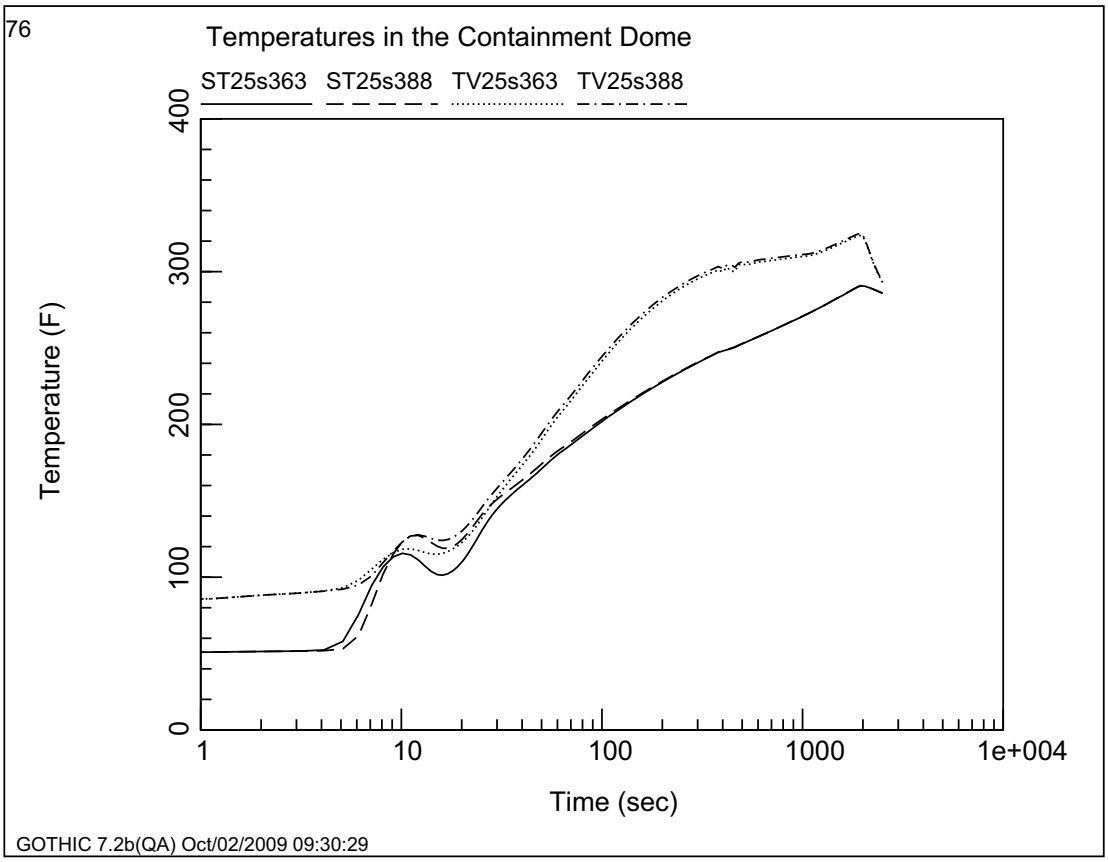


Figure 06.02.01-87-26 — Temperatures in the Center of the Subdivided Containment Dome at Elevations of +165.16ft and +172.99ft

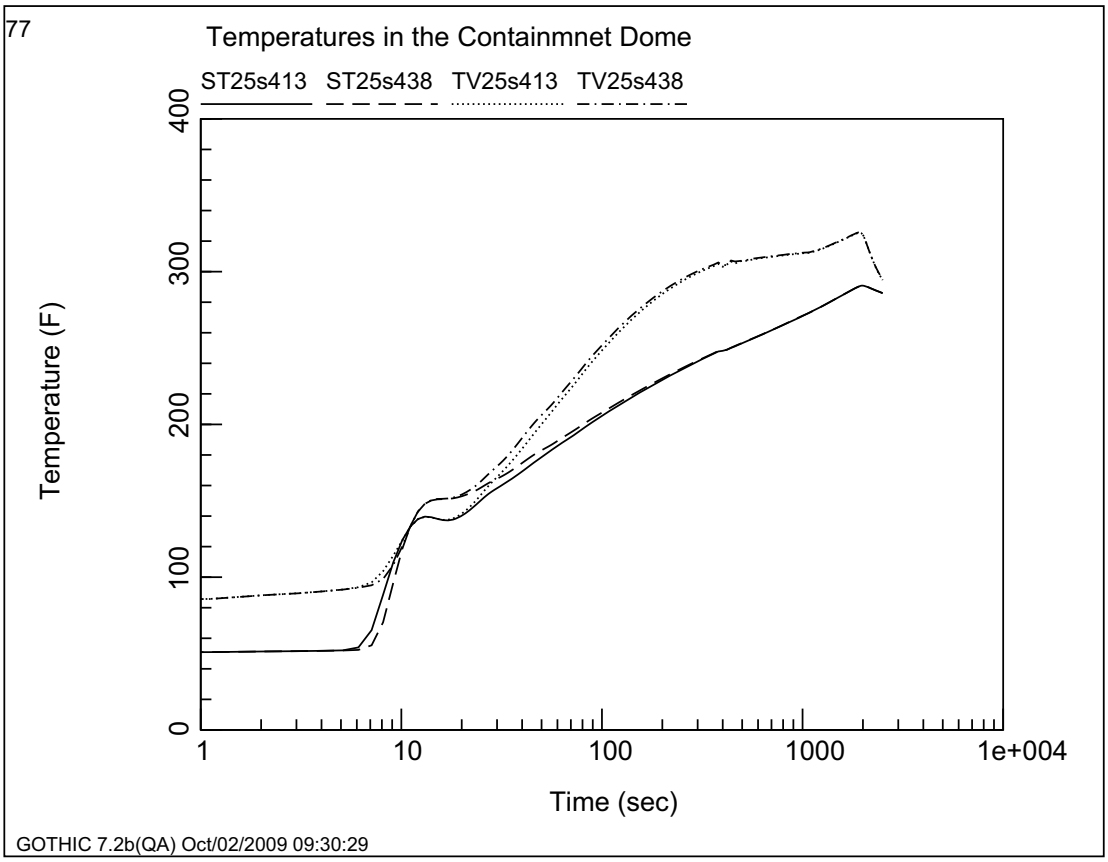


Figure 06.02.01-87-27 — Temperatures in the Center of the Subdivided Containment Dome at an Elevation of +180.82ft

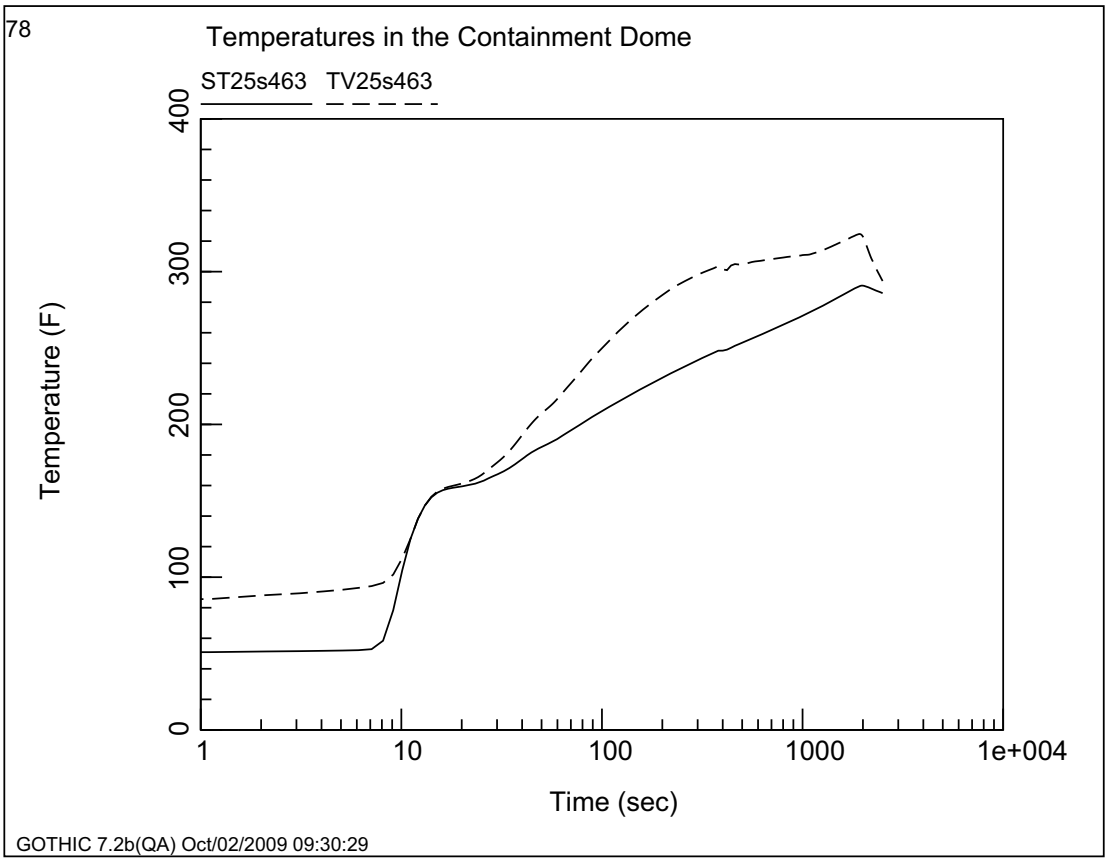


Figure 06.02.01-87-28 — Temperatures of Containment Wall at an Elevation of +93.51ft, near the Location of Maximum Temperature

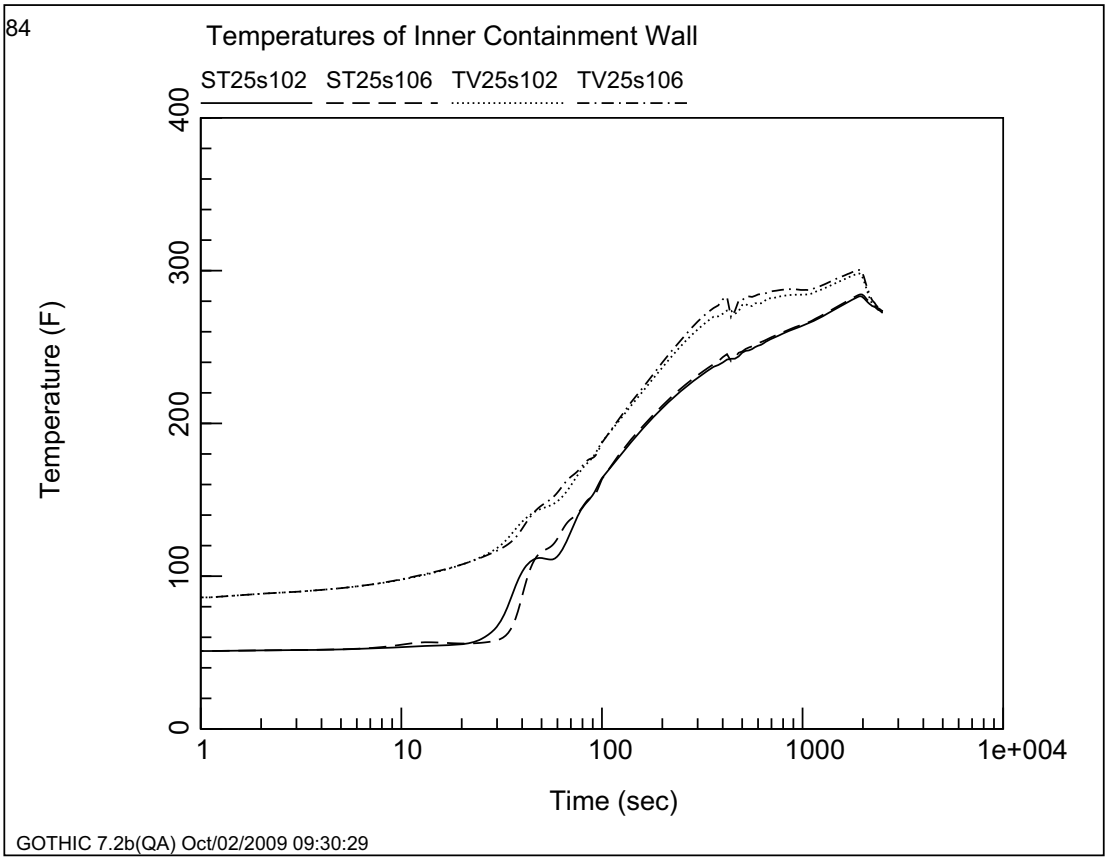


Figure 06.02.01-87-29 — Temperatures of Containment Wall at an Elevation of +93.51ft, near the Location of Maximum Temperature

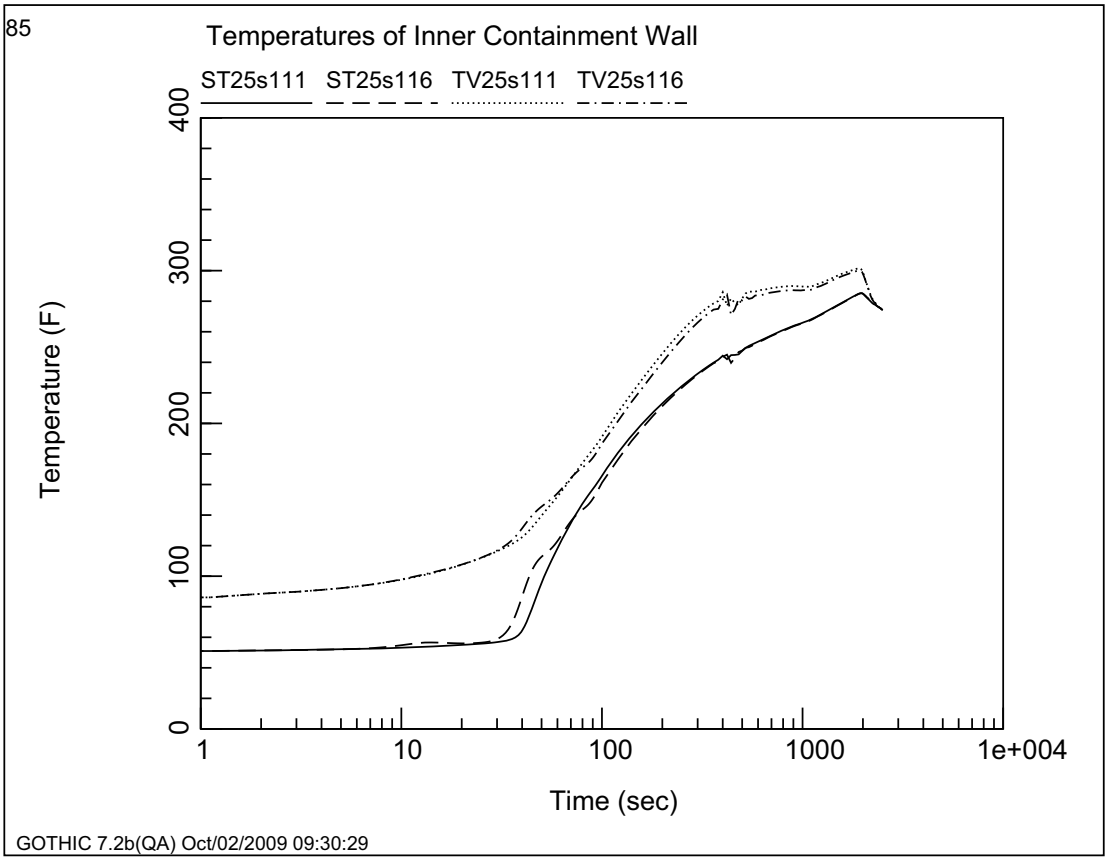


Figure 06.02.01-87-30 — Temperatures of Containment Wall at Elevations of +93.51ft and +98.59ft, near the Location of Maximum Temperature

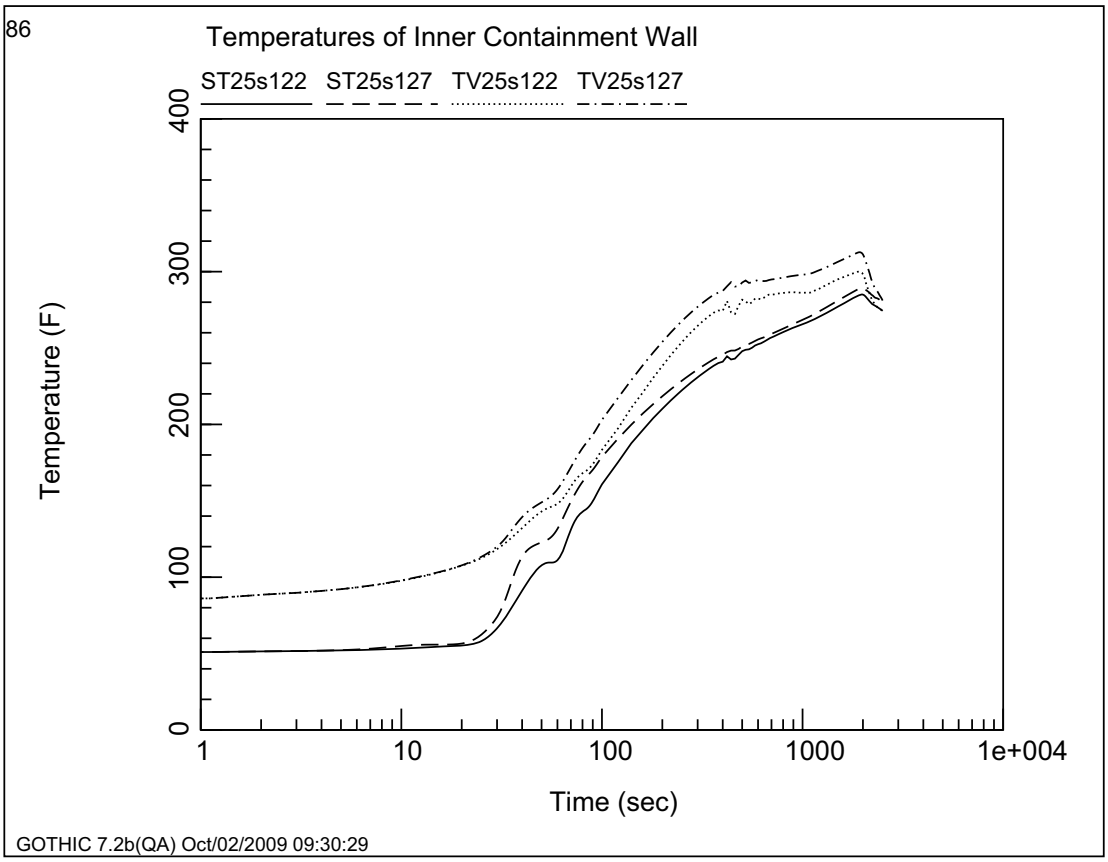


Figure 06.02.01-87-31 — Temperatures of Containment Wall at an Elevation of +98.59ft, near the Location of Maximum Temperature

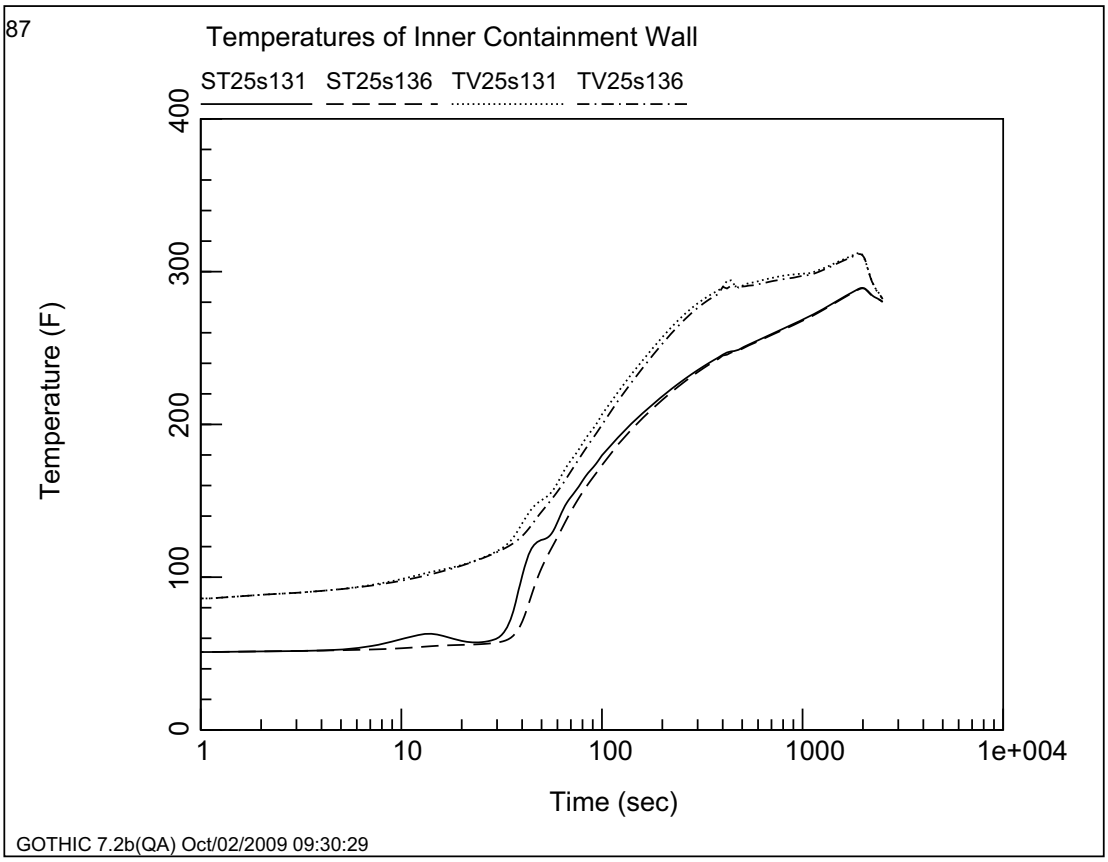


Figure 06.02.01-87-32 — Temperatures of Containment Wall at an Elevation of +98.59ft, near the Location of Maximum Temperature

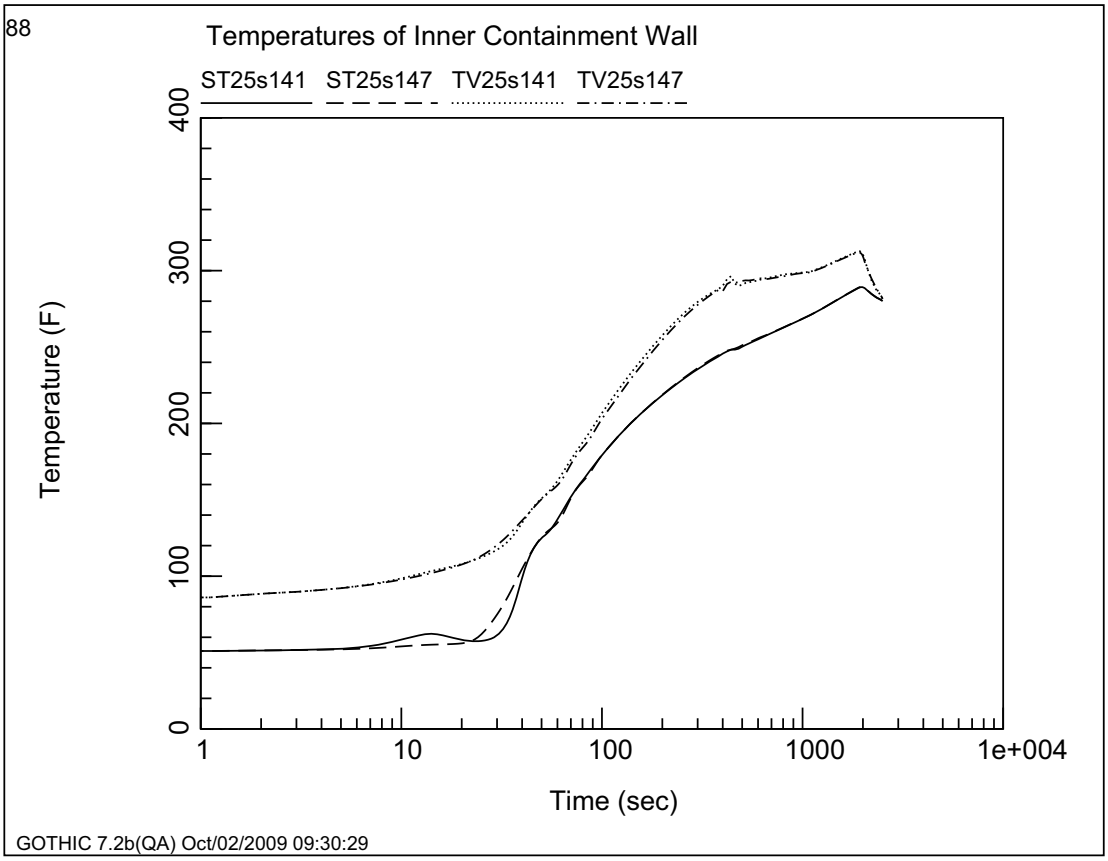


Figure 06.02.01-87-33 — Temperatures of Containment Wall at an Elevation of +103.68ft, near the Location of Maximum Temperature

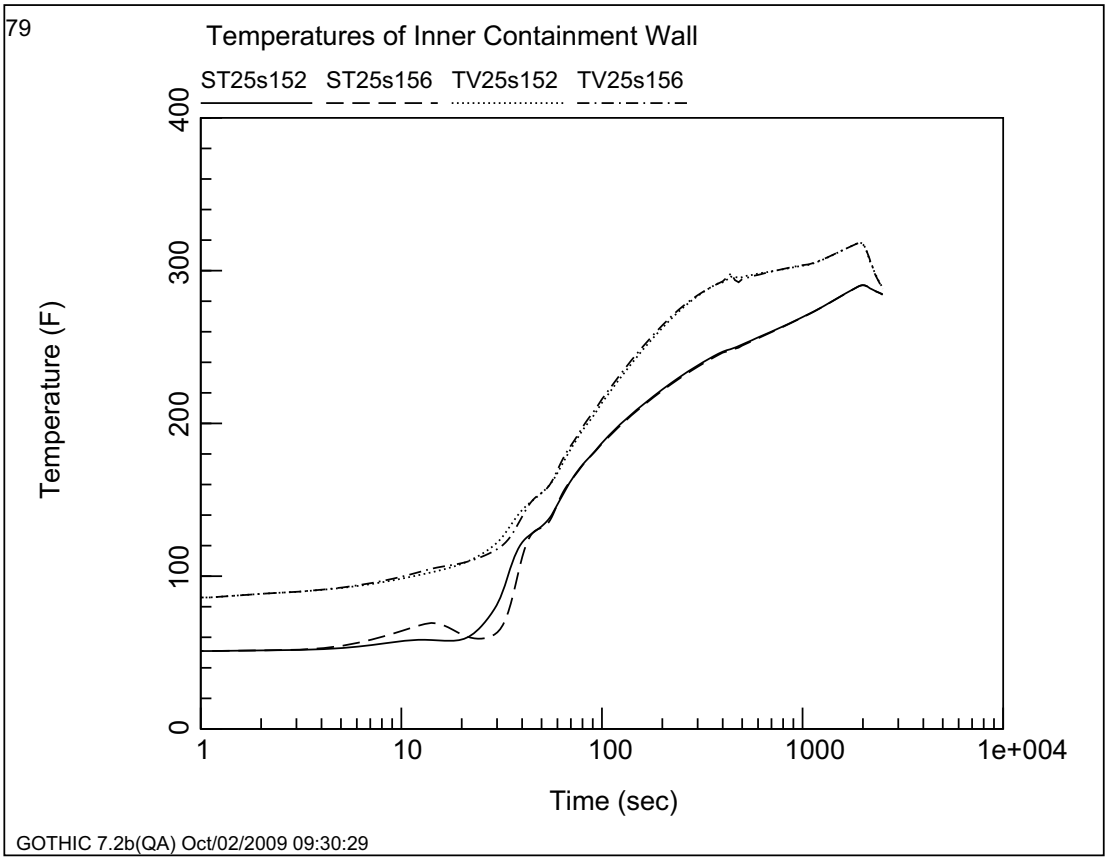


Figure 06.02.01-87-34 — Temperatures of Containment Wall at an Elevation of +103.68ft, near the Location of Maximum Temperature

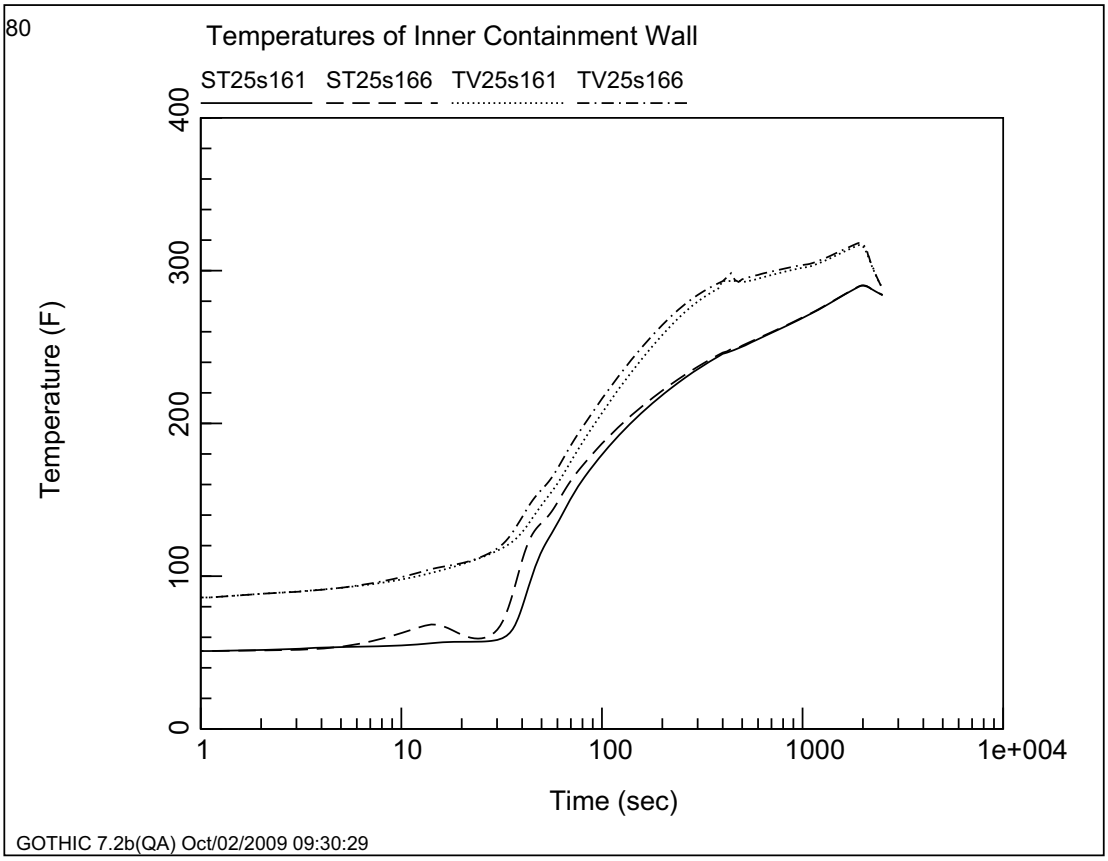


Figure 06.02.01-87-35 — Temperatures of Containment Wall at Elevations of +103.68ft and +108.76ft, near the Location of Maximum Temperature

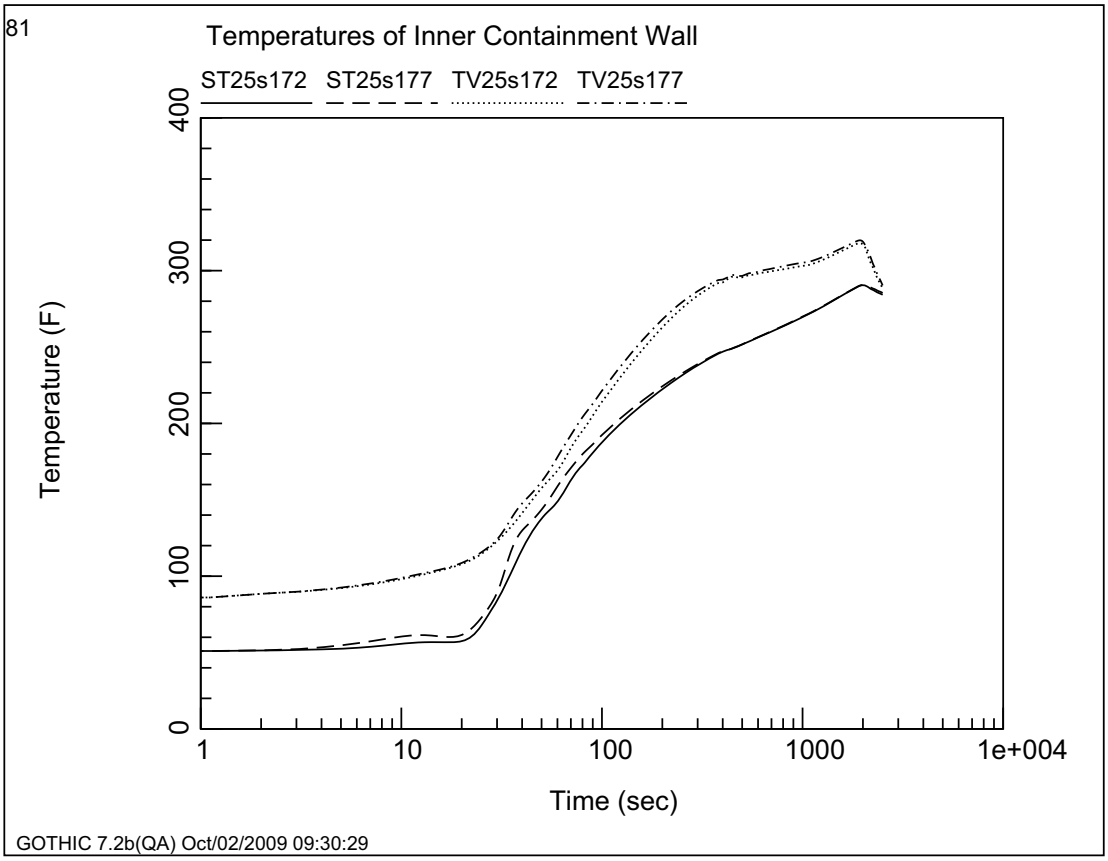


Figure 06.02.01-87-36 — Temperatures of Containment Wall at an Elevation of +108.76ft, near the Location of Maximum Temperature

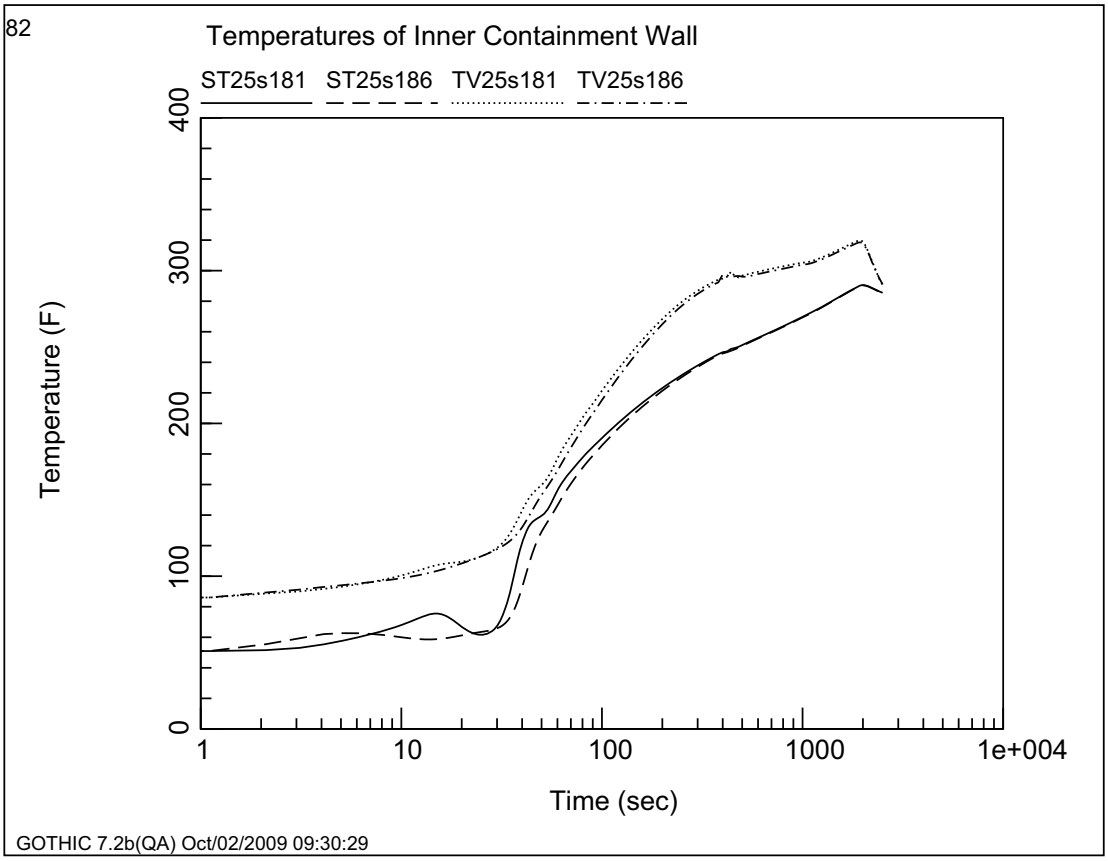
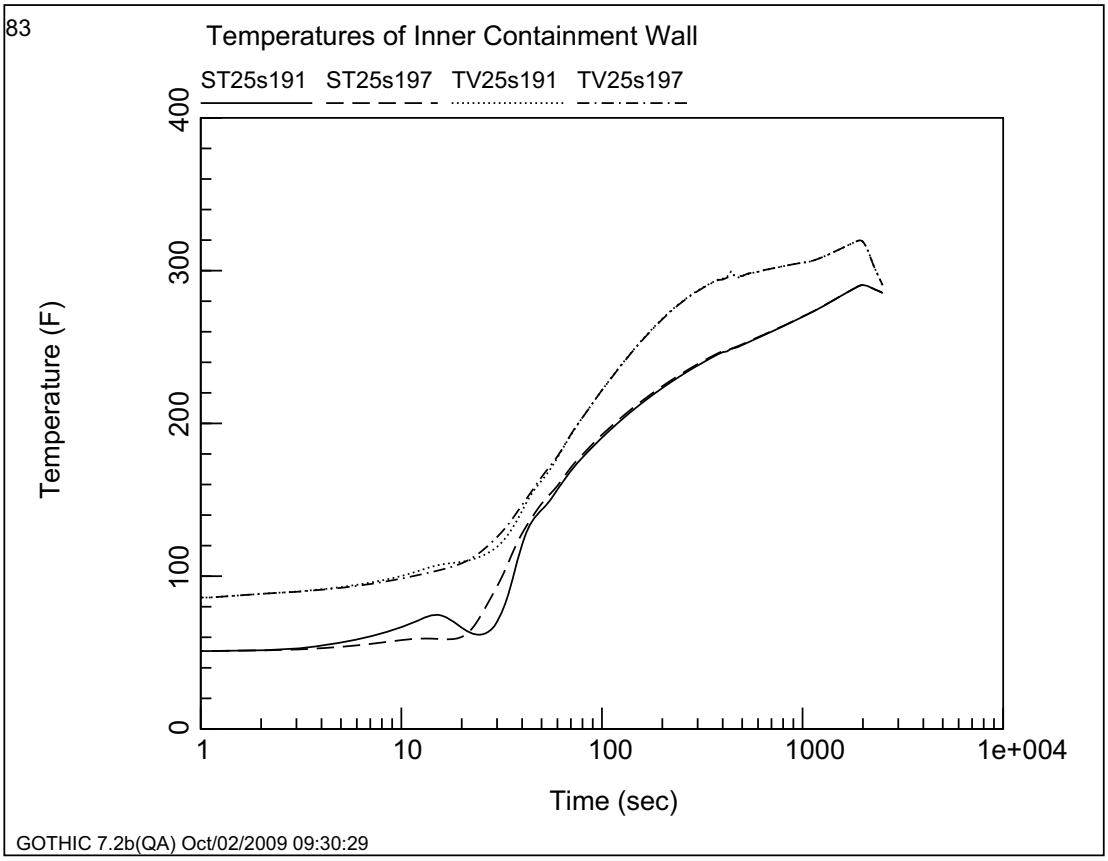


Figure 06.02.01-87-37 — Temperatures of Containment Wall at an Elevation of +108.76ft, near the Location of Maximum Temperature



Question 06.02.01-91:

i. Chapter 8 of ANP-10299P includes a table showing how the AREVA methodology meets SRP acceptance criteria for large break LOCAs. Provide the equivalent table for MSLB accidents. This question is a follow-up to the February 9 and 10, 2010 audit on containment analyses.

Response to Question 06.02.01-91:

The response to this question is included in the Response to RAI 368, Supplement 3, Question 06.02.01-78 and Table 06.02.01-78-1.

FSAR Impact:

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