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Your ref: Docket No. 52-006
Our ref: DCP_NRC_002788

February 23, 2010

Subject: AP1000 Response to Proposed Open Item (Chapter 3)

Westinghouse is submitting the following responses to the NRC open item (OI) on Chapter 3. These proposed open item response are submitted in support of the AP1000 Design Certification Amendment Application (Docket No. 52-006). The information included in these responses is generic and is expected to apply to all COL applications referencing the AP1000 Design Certification and the AP1000 Design Certification Amendment Application.

Enclosure 1 provides the response for the following proposed Open Item(s):

OI-SRP3.11-CIB1-01

As discussed with the NRC staff, Westinghouse will make the equipment qualification specification (APP-GW-VP-010) and representative valve design specifications available for NRC review to confirm the commitments in the open item response.

Questions or requests for additional information related to the content and preparation of this response should be directed to Westinghouse. Please send copies of such questions or requests to the prospective applicants for combined licenses referencing the AP1000 Design Certification. A representative for each applicant is included on the cc: list of this letter.

Very truly yours,

R. A. Lindgren /FOR

Robert Sisk, Manager
Licensing and Customer Interface
Regulatory Affairs and Standardization

/Enclosure

1. Response to Proposed Open Item (Chapter 3)

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NRO

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ENCLOSURE 1

AP1000 Response to Proposed Open Item (Chapter 3)

AP1000 DESIGN CERTIFICATION REVIEW

Response to SER Open Item (RAI)

RAI Response Number: OI-SRP3.11-CIB1-01
Revision: 0

Question:

On October 14 and 15, 2008, the NRC staff conducted an onsite review of design and procurement specifications, including environmental qualification, for pumps, valves, and dynamic restraints to be used for the AP1000 reactor at the Westinghouse offices in Monroeville, PA. At the conclusion of the onsite review, the staff provided comments on the AP1000 design and procurement specifications, and Westinghouse indicated that those comments would be addressed in a future revision to the specifications. The staff also identified several items that remain open from the onsite review that are specified in Section 3.9.6 of this SER.

Westinghouse Response:

The following is typical wording from an AP1000 active valve design specification regarding Functional Qualification:

"Active valves, as defined in paragraph 3.4.1, shall be qualified in accordance with ASME QME-1. The active valve status is identified in Appendix A. ASME QME-1 testing and documentation requirements are identified in APP GW VP 010."

ASME QME-1-2007 is the version of the standard referenced in the design specifications. This version of the standard is also referenced in the APP-GW-VP-010 document which provides specific details of how ASME QME 1 2007 qualification is actually performed. It will be clarified in the next revision of APP-GW-VP-010 that any existing testing used to demonstrate functional qualification must fully satisfy the requirements of ASME QME-1-2007.

Westinghouse response to RAI 01-SRP3.9.6-CIB1-01 through 01-SRP3.9.6-CIB1-09 provides responses to the Section 3.9.6 comments. RAI 01-SRP3.9.6-CIB1-03 describes the proposed additions to the DCD Section 3.9 to add the ASME QME-1-2007 requirements for preoperational functional qualification for active valves.

As a result of the NRC comments and observations during the subject review Westinghouse did a review of DCD Section 3.11, Appendix 3D, and supporting documents for other inconstancies and discrepancies as an extent of condition review. The DCD changes identified from this review are identified below.

Design Control Document (DCD) Revision:

DCD Appendix 3D – page 19 – Section 3D.5.2.1 – "Abnormal Events Inside Containment"

parameters. Event frequency, conditions, and duration are accounted for within the context of the qualified life objective of each equipment type test program.

~~Submergence of some equipment during certain spurious automatic depressurization system actuation scenarios is addressed by testing. Submergence testing associated with high-energy line break conditions, (subsection 3D.5.5.1.7) envelops the submergence conditions associated with abnormal environments.~~

3D.5.2.2 Abnormal Environments Outside Containment

Figure 3D.5-1 represents the assumptions made in defining potential abnormal environments due to loss of air-conditioning or ventilation systems.

Table 3D.5-4 defines the abnormal environments as a function of equipment location. The assumed duration of the abnormal conditions specified in Table 3D.5-4 are consistent with operating practices and technical specification limits. For certain plant applications, qualification for abnormal environments is not necessary when equipment is located in environmental zones that do not exceed manufacturer's design limits for equipment operation.

3D.5.3 Seismic Events

See Attachment E.

3D.5.4 Containment Test Environment

Regulatory Guide 1.18 specifies that containment integrity is demonstrated at 1.15 times design pressure. The design pressure of the AP1000 containment is 59 psig. Consequently, the maximum pressure specified for the containment test is $59 \times 1.15 = 67.85$ psig. Other environmental parameters (such as temperature and humidity) of the containment test are adequately enveloped by the parameters specified for normal or abnormal plant conditions.

3D.5.5 Design Basis Event Conditions

Performance requirements are specified for those design basis events for which the equipment performs a safety-related function and which have a potential for changing the equipment environment due to increased temperature, pressure, humidity, radiation, or seismic effects. The environmental conditions for each applicable design basis event are summarized in Table 3D.5-5 and are defined in the equipment qualification data package (see Section 1.8 of Attachment A) based on considerations and assumptions described in the following subsections.

3D.5.5.1 High-Energy Line Break Accidents Inside Containment

3D.5.5.1.1 Radiation Environment – Loss of Coolant Accident

The radiation dose rates and integrated doses following a design basis loss-of-coolant accident (LOCA) are determined based on the criteria and guidance provided in NUREG 1465. "Accident Source Terms for Light-Water Nuclear Power Plants – Final Report" (Reference 8), and

DCD – Appendix 3D - page 22 – Section D.5.5.1 Temperature / Pressure

function in the accident environment (Attachment A, subsection 1.6.1) and the dose calculations described previously, subject to the following modifications:

- For equipment only required to provide trip or activation functions after accidents involving no release of radioactive material for at least one hour, the radiation dose is based on the normal dose rates (Table 3D.5-2).

3D.5.5.1.5 Temperature/Pressure Environments

The design basis events addressed are the loss of coolant accident, steam line break and feedwater line break. The WGOTHIC code is utilized to calculate the temperature and pressure conditions resulting from these breaks. To retain the option of qualifying equipment for each of these high-energy line break conditions, as applicable, separate environmental containment envelopes are specified for the higher irradiation/lower saturated temperature conditions of the loss of coolant accident ~~(Figures 6.2.1.1-7 and 6.2.1.1-10)~~ as against the lower irradiation/short-term superheated temperature conditions associated with the steam line break ~~(Figures 6.2.1.1-1 and 6.2.1.1-2)~~. To limit the number of basic envelopes, this latter envelope is conservatively employed to define the containment environmental envelope following a feedline break.

Additionally, to facilitate AP1000 generic qualification and testing, the environmental envelopes ~~specified in Figures 6.2.1.1-1, 6.2.1.1-2, 6.2.1.1-7 and 6.2.1.1-10~~ have been combined to a single high-energy line break profile depicted in Figure 3D.5-8. This combined profile encompasses all locations inside containment on the basis of the containment analyses for the AP1000 design. The profile is used to qualify equipment for any application or location for the AP1000 consistent with the NRC requirements in 10 CFR 50.49 and IEEE 308, 323, 603, and 627 when margin is added and via conformance with IEEE 323 guidelines.

Qualification tests to high-energy line break conditions are designed to address the applicable specified environment(s) with a margin of 15°F and 10 psi. Separate envelopes ~~(Figures 6.2.1.1-1, 6.2.1.1-2, 6.2.1.1-7 and 6.2.1.1-10)~~ with margin are employed, or a combined loss of coolant accident/steam line break/feedwater line break envelope (Figures 3D.5-8 and 3D.5-9) may be employed for in-containment equipment qualification tests. Figures 3D.5-8 and 3D.5-9 do not include margin from IEEE 323-1974, which will be incorporated in the environmental qualification programs. The simulated post-design basis event aging time-temperature profile (Figures 3D.5-8 and 3D.5-9 from 24 hours to test conclusion) is defined consistent with the smallest value of activation energy applicable to the thermal aging sensitive components composing the test equipment or by a demonstrably conservative activation energy, as described in Attachment D.

3D.5.5.1.6 Chemical Environment

The high-energy line break test will include chemical injection during the first 24 hours of the test, to simulate the reactor coolant system fluid. Initial pH is from 4 to 4.5, with the solution consisting primarily of boric acid.

Since there is no caustic containment spray in the AP1000, subsequent adjustments in pH may not be necessary for all tests. Sump solution chemistry is adjusted by release of alkaline

DCD Appendix 3D – page 39 – Table 3D.4-3 - "AP1000 EQ Program Margin Requirements"

Table 3D.4-3

AP1000 EQ PROGRAM MARGIN REQUIREMENTS

Condition	Parameter	Required Margin	Notes
NORMAL:	Aging	+10%	+10% time margin, +10% radiation and/or selection of conservative test parameters. Comply with guidance of subsection 3D.4.8.2.
ABNORMAL:	Temperature/ Humidity		Margin is in "time" at abnormal test extremes.
	Pressure	None	Nominally atmospheric.
	Radiation	+10%	Include in aging doses, if applicable.
	~~Chemical Effects~~	~~+10%~~	~~In alkalinity of adjusted sump pH. Not applicable outside containment.~~
	Voltage & Frequency	+/- 10%	Simulated during temperature/humidity test.
	~~Submergence~~	~~Note 1~~	~~Generally, precluded by design.~~
ACCIDENT:	Transient Temperature and Pressure		Temperature (+15°F) and pressure (+10 psig peak) margins added to transient profile.
	Chemical effects	+10%	In alkalinity of adjusted sump pH. Not applicable outside containment.
	Radiation	+10%	Added to calculated total integrated dose.
	Submergence	Note 1	Generally, precluded by design.
	Seismic/ Vibration	+10%	Of acceleration at equipment mounting point for either SSE or line-mounted equipment vibration. (See subsection 3D.4.8.4.)
	Post-accident Aging	+10%	In time demonstrated via Arrhenius time/temperature relationship calculation.

Note:

1. Margin in submergence conditions is achieved by increases in ~~temperature (+15°F), pressure (+10%)~~ the Post Accident time duration (+10%)~~,~~ and chemistry (+10% in alkalinity of adjusted sump pH). ~~Also, accident conditions submergence testing envelops abnormal conditions submergence conditions.~~

DCD Appendix 3D – page 40 - Table 3D.5-1 - "Normal Operating Environments (Sheet 1 of 3)"

Table 3D.5-1 (Sheet 1 of 3)

NORMAL OPERATING ENVIRONMENTS

(Notes 1 and 2)

Location/Parameter	Normal Range	Notes
Zone 1 – Containment (Room numbers: 11000 through 11999)		
Temperature	50° - 120°F	
Pressure	-0.2 - +1.0 psig	
Humidity	0 - 100%	
Radiation	see Table 3D.5-2	
Chemistry	None	
Zone 2 - Auxiliary Building - Non-Radiological - I&C, DC Equipment, RCP Switchgear & Battery rooms, etc. (Room numbers: 12101, 12102, 12103, 12104, 12105, 12111, 12112, 12113, 12201, 12202, 12203, 12204, 12205, 12207, 12211, 12212, 12213, 12301, 12302, 12303, 12304, 12305, 12311, 12312, 12313, 12405, 12411, 12412, 12501, and 12505)		
Temperature	67 - ~~73~~77°F (All rooms except 12405 and 12505) 50 – 85°F (Rooms 12405 and 12505)	
Pressure	Slightly positive to slightly negative	
Humidity	10 - 60%	
Radiation	<10^3 rads gamma	
Chemistry	None	
Zone 3 - Auxiliary Building - Non-Radiological - Main Control Room (Room number: 12400, 12401)		
Temperature	67 - 78°F	
Pressure	Slightly positive	
Humidity	25 - 60%	
Radiation	<10^3 rads gamma	
Chemistry	None	
Zone 4 - Auxiliary Building - Non-Radiological - Accessible (Room numbers: 12321, 12421, 12422, 12423)		
Temperature	50 - 105°F	
Pressure	Slightly positive	
Humidity	10 - 60%	
Radiation	<10^3 rads gamma	
Chemistry	None	

DCD Appendix 3D – page 41 - Table 3D.5-1 - "Normal Operating Environments (sheet 2 of 3)"

Table 3D.5-1 (Sheet 2 of 3)

NORMAL OPERATING ENVIRONMENTS

(Notes 1 and 2)

Location/Parameter	**Normal Range**	**Notes**
Zone 5 - Auxiliary Building - Non-Radiological - MSIV Compartments (Room numbers: 12404, 12406, 12504, 12506)		
Temperature	50 - 130°F	
Pressure	Atmospheric	
Humidity	10 - 100%	
Radiation	$<10^4$ ~~10^3~~ rads gamma	
Chemistry	None	
Zone 6 - Auxiliary Building - Radiological - Inaccessible (Room numbers: 12154, 12158, 12162, 12163, 12166, 12167, 12171, 12172, 12254, 12255, 12256, 12258, 12262, 12264, 12265, 12354, 12362, 12363, 12365, 12371, 12372, 12373, 12374, 12454, 12462, 12463)		
Temperature	50 - 130°F	
Pressure	Slightly negative to atmospheric	
Humidity	10 - 100%	
Radiation	See Table 3D.5-2	
Chemistry	None	
Zone 7 - Auxiliary Building - Radiological - Accessible (Room numbers: 12151, 12152, 12153, 12155, 12156, 12161, 12169, 12241, 12242, 12244, 12251, 12252, 12261, 12268, 12271, 12272, 12273, 12274, 12275, 12341, 12351, 12352, 12361, 12451, 12452, 12461, ~~12551, 12552,~~ 12553, 12554, 12555, 12561)		
Temperature	50 - 104°F	
Pressure	Atmospheric	
Humidity	10 - 100%	
Radiation	See Table 3D.5-2	
Chemistry	None	
Zone 8 - Turbine Building (Room numbers: 20300 through 20799)		
Temperature	50 - ~~104~~ 105°F	
Pressure	Atmospheric	
Humidity	10 - 100%	
Radiation	$<10^3$ rads gamma	
Chemistry	None	

DCD - Appendix 3D – page 43 - Table 3D.5-2 – “60-year Normal Operating Doses”

Table 3D.5-2

60-YEAR NORMAL OPERATING DOSES

Location	Gamma Dose Rate (Rad air hour)	60-Year Gamma Dose (Rads air)
Inside Containment:		
RCS Pipe - Center	1.9×10^3	1.0×10^9
RCS Pipe - ID	1.1×10^3	5.7×10^8
RCS Pipe - OD (contact)	7.8×10^1	4.1×10^7
RCS Pipe - General Area(b)	4.0×10^1	2.1×10^7
Outside CA01 excluding rooms 11104 and 11204	<0.45	$<2.4 \times 10^5$
Adjacent to Reactor Vessel Wall	$\leq 5.0 \times 10^4$ ~~4.4×10^4~~	$\leq 1.9 \times 10^{10(a)}$ ~~$2.7 \times 10^{10(a)}$~~
Outside Containment:		
Penetration Area	--	$<2 \times 10^7$ ~~1×10^6~~
Pump Cubicles	--	$<2 \times 10^7$ ~~1×10^6~~
Radioactive Waste Area	--	$<2 \times 10^7$ ~~1×10^6~~
Radwaste Tank Cubicles	--	$<5 \times 10^7$ ~~1×10^7~~
Other General Areas not under radiation control	--	$<1 \times 10^4$ ~~5×10^3~~

Notes:

a. 60-year ~~integrated~~ neutron ~~dose~~ fluence for E>1 MeV is 4.6×10^{18} ~~6×10^{17}~~ n/cm^2

b. 12 inches from RCS pipe OD

DCD - Appendix 3D – page 44 - Table 3D.5-3 - "Abnormal Operating Environments Inside Containment"

Table 3D.5-3

ABNORMAL OPERATING ENVIRONMENTS INSIDE CONTAINMENT

Conditions/Parameter	Abnormal Extreme	Duration	Notes
Group 1 (150°F) Abnormal Events			
Temperature	150°F	4 hours	Note 1
Pressure	Atmospheric		
Humidity	100%	4 hours	Note 1
Radiation	Same as normal		
Chemistry	None		
Submergence	None		
Group 2 (250°F) Abnormal Events			
Temperature	250°F	30 days	Note 1
Pressure	15 psig	30 days	Note 1
Humidity	100%	30 days	Note 1
Radiation			Note 2
Chemistry	~~4.0 - 4.5 pH~~ None	~~30 days~~	~~Note 3~~
Submergence	None	~~30 days~~	~~Note 4~~

Notes:

1. Parameter value is not maximum for full duration.
2. Minor increase over normal radiation conditions expected.
3. ~~Containment sump pH is adjusted to the range of 7.0 to 9.5, if containment is flooded.~~
4. ~~While most ADS events are terminated in 40 minutes with only minor flooding, there is the potential for flooding of the containment to the 110' 2" level. This flooded state is assumed to last for 30 days.~~

DCD - Appendix 3D – page 45 - Table 3D.5-4 - "Abnormal Operating Environments Outside Containment"

Old Table 3D.5-4:

3. Design of Structures, Components, Equipment and Systems — AP1000 Design Control Document

Table 3D.5-4

ABNORMAL OPERATING ENVIRONMENTS OUTSIDE CONTAINMENT

Conditions/Parameter	Abnormal Extreme	Duration	Notes
Zones 4, 5, 6, 7, 8, 9, 10	Same as normal		
Zone 2 - Loss of HVAC - (I&C Rooms, DC Equipment Rooms)			Note 4
Temperature	Figure 3D.5-1 (Sheet 2)	7 days	Note 3
Pressure	Atmospheric		
Humidity	40 – 95%		Note 2
Radiation	Same as normal		
Chemistry	None		
Submergence	None		
Zone 3 - Loss of HVAC - (Main Control Room)			
Temperature	Figure 3D.5-1 (Sheet 1)	7 days	
Pressure	Atmospheric		Note 1
Humidity	60 – 95%		Note 2
Radiation	Same as normal		
Chemistry	None		
Submergence	None		
Zone 11 - Loss of AC Power - (Fuel Handling Area)			
Temperature	212°F maximum		
Pressure	Atmospheric		Note 5
Humidity	100%		
Chemistry	None		
Duration	2 weeks		

Notes:

1. Main control room air pressure is maintained above a nominal value of atmospheric during accident conditions to prevent radioactive contaminant entry.
2. Figure 3D.5-1 Sheets 1 and 2 have two curves post-72 hours. The high curve represents the introduction of outside air that is high temperature, low humidity. The low curve represents the introduction of outside air that is low temperature, high humidity. The EQ Programs will include both of these extremes.
3. Test environments resulting from rooms with equipment supplied by 24- and 72-hour batteries are shown on Sheet 2 for the DC equipment rooms 12203 and 12207 and for the I&C rooms 12302 and 12304. The 24-hour battery is disconnected at 24 hours. The 72 hour battery is not disconnected. Environments resulting from rooms with equipment supplied by 24-hour batteries only, i.e., DC equipment rooms 12201 and 12205 and I&C rooms 12301 and 12305 are enveloped by the environments shown on Sheet 2.
4. Abnormal environments in other rooms within Zone 2 are the same as normal.
5. A relief panel is designed to open when the fuel handling area temperature exceeds 165°F.

Tier 2 Material — 3D-45 — Revision 17

New Table 3D5.-4

Table 3D.5-4

ABNORMAL OPERATING ENVIRONMENTS OUTSIDE CONTAINMENT

Conditions/ Parameter	Abnormal Extreme	Duration	Notes	Conditions/ Parameter	Abnormal Extreme	Duration	Notes
Zone 2 - Loss of AC Power				Zone 6 - Loss of AC Power			
Temperature	Figure 3D.5-1 (Sh. 2)	7 days	Note 3	Temperature	140 F Max	10 x 4 hrs	
Pressure	Atmospheric			Pressure	Atmospheric		
Humidity	40 - 95%		Note 2	Humidity	Same as normal		
Radiation	Same as normal			Radiation	Same as normal		
Chemistry/Submergence	None			Chemistry/Submergence	None		
Zone 3 - Loss of HVAC				Zone 7 - Loss of AC Power			
Temperature	Figure 3D.5-1 (Sh. 1)	7 days		Temperature	114 F Max	10 x 4 hrs	
Pressure	Atmospheric		Note 1	Pressure	Atmospheric		
Humidity	60 - 95%		Note 2	Humidity	Same as normal		
Radiation	Same as normal			Radiation	Same as normal		
Chemistry/Submergence	None			Chemistry/Submergence	None		
Zone 4 - Loss of AC Power				Zones 8, 9, 10			
Temperature	120 F Max	10 x 4 hrs		Temperature	Same as normal		
Pressure	Atmospheric			Pressure	Same as normal		
Humidity	Same as normal			Humidity	Same as normal		
Radiation	Same as normal			Radiation	Same as normal		
Chemistry/Submergence	None			Chemistry/Submergence	None		
Zone 5 - Loss of AC Power				Zone 11 - Loss of AC Power - (Fuel Handling Area)			
Temperature	150 F Max	10 x 4 hrs		Temperature	212 F Max	7 days	
Pressure	Atmospheric			Pressure	Atmospheric		Note 4
Humidity	Same as normal			Humidity	100%		
Radiation	Same as normal			Radiation	Same as normal		
Chemistry/ Submergence	None			Chemistry/Submergence	None		

Notes:

1. Main control room air pressure is maintained above a nominal value of atmospheric during accident conditions to prevent radioactive contaminant entry.
2. Figure 3D.5-1 Sheets 1 and 2 have two curves post-72 hours. The high curve represents the introduction of outside air that is high temperature, low humidity. The low curve represents the introduction of outside air that is low temperature, high humidity. The EQ Programs will include both of these extremes.
3. Test environments resulting from rooms with equipment supplied by 24- and 72-hour batteries are shown on Sheet 2 for the DC equipment rooms 12203 and 12207 and for the I&C rooms 12302 and 12304. The 24-hour battery is disconnected at 24 hours. The 72-hour battery is not disconnected. Environments resulting from rooms with equipment supplied by 24-hour batteries only, i.e., DC equipment rooms 12201 and 12205 and I&C rooms 12301 and 12305 are enveloped by the environments shown on Sheet 2.
4. A relief panel is designed to open when the fuel handling area temperature exceeds 165°F.

DCD – Appendix 3D – page 46 – Table 3D.5-5 – Accident Environments

Table 3D.5-5

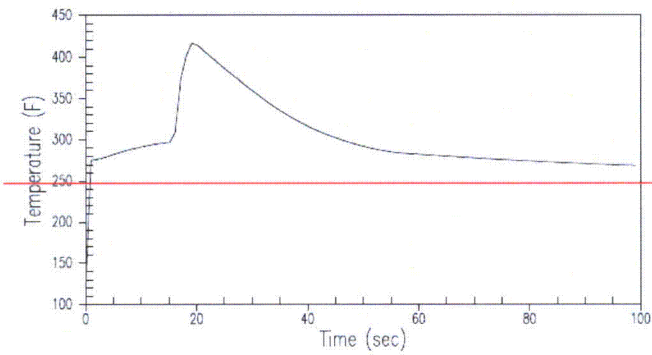
ACCIDENT ENVIRONMENTS

(See Table 3D.5-1 for environmental zones)

Zone 1 - Inside Containment	
Temperature and, pressure ~~and relative humidity~~ Submergence as applicable up to elevation 110'6"	See Figures 3D.5-8 ~~6 and 3D.5-7~~
Radiation	See Figures 3D.5-2 through 3D.5-5
Zones 2, 3, 4, 6, 7, 8, 9, 11	
(Same as abnormal - see Table 3D.5-4)	
Zones 5 and 10 - Outside Containment	
MSIV Compartments	
Temperature~~, pressure and relative humidity~~	See Figure 3D.5-9 ~~8~~
Radiation	See Figures 3D.5-4 and 3D.5-5

DCD – Appendix 3D – pp 55 & 56 -- Figure 3D.5-6 (Sh.1&2) -- To be deleted.

3. Design of Structures, Components, Equipment and Systems **AP1000 Design Control Document**

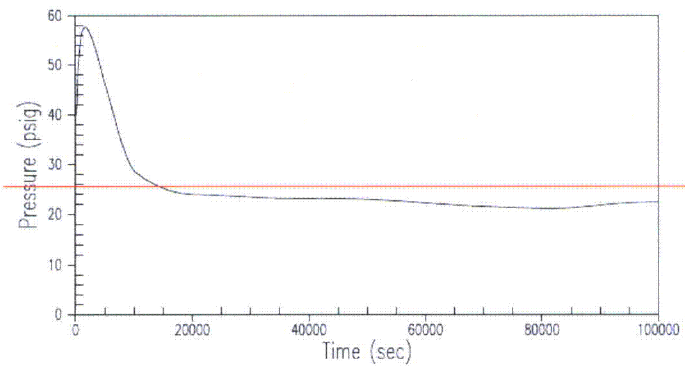


~~Figure 3D.5-6 (Sheet 1 of 2)~~

~~Containment Temperature Design Conditions: LOCA~~

Tier 2 Material 3D-55 Revision 17

3. Design of Structures, Components, Equipment and Systems **AP1000 Design Control Document**



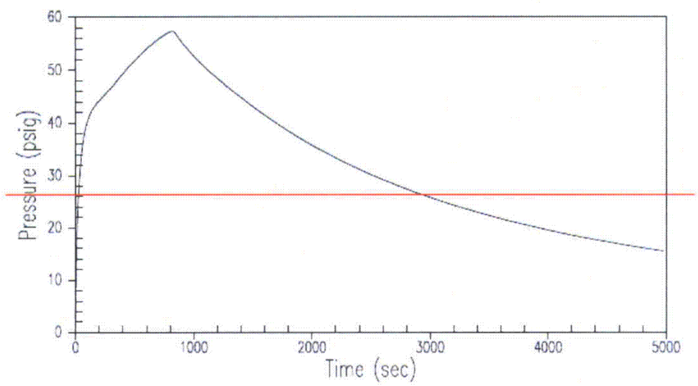
~~Figure 3D.5-6 (Sheet 2 of 2)~~

~~Containment Pressure Design Conditions: LOCA~~

Tier 2 Material 3D-56 Revision 17

DCD – Appendix 3D – pp 57 & 58 -- Figure 3D.5-7 (Sh.1&2) --To be deleted.

3. Design of Structures, Components, Equipment and Systems | AP1000 Design Control Document

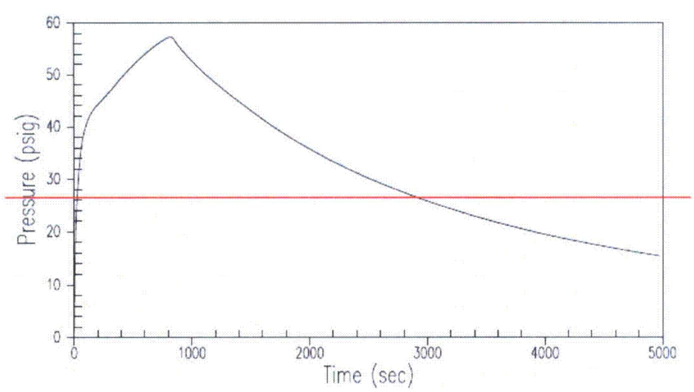


~~Figure 3D.5-7 (Sheet 2 of 2)~~

~~Containment Pressure Design Conditions: MSLB~~

Tier 2 Material | 3D-58 | Revision 17

3. Design of Structures, Components, Equipment and Systems | AP1000 Design Control Document



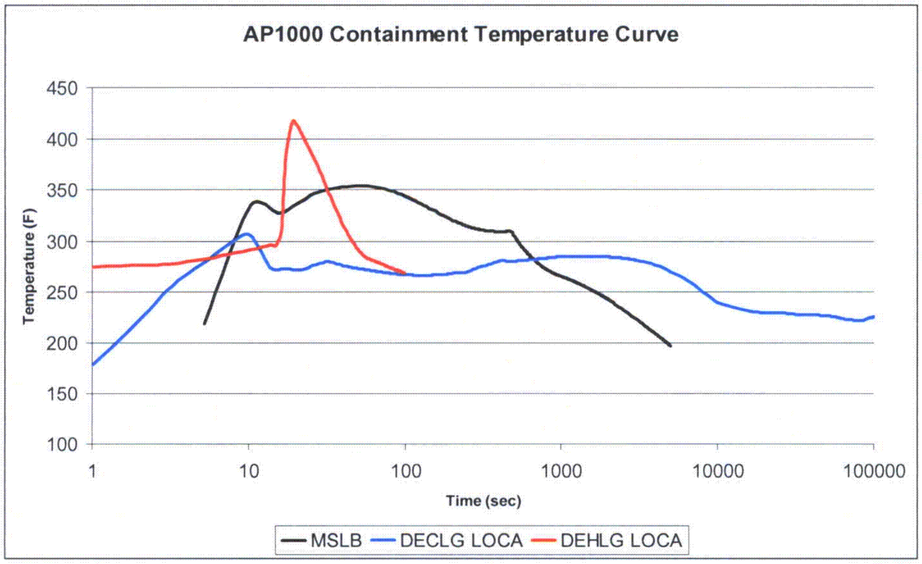
~~Figure 3D.5-7 (Sheet 2 of 2)~~

~~Containment Pressure Design Conditions: MSLB~~

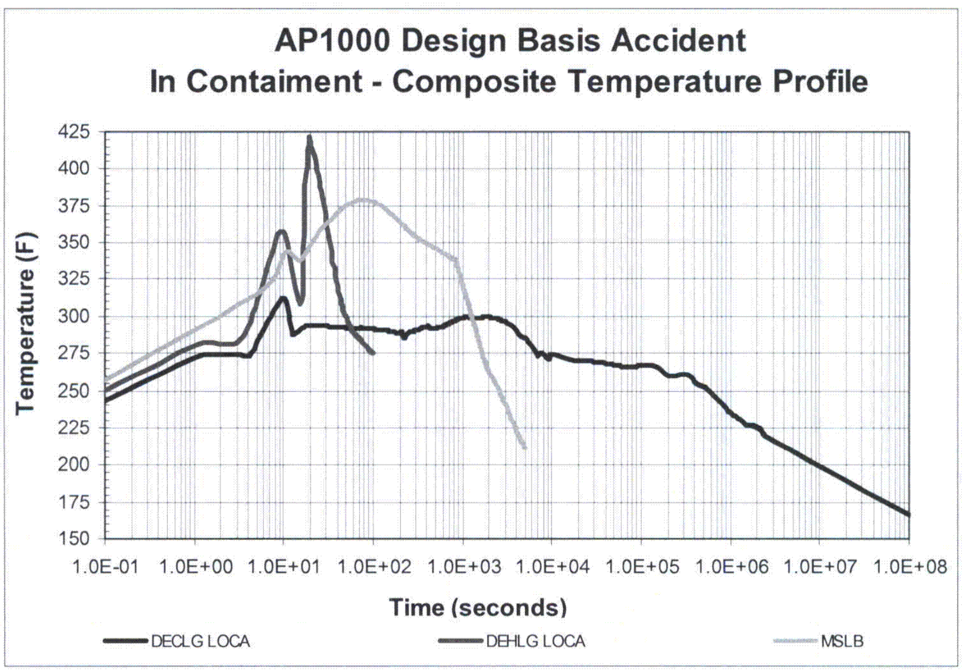
Tier 2 Material | 3D-58 | Revision 17

DCD Appendix 3D – page 59 – Figure 3D.5-8 (Sh 1 of 2) 'AP1000 Design Basis Accident In Containment – Composite Temperature Profile'

Old Figure

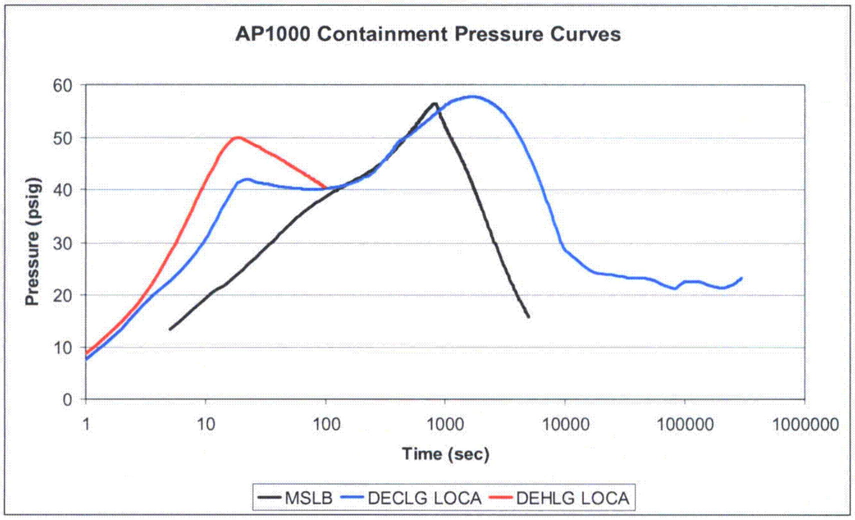


New Figure

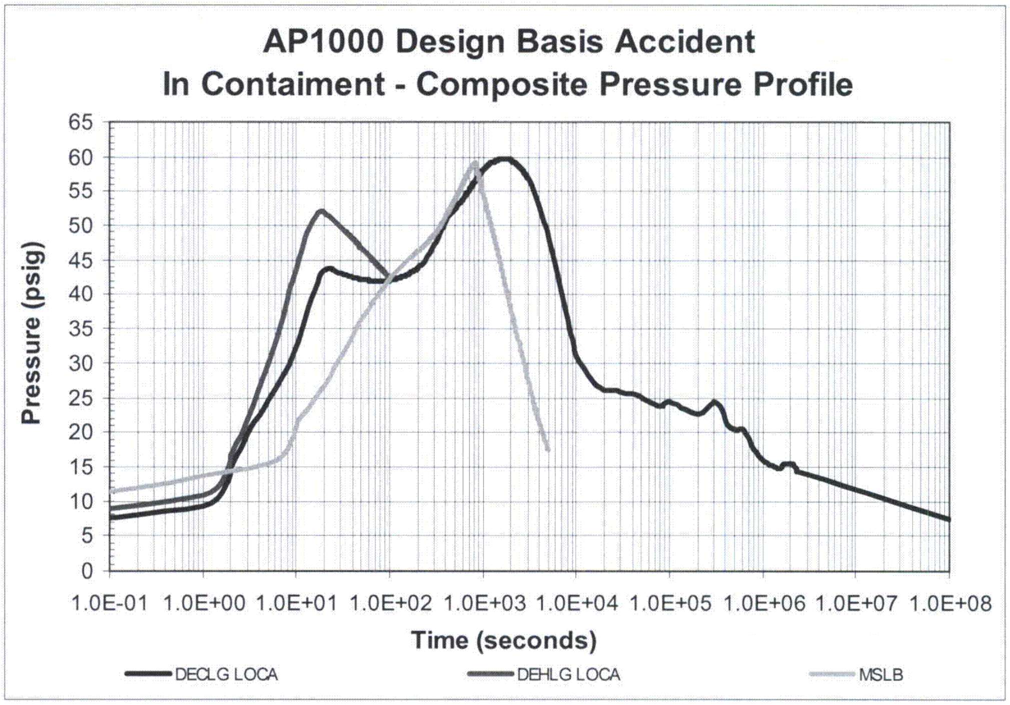


DCD Appendix 3D – page 60 – Figure 3D.5-8 (Sh 2 of 2) 'AP1000 Design Basis Accident In Containment – Composite Pressure Profile'. Reference APP-SSAR-GSC-123, Rev.0, November 2009.

Old Figure

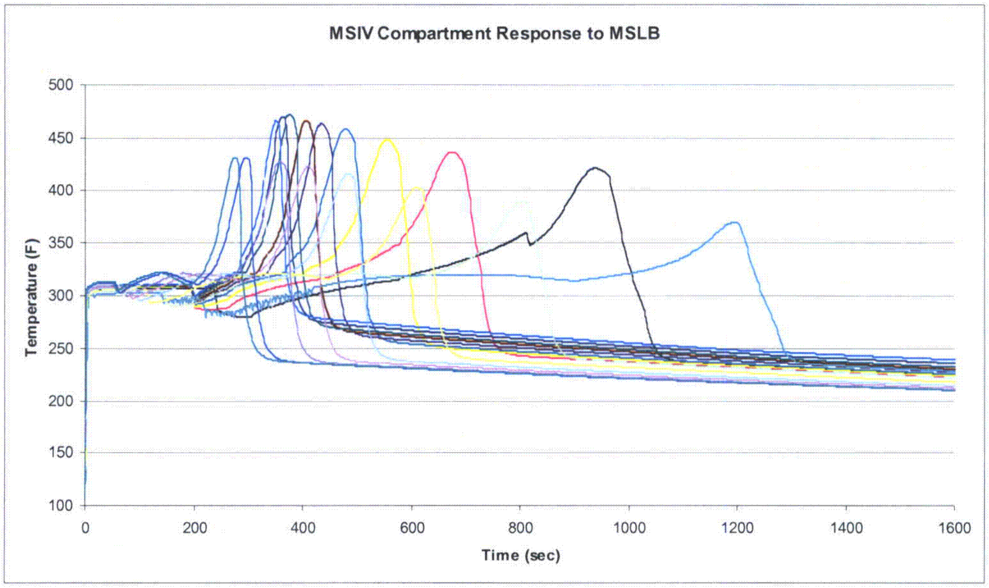


New Figure

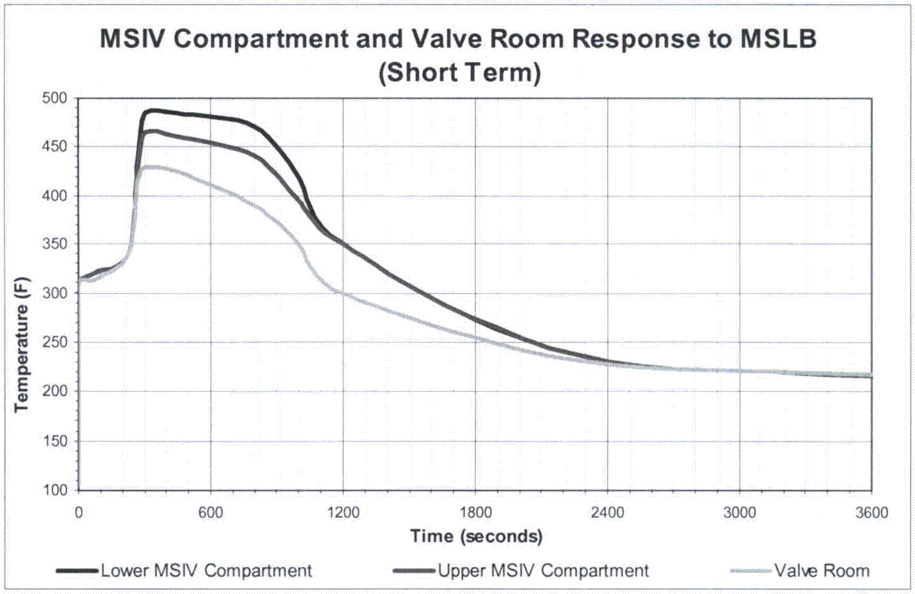


DCD Appendix 3D – Page 61 – Figure 3D.5-9 (Sh. 1 of 2) "MSIV Compartment Response to MSLB"

Old Figure



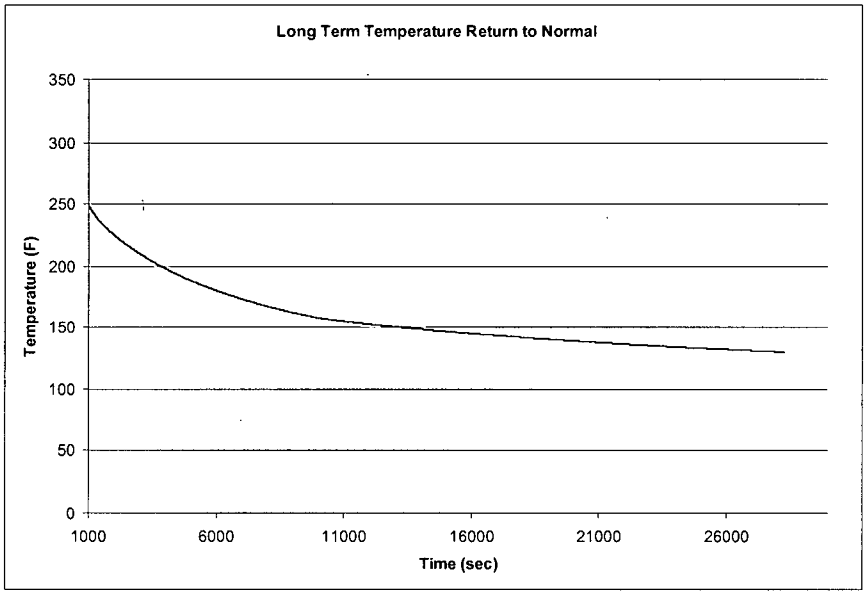
New Figure



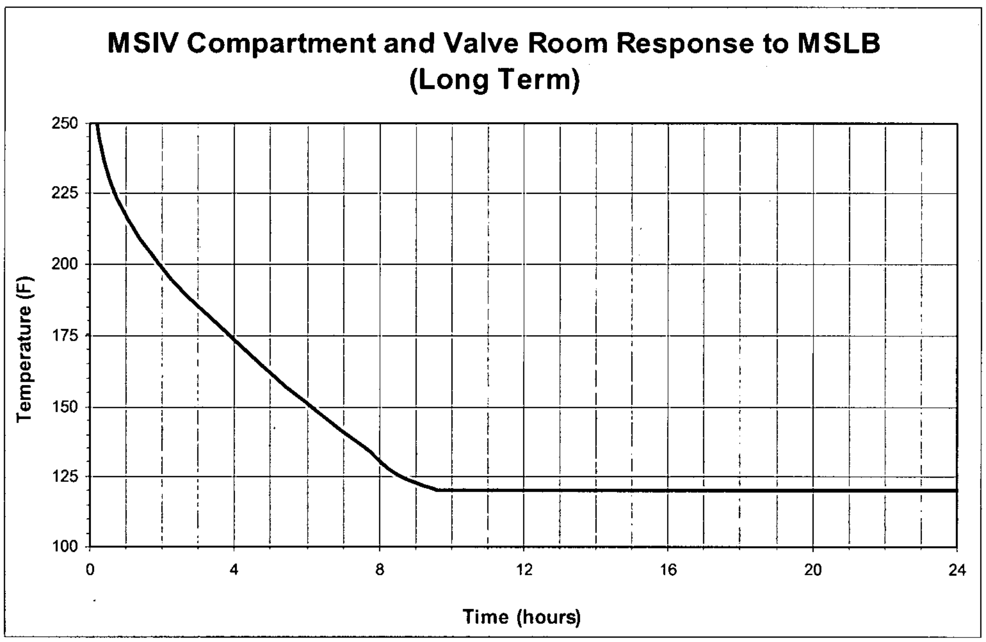
Note: This figure represents bounding curves of varying break sizes and power levels.

DCD Appendix 3D – Page 62 – Figure 3D.5-9 (Sh. 2 of 2) 'MSIV Compartment Response to MSLB (Long Term)'.

Old Figure



New Figure



DCD Appendix 3D– Page 100 – Attachment D - Section D.5.1 "Post Accident Temperatures"

D.4.3.2 For a Normally De-energized Component Aged Energized – the Self-heating Effect is Added Only to T_i:

Conditions: $T_a = 25°C$, $T_r = 10°C$
$T_j = 25°C$, $eV = 0.5$, Aging time = t_1
Oven temperature = 130°C
Qualified life goal = 10 years

Therefore $T_o = 25 + 10 = 35°C = 308K$
$T_i = 130 + 25 + 155°C = 428K$

$$t_1 = 10e\,\frac{-0.5}{K}\,\frac{(428-308)}{(428\times 308)} = 445 \text{ hours}$$

D.5 Post-Accident Thermal Aging

Most cases, some safety-related postaccident performance capability is specified by the functional requirements. As a consequence, to qualify equipment to IEEE 323, the effects of post-accident thermal aging must be simulated after the high-energy line break test. This section establishes the accelerated thermal aging parameters employed in performing this simulation.

D.5.1 Post-Accident Operating Temperatures

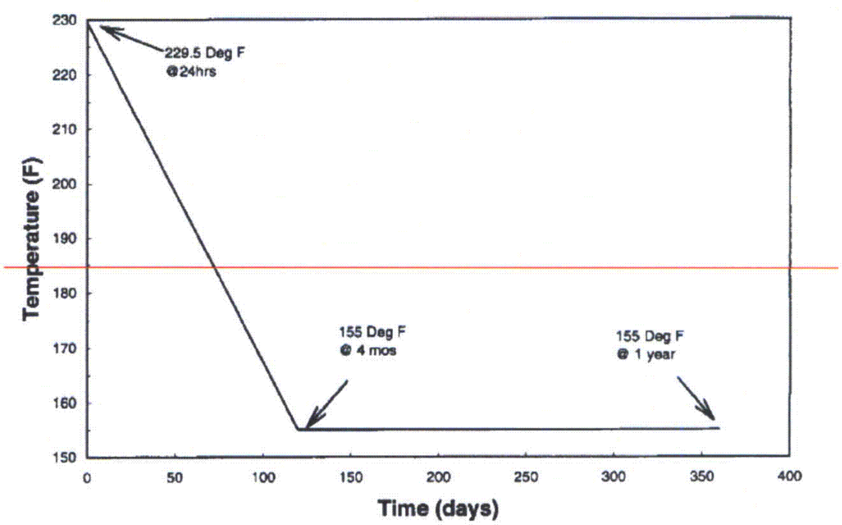
Assuming continuous operation of containment safeguards systems following an accident, the containment environment temperature is reduced to the external ambient temperature well within one year for any postulated high-energy line break. However, to allow for possible variations in plant operations following an accident, the limiting design high-energy line break envelope extending to one year is indicated by Figure 3D.5-8.~~is assumed to remain constant at 155°F (68°C) between four months and one year. As indicated in Figure 3D.D-3, the limiting design profile post accident is defined by the LOCA envelope (Figure 3D.5-6) starting at one day.~~

For safety-related equipment located inside containment, either the self-heating effects of the operating unit, under post-accident conditions, may be insignificant compared to the heat input from the external environment (transmitters, RTDs), or the unit may not be in continuous operation during this phase (valve operators). So it may not be necessary to add a specific temperature increment to account for self-heating of these devices following an accident. The ~~profile reproduced here as Figure 3D.D-3~~portion of Figure 3D.5-8 that is not addressed by DBA testing is then input at T_0 into the Arrhenius equation to calculate appropriate accelerated aging parameters for post-accident conditions. However, as noted in Section D.4, if the equipment is energized during the aging simulation period, the self-heating effect is added to both T_o and T_i.

D.5.2 Accelerated Thermal Aging Parameters for Post-Accident Conditions

The aging temperature most often used for post-accident simulation is 250°F (121°C). This temperature is selected as a maximum for electronic components and is generally used for tests. Using this value and the conservative activation energy of 0.5 eV, the Arrhenius equation is applied to the curve in Figure 3D.5-8 ~~D-3~~ from one day to four months or to one year in small increments of time. The required aging times to simulate these small increments are then summed

DCD Appendix 3D – page 3D-106 – Attachment D – Figure 3D.D-3 "Post Accident Temperature Profile". To be deleted.



~~Figure 3D.D-3~~

~~Post Accident Temperature Profile~~

PRA Revision: None