6.2 Containment Systems

The information in this section of the reference ABWR DCD, including all subsections, tables, and figures, is incorporated by reference with the following departures and supplements.

STD DEP T1 2.3-1 (Table 6.2-7)

STD DEP T1 2.4-2

STD DEP T1 2.4-3 (Tables 6.2-7, 6.2-8 and 6.2-10)

STD DEP T1 2.14-1 (Figure 6.2-38, Figure 6.2-40, Figure 6.2-41, Tables 6.2-7, 6.2-8 and 6.2-10)

STD DEP T1 3.4-1

~~STD DEP 6.2-1 (Tables 6.2-7 and 6.2-8)~~

STD DEP 6.2-2 (~~Tables 6.2-1, 6.2-2 and 6.2-2a~~Tables 6.2-1 and 6.2-2, Figures 6.2-2, 6.2-3, 6.2-4, 6.2-5, 6.2-6, 6.2-7, 6.2-9, 6.2-10, 6.2-11, 6.2-12, 6.2-13, 6.2-14 and 6.2-15))

STD DEP 6.2-3 (Tables 6.2-5, 6.2-6, 6.2-7, 6.2-8 and 6.2-10)

STD DEP 6C-1(Table 6.2-2b, 6.2-2c)

STD DEP 9.2-7 (Table 6.2-9)

STD DEP 9.2-9 (Table 6.2-9)

STD DEP 9.3-2 (Tables 6.2-7, 6.2-8, 6.2-9 and 6.2-10)

STD DEP Admin (Tables 6.2-5, 6.2-7, 6.2-8 and 6.2-10)

~~Licensing Topical Report (LTR), NEDO-33372, September 2007, provides a revised containment analysis. The markups provided in the LTR for Subsections 6.2.1 and 6.2.2; Tables 6.2-1, 6.2-2 and 6.2-2a; Figures 6.2-2 through 6.2-4; Figures 6.2-6 through 6.2-15 including new Figure 6.2-8a; Figures 6.2-17 and 6.2-18; and Figures 6.2-22 through 6.2-25 are incorporated by reference. LTR, NEDO-33330P, Rev. 1, September 2007, provides the justification for the elimination of the Hydrogen Recombiners. The markups for Subsections 6.2.5; a portion of Tables 6.2-7 and 6.2-8; and Figures 6.2-40 and 41 in that LTR are incorporated by reference.~~

6.2.1.1.1 Design Bases

STD DEP T1 2.14-1

(9) The Atmospheric Control System (ACS) establishes and maintains the containment atmosphere to less than 3.5% by volume oxygen during normal operating conditions to ~~assure that~~maintain an inert atmosphere ~~operation of two permanently installed recombiners can be initiated on high levels as determined by the Containment Atmospheric Monitoring System (CAMS)~~.

6.2.1.1.2.1 Drywell

STD DEP 6.2-2

The maximum drywell temperature occurs in the *case of a steamline break (~~169.7°C~~*161°C*) and is below the design value (171.1°C).*

The maximum drywell pressure occurs in the *case of a feedwater line break (~~268.7~~*240 *kPaG). The design pressure for the drywell (309.9 kPaG) includes ~~16%~~*approximately *22% margin.*

6.2.1.1.2.2 Wetwell

STD DEP 6.2-2

*The wetwell chamber design pressure is 309.9 kPaG and design temperature is ~~103.9°C~~*104°C.

6.2.1.1.3.3 Accident Response Analysis

STD DEP 6.2-2

The containment design pressure and temperature were established based on enveloping the results of this range of analyses plus providing NRC prescribed margins.

*For the ABWR pressure suppression containment system, the peak containment pressure following a LOCA is ~~very~~*relatively *insensitive to variations in the size of the assumed primary system rupture. This is because the peak occurs late in the blowdown and is determined in very large part by the transfer of the noncondensible gases from the drywell to the wetwell airspace. ~~This process is not significantly influenced by the size of the break.~~ In addition, there is ~~a 15%~~*an approximately 22% *margin between the peak calculated value and the containment design pressure that will easily accomodate small variations in the calculated maximum value.*

*Tolerances associated with fabrication ~~and installation may result in the as-built size of the postulated break areas being 5% greater than the values presented in this chapter Based on the above, these as-built variations would not invalidate the plant safety analysis presented in this chapter and Chapter 15~~*of the RPV nozzles have been taken into account in this analysis.

6.2.1.1.3.3.1 Feedwater Line Break

STD DEP T1 2.4-2

STD DEP 6.2-2

*Immediately following a double-ended rupture in one of the two main feedwater lines just outside the vessel (Figure 6.2-1), the flow from both sides of the break will be limited to the maximum allowed by critical flow considerations. The effective flow area on the RPV side is ~~given in Figure 6.2-2~~*0.08399 m^2*. Reverse RPV flow in the second FW line is prevented by check valves shown in Figure 6.2-1. ~~During the inventory depletion period, subcooled blowdown occurs and the effective flow area at saturated condition is much less than the actual break area. The detailed calculational method is provided in Reference 6.2-1.~~*

~~The maximum possible feedwater flow rate was calculated to be 164% of nuclear boiler rated (NBR), based on the response of the feedwater pumps to an instantaneous loss of discharge pressure. Since the Feedwater Control System will respond to decreasing RPV water level by demanding increased feedwater flow, and there is no FWLB sensor in the design, this maximum feedwater flow was conservatively assumed to continue for 120 seconds (Figure 6.2-3). This is very conservative because:~~

~~(1) All feedwater system flow is assumed to go directly to the drywell.~~

~~(2) Flashing in the broken feedwater line was ignored.~~

~~(3) Initial feedwater flow was assumed to be 105% NBR.~~

~~(4) The feedwater pump discharge flow will coastdown as the feedwater system pumps trip due to low suction pressure. During the inventory depletion period, the flow rate is less than 164% because of the highly subcooled blowdown. A feedwater line length of 100m was assumed on the feedwater system side.~~

In order to provide further assurance of conservatism, FWLB mitigation is added to the ABWR design. The system is described in Section 7.3.1.1.2. *The specific enthalpy time history, assuming the break flow of Figure 6.2-3, is shown in Figure 6.2-4.* Initial reactor power is assumed to be 102% NBR.

6.2.1.1.3.3.1.1 Assumptions for Short-Term Response Analysis

STD DEP 6.2-2

The response of the Reactor Coolant System and the Containment System during the short-term blowdown period of the accident has been analyzed using the following assumptions:

(1) *The initial conditions for the FWLB accident* ~~*are such that system energy is maximized and the system mass is minimized*~~maximize the containment pressure response. *That is:*

(a) *The reactor is operating at 102% of the rated thermal power, which maximizes the post-accident decay heat.*

(b) *The initial suppression pool mass is at the* ~~*low*~~nominal *water level.*

(c) *The initial wetwell air space volume is at the high water level.*

(d) *The suppression pool temperature is the operating maximum* ~~*temperature*~~value.

(4) ~~*The main steam isolation valves (MSIVs) start closing at 0.5 s after the accident. They are fully closed in the shortest possible time (at 3.5 s) following closure initiation.*~~The turbine stop valves are closed in 0.2 seconds after reactor trip/turbine trip (RT/TT). *By assuming rapid closure of these valves, the RPV is maintained at a high pressure, which maximizes the calculated discharge of high energy water into the drywell.*

(5) ~~*The vessel depressurization flow rates are calculated using Moody's homogeneous equilibrium model (HEM) for the critical break flow (Reference 6.2-2). The break area on the RPV side for this study is shown in Figure 6.2-2. During the inventory depletion period, subcooled blowdown occurs and the effective break area at saturated conditions is much less than the actual area. The detailed calculational method is provided in Reference 6.2-1.*~~

Reactor vessel internal heat transfer is modeled by dividing the vessel and internals into six metal nodes. A seventh node depends on the fluid (saturated or subcooled liquid, saturated steam) covering the node at the time. The assumptions include:

(a) *The center of gravity of each node is specified as the elevation of that node.*

(b) *Mass of water in system piping (except for HPCF and feedwater) is included in initial vessel inventory.*

(c) *Initial thermal power is 102% of rated power at steady-state conditions with corresponding heat balance parameters which correspond to turbine control valve constant pressure of 6.75 MPaA.*

(d) *Pump heat, fuel relaxation, and metal-water reaction heat are added to the ANSI/ANS-5.1 decay heat curve plus 20% margin.*

(e) Initial vessel pressure is 7.31 MPaA.Not Used

(6) *There are two HPCF Systems, one RCIC System, and three RHR Systems in the ABWR. One HPCF System, one RCIC System and two RHR Systems are assumed to be available. HPCF flow cannot begin until 36 seconds after a break, and then the flow rate is a function of the vessel-to-wetwell differential pressure. Rated HPCF flow is 182 m^3/h per system at 8.12 MPaD and 727 m^3/h, per system at 0.69 MPaD. Rated RHR flow is 954 m^3/h at 0.28 MPaD with shutoff head of 1.55 MPaD. Rated RCIC flow is 182 m^3/h with reactor pressure between 8.12 MPaG and 1.04 MPaG, and system shuts down at 0.34 MPaG*Influence of these systems is minimal since the time interval analyzed for short-term is approximately the same time as the response time of associated systems injections into the RPV.

(8) *The wetwell airspace temperature is allowed to exceed the suppression pool temperature as determined by a mass and energy balance on the airspace.*Not Used

(9) *Wetwell and drywell wall and structure heat transfer are*is *ignored.*

(10) *Actuation of SRVs is modeled.*

(11) *Wetwell-to-drywell vacuum breakers are not modeled*do not open in the short-term response analysis*.*

(12) *Drywell and wetwell sprays and RHR cooling mode are not modeled.*

(13) *The dynamic backpressure model is used.*Not Used

(14) *Initial drywell conditions are 0.107 MPa, 57°C*106.5 kPa*, and 20% relative humidity.*

(15) Initial wetwell airspace conditions are ~~0.107 MPa~~106.5 kPa, 35°C and 100% relative humidity.

(16) ~~The drywell is modeled as a single node. All break flow into the drywell is homogeneously mixed with the drywell inventory.~~Not Used

(17) ~~Because of the unique containment geometry of the ABWR, the inert atmosphere in the lower drywell would not transfer to the wetwell until the peak pressure in the drywell is achieved. Figure 6.2-5 shows the actual case and the model assumption. Because the lower drywell is connected to the drywell connecting vent, no gas can escape from the lower drywell until the peak pressure occurs. This situation can be compared to a bottle whose opening is exposed to an atmosphere with an increasing pressure. The contents of the lower drywell will start transferring to the wetwell as soon as the upper drywell pressure starts decreasing. A conservative credit for transfer of 50% of the lower drywell contents into the wetwell was taken.~~ Not Used

6.2.1.1.3.3.1.2 Assumptions for Long-Term Cooling Analysis

STD DEP 6.2-2

Following the blowdown period, the ECCS discussed in Section 6.3 provides water for core flooding, containment spray, and long-term decay heat removal. The containment pressure and temperature response during this period was analyzed using the following assumptions:

(3) *The suppression pool is* ~~*the only*~~modelled as a *heat sink* ~~*available*~~ *in the containment system.*

6.2.1.1.3.3.1.3 Short-Term Accident Responses

STD DEP 6.2-2

The calculated containment pressure and temperature responses for a feedwater line break are shown in Figures 6.2-6 and 6.2-7, respectively. ~~*The peak pressure (268.7 kPaG) and temperature (140°C) occur in the drywell. The containment design pressure of 309.9 kPaG is 115% of the peak pressure.*~~

~~*The drywell pressurization is driven by the wetwell pressurization for stable peaks. The wetwell pressurization is a function of three major parameters:*~~

~~(1) *The increased wetwell air mass caused by the addition of drywell air*~~

~~(2) *Compression of the airspace volume due to increased suppression pool volume*~~

~~(3) *Increased vapor partial pressure from increasing suppression pool temperature*~~

~~*The suppression pool volume increase is caused by the liquid addition to the containment system from the broken feedwater line. Contribution of these parameters to wetwell pressurization is about 80% by the increased air mass, 15% by the compression effects, and 5% by the increased vapor partial pressure. Once air carryover from the drywell is completed, the wetwell and, subsequently, the drywell pressure peak occurs as the volumetric compression is completed and the pool volume begins to decrease due to the drawdown effects of the ECCS flow. Since the suppression pool volume continues to decrease as the ECCS flow continues, the short-term pressure peak is the peak pressure for the transient.*~~The containment pressure response (Figure 6.2-6) covers the pool swell phase of the short-term containment response. The drywell pressure peaks soon after bubble breakthrough as the break flow continues to push the drywell air to the wetwell. The wetwell pressure also continues to climb after this phase as the air carryover from the drywell continues.

6.2.1.1.3.3.1.4 Long-Term Accident Responses

STD DEP 6.2-2

In order to assess the adequacy of the containment system following the initial blowdown transient, an analysis was made of the long-term temperature and pressure response following the accident. The analysis assumptions are those discussed in Subsection 6.2.1.1.3.3.1.2.

~~*The short-term pressure peak (268.7 kPaG) of Figure 6.2-6 is the peak pressure for the whole transient.*~~ *Figure 6.2-8 shows temperature time histories for the suppression pool, wetwell, and drywell temperatures. The peak pool temperature (96.9°C) is reached at 15,350 seconds (4.264 hours) and remains below the 97.2°C limit.*

6.2.1.1.3.3.2 Main Steamline Break

STD DEP 6.2-2

A schematic of the ABWR main steamlines, with a postulated break in one of the main steamlines, is shown in Figure 6.2-9. The main steamline (MSL) break is a double-ended break with one end fed by the RPV directly through the broken line, and the other fed by the RPV through the unbroken main steamlines until the MSIVs are closed. Once the MSIVs are closed, the break flow is only from the RPV through the broken line.

Each MSL contains a flow limiter built into the MSL nozzle on the RPV with a throat area of 0.09848 m^2, as shown in Figure 6.2-9. This flow limiter provides the effective break area for the vessel side.

Flow from the condenser side of the break continues for 0.5 seconds, at which time the MSIVs begin to close on high flow signal. A valve stroke time of 5 seconds is used for the MSIV closure. Flow from the condenser side of the break is linearly ramped down to zero between 0.5 and 5.5 seconds.~~*The effective break area used for the MSL is shown in Figure 6.2-10. More detailed descriptions of the MSL break model are provided in the following:*~~

(1) *Each MSL contains a flow limiter built into the MSL nozzle on the RPV with a throat area of 0.0983m^2, as shown in Figure 6.2-9.*

(2) *The break is located in one MSL at the inboard MSIV.*

(3) *During the inventory depletion period, the flow multiplier of 0.75 is applied (Reference 6.2-1).*

(4) *The flow resistance of open MSIVs is considered. A conservative value of 2.062 for pressure loss coefficient for two open MSIVs was taken. The nominal value is approximately 3.0. When the open MSIV resistance is considered, the flow chokes at the MSIV on the piping side as soon as the inventory depletion period ends. The effective flow area on the piping side reduces to 70% of a frictionless piping area. The value of 70% applies to flow of steam and twophase mixture with greater than 15% quality.*

This assumption is quite conservative because all other resistances in piping are ignored and the flow in the steamline within a one to two second period is either all steam or a two-phase mixture of much greater than 15% quality.

(5) *MSIVs are completely closed at a conservative closing time of 5.5 seconds (0.5 seconds greater than the maximum closing time plus instrument delay), in order to maximize the break flow.*

6.2.1.1.3.3.2.1 Assumptions for Short-Term Response Analysis

STD DEP 6.2-2

The response of the reactor coolant system and the containment system during the short-term blowdown period of the MSLB accident is analyzed using the assumptions listed in the above subsection and Subsection 6.2.1.1.3.3.1.1 for the feedwater line break, with the following exceptions: except feedwater mass flow rate for a MSL break was assumed to be 130% NBR.

(1) *The vessel depressurization flow rates are calculated using the Moody's HEM for the critical break flow.*

(2) *The turbine stop valve closes at 0.2 second. This determines how much steam flows out of the RPV, but does not affect the inventory depletion time on the piping side.*

(3) *The break flow is saturated steam if the RPV collapsed water level is below the MSL elevation; otherwise, the flow quality is the vessel average quality. This case provides the limiting drywell temperature.*

Another case was evaluated with the assumption that the two-phase level swell would reach the main steam nozzle in one second, thereby changing the flow quality to the RPV average quality after one second. This case provides a higher drywell pressure but a lower drywell temperature than the first assumption.

(4) The feedwater mass flow rate for a MSL break was assumed to be 130% NBR for 120 seconds. This is a standard MSL break containment analysis assumption based on a conservative estimate of the total available feedwater inventory and the maximum flow available from the feedwater pumps with discharge pressure equal to the RPV pressure. The feedwater enthalpy was calculated as described for the FWL break (Subsection 6.2.1.1.3.3.1.1) for 130% NBR flow, and is shown in Figure 6.2-11.

(5) The SRVs are not actuated.

6.2.1.1.3.3.2.3 Short-Term Accident Response

STD DEP 6.2-2

*Figures 6.2-12 through 6.2-15*and 6.2-13 *show the pressure and temperature responses of the drywell and wetwell during the blowdown phase of the steamline break accident.*

The maximum drywell temperature (161°C) is predicted to occur for the steamline break. *The MSLB with two-phase blowdown starting when the RPV collapsed level is at the main steamline nozzle provides the highest peak drywell temperature. The peak drywell temperature is 169.7*161°C*, below the design value of 171.1°C, and is the limiting one as compared to the FWLB peak temperature. The peak drywell pressure for the MSLB remains below that for the FWLB, which becomes the most limiting.* The peak drywell temperature and pressure is below the design temperature and pressure. The MSLB is the limiting event for peak drywell temperature. The FWLB is the most limiting for drywell pressure.

6.2.1.1.3.3.2.4 Long-Term Accident Response

STD DEP 6.2-2

*The long-term containment pressure and temperature responses following the MSLB accident remain below those for the feedwater line break, which is the most limiting event.*The long-term containment pressure response following the MSLB accident remains below that for the feedwater line break. The long-term temperature response remains below that for the peak achieved in the short term for the steam line break shown in Figure 6.2-13.

6.2.1.1.3.4.1 Short-Term Pressurization Model

STD DEP 6.2-2

*The analytical models, assumptions and methods used to evaluate the containment response during the reactor blowdown phase of a LOCA are described in References 6.2-1, and 6.2-2*similar to those for the feedwater line break.

6.2.1.1.4 Negative Pressure Design Evaluation

STD DEP 6.2-2

Drywell depressurization following a ~~FWLB~~LOCA results in the severest pressure transient in the drywell; this transient is therefore used in sizing the Wetwell-to-Drywell Vacuum Breaker System (WDVBS). The most severe depressurization in the wetwell is caused by wetwell spray actuation subsequent to a stuck open relief valve. The analysis of this transient shows that the Primary Containment Vacuum Breaker System (PCVBS) is not required.

6.2.1.1.7 Asymmetric Loading Conditions

STD DEP Admin

Localized pipe forces, pool swell and SRV actuation are asymmetric pressure loads which act on the containment and internal structure (see Subsection ~~6.2.1.1.5~~ 6.2.1.1.6 *for magnitudes of pool swell and SRV loads).*

6.2.4.3.2.1.1.6 Recirculation Pump Seal Purge Water Supply Line

STD DEP 6.2-3

The evaluations for previous similar designs show that the consequences of breaking the line are less severe than those of failing an instrument line. The recirculation pump seal water line is 20A Quality Group B from the manual shutoff valve located close to the recirculation pump motor housing through the ~~second~~ excess flow *check valve (located outside the containment). From the ~~second~~ excess flow check valve to the CRD connection, the line is Quality Group D.* An orifice is located inside the containment and if *~~If~~ the line is postulated to fail and ~~either one of~~ the* excess flow check valve *~~check valves~~ is assumed not to close (single active failure), the flow rate through the broken line is calculated to be substantially less than permitted for a broken instrument line. Therefore, ~~the two check valves in series~~* this configuration provides *~~provide~~ sufficient isolation capability for postulated failure of the line.*

6.2.4.3.2.1.2 Effluent Lines

STD DEP Admin

Table ~~6.2-3~~ ~~6.2.7~~6.2-6 *contains those effluent lines that comprise the reactor coolant pressure boundary and which penetrate the containment.*

~~6.2.4.3.2.2.1.2 RCIC Turbine Exhaust and Pump Minimum Flow Bypass Lines~~

~~STD DEP 6.2-3~~

~~The RCIC turbine exhaust line, which penetrates the containment and discharges to the suppression pool, is equipped with a normally open, motor-operated, remote-manually actuated gate valve located as close to the containment as possible. In addition, there is a simple check valve upstream of the gate valve, which provides positive actuation for immediate isolation in the event of a break upstream of this valve. The gate valve in the RCIC turbine exhaust is designed to be locked open in the control room~~ normally open *~~and is interlocked to preclude opening of the inlet steam valve to the turbine until the turbine exhaust valve is in its full-open position. The RCIC pump~~*

minimum flow bypass line is isolated by a normally closed, remote manually actuated valve outside containment.

6.2.4.3.2.2.2.3 ACS Lines to Containment

STD DEP 6.2-1

The Atmospheric Control System (ACS) has both influent and effluent 550A 500A lines which penetrate the containment. Both isolation valves on these lines are outside of the containment vessel to provide accessibility to the valves. The valves are located as close as practical to the containment vessel.

The ACS also has two 50A makeup line isolation valves which are normally open during normal reactor operation to provide nitrogen makeup into the containment. If these isolation valves are placed in the normally closed position, nitrogen makeup will not be possible without opening. In either position, these valves need to open to provide nitrogen makeup. The normally open position provides automatic nitrogen makeup without frequent cycling that could cause damage to valves. In the event of a LOCA or an event requiring primary containment isolation, these valves automatically close upon receipt of the following signals: high drywell pressure, low water level, high radioactivity in the purge and vent exhaust line. These valves are redundant and meet ESF requirements as described above for the 550A 500A influent and effluent lines.

6.2.4.3.4 Evaluation of Containment Purge and Vent Valves Isolation Barrier Design

STD DEP T1 3.4-1

STD DEP 6.2-3

Protection of the containment purge system CIVs from the effects of flood and dynamic effects of pipe breaks will be provided in accordance with Sections 3.4 and 3.6. The CIVs are air-operated with pilot DC AC *solenoid valve. The power to the DC* AC *solenoid valve is supplied from the DC* Vital AC *distribution system to the demultiplexer* I/O device *for the valve. Both the supply and return lines for the DC* AC *are fused at the multiplexer* I/O device *so that faults are isolated and do not propagate back up into the portions of the DC* Vital AC *system common with other systems. This is also discussed in the Fire Hazard Analysis in Section 9A.5.*

6.2.4.3.5 Evaluation of Simultaneous Venting of Drywell and Wetwell

STD DEP 6.2-1

The large (550A 500A) purge and vent lines for the ACS, shown in Figure 6.2-39 are not used for purge or venting during normal reactor operation. The isolation valves in these lines are normally closed, they fail in the closed position, they receive an automatic closure signal in the event of a LOCA and they are not needed for pressure control of the containment during normal operation. Administrative controls are used to prevent opening of these valves except at the beginning and end of an operating cycle.

~~*Pressure control of the containment during operation is maintained by a single, small (50A) nitrogen supply line, and a single, small (50A) vent line. The supply line is divided and provides makeup nitrogen to both drywell and wetwell. The small vent line is attached to the 550A 500A drywell purge exhaust line and bypasses the closed 550A 500A valve (F004). There is no equivalent vent line from the wetwell. Therefore, the drywell and wetwell are not vented simultaneously during operation and the system has only one supply and one exhaust line as required by BTP CSB 6-4.*~~

6.2.5 Combustible Gas Control in Containment

STD DEP T1 2.14-1

The Atmospheric Control System (ACS) is provided to establish and maintain an inert atmosphere within the primary containment during all plant operating modes except during shutdown for refueling or equipment maintenance and during limited periods of time to permit access for inspection at low reactor power. ~~*The Flammability Control System (FCS) is provided to control the potential buildup of hydrogen and oxygen from design basis metal water reaction and radiolysis of water. The objective of these systems is to preclude combustion of hydrogen causing damage to essential equipment and structures. The COL applicant is required to provide a comparison of costs and benefits for any optional alternate system of hydrogen control.*~~

6.2.5.1 Design Bases

STD DEP T1 2.14-1

Since there is no design requirement for the ACS ~~*or FCS*~~ *in the absence of a LOCA and since there is no design basis accident in the ABWR that results in core uncovery or fuel failures, the following requirements mechanistically assume that a LOCA producing the design basis quantities of hydrogen and oxygen has occurred. Following are criteria that serve as the bases for design:*

(1) *The hydrogen generation from metal-water reaction is defined in Regulatory Guide 1.7.*

(2) *The hydrogen and oxygen generation from radiolysis is defined in Regulatory Guide 1.7.*

(7) ~~*The FCS is capable of controlling combustible gas concentrations in the containment atmosphere for the design bases LOCA without relying on purging and without releasing radioactive material to the environment.*~~ Not Used

(8) *The ACS* ~~*and FCS together are*~~ is *designed to maintain an inert primary containment after the design-bases LOCA, assuming a single-active failure The backup purge function need not meet this criterion.*

(12) *The ACS is non-safety class except as necessary to assure primary containment integrity (penetrations, isolation valves). The ACS* ~~*and FCS are*~~ is *designed and built to the requirements specified in Section 3.2.*

6.2.5.2.1 General

STD DEP T1 2.14-1

The ~~*FCS and*~~ *ACS* ~~*are systems*~~system is *designed to control the environment within the primary containment.* ~~*The FCS provides control over hydrogen and oxygen generated following a LOCA. In an inerted containment, mixing of any hydrogen generated is not required.*~~ *Any oxygen evolution from radiolysis is very slow such that natural convection and molecular diffusion is sufficient to provide mixing. Spray operation will provide further assurance that the drywell or wetwell is uniformly mixed.* ~~*The FCS consists of the following features:*~~

~~*(1)*~~ ~~*(1) The FCS has two recombiners installed in the secondary containment. The recombiners process the combustible gases drawn from the primary containment drywell.*~~

~~*(2)*~~ ~~*(2) The FCS is activated when a LOCA occurs. The oxygen and hydrogen remaining in the recombiners after having been processed are transmitted to the suppression pool.*~~

The ACS provides and maintains an inert atmosphere in the primary containment during plant operation. The system is not designed as a continuous containment purging system. The ACS exhaust line isolation valves are closed when an inert condition in the primary containment has been established. The nitrogen supply makeup lines, compensating for leakage, provide a makeup flow of nitrogen to the containment. If a LOCA signal is received, the ACS valves close. Nitrogen purge from the containment occurs during shutdown for personnel access. Purging is accomplished with the containment inlet and exhaust isolation valves opened to the selected exhaust path and the nitrogen supply valves closed. Nitrogen is replaced by air in the containment (see Item (3) Shutdown-Deinerting below this subsection). The system has the following features:

(3) *The redundant oxygen analyzer system (CAMS) measures oxygen in the drywell and suppression chamber. Oxygen concentrations are displayed in the main control room.* ~~*Description of safety-related display instrumentation for containment monitoring is provided in Chapter 7. Electrical requirements for equipment associated with the combustible gas control system are in accordance with the appropriate IEEE standards as referenced in Chapter 7.*~~

The following interfaces with other systems are provided:

(1) *Residual Heat Removal System (RHR): The RHR System provides postaccident suppression pool cooling, as necessary, following heat dumps to the pool, including the exothermic heat of reaction released by the design basis metal-water reaction. This heat of reaction is very small and has no real effect on pool temperature or RHR heat exchanger sizing. The wetwell spray portion of the RHR may be activated during a LOCA help mixing by reducing pocketing. Wetwell spray would also serve to accelerate deaeration of the*

suppression pool water, though the impact of the dissolved oxygen on wetwell airspace oxygen concentration is very small. ~~The RHR System also provides cooling water to the exhaust flow from the FCS.~~

(6) *Containment Atmospheric Monitoring System: Monitors oxygen levels in the wetwell and drywell ~~during accident conditions~~ to confirm the primary containment oxygen level is kept within limits.*

6.2.5.2.6.1 General

STD DEP 6.2-3

(6) *The rupture disk is part of the primary containment boundary and is able to withstand the containment design pressure (309.9 kPa) with no leakage to the environment. It is also capable of withstanding full vacuum in the wetwell vapor space without leakage. The disk ruptures at 617.8 kPa due to overpressurization during a severe accident as required to assure containment structural integrity. As potential backup to a leaking, fractured or improperly sealed rupture disk, the two valves upstream of the disk can be closed. These valves are safety-related and are subjected to all testing required for normal isolation valves. The solenoids in these valves are ~~DC~~ powered* by vital AC (VAC)*. These valves are capable of closing against pressures up to 617.8 kPaG.*

6.2.5.2.7 ~~Flammability Control System~~Not Used

STD DEP T1 2.14-1

~~(1) *The FCS consists of two permanently installed, safety-related thermal hydrogen recombiners with associated piping, valves, controls and instrumentation. The recombiner units are located in the secondary containment and controlled from the main control room. Each recombiner shown in Figure 6.2-40 removes gas from the drywell, recombines the oxygen with hydrogen, and returns the gas mixture along with the condensate to the suppression chamber. Each recombiner unit is an integral package consisting of a blower, electric heater, reaction chamber, water spray cooler, water separator, piping, valves, controls and instrumentation.*~~

~~(2) *During operation of the system, gas is drawn from the drywell by the blower and heated. Hydrogen and oxygen in the gas will be recombined into steam in the reaction chamber and condensed in the spray cooler. The condensate and spray water, along with some of the gas, are returned to the wetwell. The rest of the gas is recycled through the blower. Cooling water required for operation of the system after a LOCA is taken from the RHR system. The cooling water is used to cool the water vapor and the residual gases leaving the recombiner prior to returning them to the containment.*~~

~~*(3) All pressure containing equipment, including piping between components is considered an extension of the containment, and designed to ASME Section III Safety Class 2 requirements. Independent drywell and suppression chamber penetrations are provided for the two recombiners. Each penetration has two normally closed isolation valves; one pneumatically operated and one motor operated. The system is designed to meet Seismic Category I requirements. The recombiners are in separate rooms in the secondary containment and are protected from damage by flood, fire, tornadoes and pipe whip.*~~

~~*(4) After a LOCA, the system is manually actuated from the control room when high oxygen levels are indicated by the containment atmospheric monitoring system (CAMS). (If hydrogen is not present, oxygen concentrations are controlled by nitrogen makeup.) Operation of either recombiner will provide effective control over the buildup of oxygen generated by radiolysis after a design basis LOCA. Once placed in operation the system continues to operate until it is manually shut down when an adequate margin below the oxygen concentration design limit is reached.*~~

~~6.2.5.3 Design Evaluation~~

~~STD DEP 6.2-1~~

~~*During normal operation, nitrogen makeup and containment pressure control are accomplished using only the 50A supply lines. The large valves (550A 500A) in the containment ventilation lines are closed and flow to the plant stack through the overpressure protection line (250A) is prevented by the rupture disk.*~~

~~*The following conditions assure that the large (550A 500A) containment purge and vent lines will be isolated following a LOCA:*~~

6.2.5.4 Tests and Inspections

STD DEP T1 2.14-1

Preoperational tests of the ACS ~~and FCS~~ are conducted during the final stages of plant construction prior to initial startup.

6.2.5.5 Instrumentation Requirements

As discussed in Subsection 6.2.5.2, ~~safety-grade~~ oxygen monitoring is provided in the wetwell and drywell by the CAMS. This monitoring function, when used during normal operation, determines when the primary containment is inert and nitrogen purging may be terminated. It also determines when primary containment is de-inerted and personnel re-enter procedures may be initiated.

6.2.5.6 Personnel Safety

The following standard supplement addresses the COL License Information Item in this subsection of the reference ABWR DCD.

A special maintenance procedure provides the requirements for controlling purged drywell entry. This procedure contains the following elements:

(1) Inerting and de-inerting of the drywell is in conformance with applicable Technical Specifications.

(2) Personnel access to the drywell is normally prohibited at all times when the drywell has an oxygen-deficient atmosphere, unless an emergency condition arises, in which case the procedure outlined in Subsection 6.2.5.6(8) should be followed.

(3) The status of the drywell atmosphere is posted at the drywell entrance at all times, and the entrance locked, except when cleared for entry.

(4) Suitable authorization, control and recording procedures are established and remain in effect throughout the entry process.

(5) Prior to initial entry, the drywell is purged with air in accordance with operating procedure until drywell samples indicate that the following conditions are met:

(a) Oxygen: Greater than 16.5% content by volume.

(b) Hydrogen: Less than 14% of the lower limit of flammability, or a limit of 0.57% hydrogen by volume. (The lower flammability limit is 4.1% hydrogen content by volume.)

(c) Carbon Monoxide: Less than 100 ppm.

(d) Carbon Dioxide: Less than 5000 ppm.

(e) Airborne Activity: Less than applicable limits in 10 CFR 20, or equivalent.

(6) During the purge, drywell atmosphere samples are drawn from a number of locations when the drywell oxygen analyzer indicates an oxygen concentration of 16.5% or greater. Samples are analyzed for oxygen, hydrogen, carbon monoxide, carbon dioxide and airborne activity. When the results of two successive samples taken at least one-half hour apart are found to be within the conditions in Subsection 6.2.5.6(5), initial entry may be authorized.

(7) Criteria for entry are:

(a) The initial entry will require a minimum of two (2) persons.

(b) Initial entry will require, in addition to normal protective clothing and protective equipment consisting of self-contained breathing apparatus

(such as Scott Air Pack), portable air sampling and monitoring equipment, and portable radiation survey meters.

(c) A means of communication shall be established.

(8) Under certain conditions, the Plant General Manager (or his designee) may deem that an emergency condition exists which would justify drywell entry with an oxygen deficient atmosphere.

(9) When it has been determined from the results of the initial entry survey and samples that the entire drywell atmosphere meets the required conditions, the drywell may be cleared for general access and the drywell status posted at the drywell entrance.

6.2.7 COL License Information

6.2.7.1 Alternate Hydrogen Control

The following standard supplement addresses COL License Information Item 6.2.

The NRC has revised 10 CFR 50.44 to amend its standards for combustible gas control in light-water-cooled power reactors. The amended rule eliminates the requirements for hydrogen recombiners and relaxes the requirements for hydrogen and oxygen monitoring. ~~The design departure describing the elimination of the hydrogen recombiners from the certified design was provided in ABWR Licensing Topical Report NEDE-33330P, "Advanced Boiling Water Reactor (ABWR) Hydrogen Recombiner Requirements Elimination," dated May 2007 (Ref. 6.2-7). As discussed in the LTR, with~~With the elimination of the requirement to provide hydrogen control equipment, the need to provide cost analysis for alternate control systems is also eliminated.

6.2.7.2 Administrative Control Maintaining Containment Isolation

The following standard supplement addresses COL License Information Item 6.3.

The necessary controls for maintaining the primary containment boundary in accordance with Subsection 6.2.6.3.1 are in various plant operating procedures which control operation, testing and maintenance requirements for containment barriers. These include administrative procedures for controlling access, surveillance and maintenance procedures for controlling testing and restoration of containment components and operating procedures for controlling the routine operation of containment valves and components.

6.2.7.3 Suppression Pool Cleanliness

The following standard supplement addresses COL License Information Item 6.4.

Appendix 6C provides a discussion of suppression pool cleanliness in support of preventing ECCS suction strainer plugging in accordance with Subsection 6.2.1.7. Periodic inspections of the suppression pool for cleanliness are performed during outage periods. Maintenance procedures provide procedure steps for removing, at periodic intervals, sediment and floating or sunk debris from the suppression pool that the SPCU does not remove.

6.2.7.4 Wetwell to Drywell Vacuum Breaker Protection

The following standard supplement addresses COL License Information Item 6.5.

The vacuum breakers are installed horizontally and located in the wetwell gas space. There is one valve per penetration (through the pedestal wall) with the valves opening into the lower drywell. The location protects vacuum breaker valves from being subjected to the cyclic pressure loading during LOCA steam condensation period. The location of these valves, both axially and azimuthally, is shown in Figures 1.2-3c and 1.2-13k. A Vacuum Breaker Shield (consisting of a solid "V" shaped plate) is provided below each vacuum breaker to protect the valves from LOCA pool swell loads. The pool swell loads in the wetwell space, where the vacuum breaker assemblies are exposed, are discussed in FSAR Appendix 3B.

6.2.7.5 Containment Penetration Leakage Rate Test (Type B)

The following standard supplement addresses COL License Information Item 6.5a.

Type B leakage rate tests are performed in conformance with 10 CFR 50 Appendix J for containment penetrations whose designs incorporate resilient seals, bellows, gaskets, or sealant compounds, airlocks and lock door seals, equipment and access hatch seals, and electrical canisters, and other such penetrations. The Containment Leakage Rate Program is described in Subsection 6.2.6.2.1.

6.2.8 References

The following supplement adds references to this subsection.

6.2-1 ABWR Licensing Topical Report NEDO-33372, "Advanced Boiling Water Reactor (ABWR) Containment Analysis," dated September 2007.

6.2-2 ABWR Licensing Topical Report NEDE-33330P, "Advanced Boiling Water Reactor (ABWR) Hydrogen Recombiner Requirements Elimination," Rev. 1, dated September 2007.

Table 6.2-1 Containment Parameters

Design Parameter	Design Value	Calculated Value
1. Drywell pressure	309.9 kPaG	~~268.7 kPaG~~240 kPaG
2. Drywell temperature	171.1°C	~~170°C~~161°C
3. Wetwell pressure	309.9 kPaG	~~179.5~~ 210.2 kPaG
4. Wetwell temperature		
• Gas Space	~~103.9 °C~~104°C	98.9°C
• Suppression pool	97.2°C	96.9°C

Table 6.2-2 Containment Parameters

	Drywell	Wetwell
A. Drywell and Wetwell		
1. Internal Design Pressure (kPaG)	309.9	~~309.96~~309.9
3. Design Temperature (°C)	171.1	~~103.9~~104
B. Vent System		
5. Vent Loss Coefficient (Varies with number of vents open)		~~2.5 – 3.5~~3.5 - 5.0

Table 6.2-2b Net Positive Suction Head (NPSH) Available to RHR Pumps

A. Suppression pool is at its minimum depth, El. –3740 mm.

B. ~~Centerline of pump suction~~**NPSH Reference level** is at El. –7200 mm*.

C. Suppression pool water is at its maximum temperature for the given operating mode, 100°C.

D. Pressure is atmospheric above the suppression pool.

E. Minimum suction strainer area as committed to by Appendix 6C methods.

NPSH available = $H_{ATM} + H_S - H_{VAP} -$ ~~H_F~~ **$(H_F + H_{ST})$**

where:

H_{ATM}= Atmospheric head

H_S= Static head

H_{VAP}= Vapor pressure head

H_F= Maximum Frictional head ~~including strainer allowed~~**excluding strainer frictional head**

H_{ST} = Strainer frictional head

Minimum Expected NPSH

RHR Pump Runout is 1130 m^3/h.

Maximum suppression pool temperature is 100°C.

H_{ATM}=~~10.78m~~**10.77m**

H_S=3.46m

H_{VAP} =~~10.78m~~**10.77m**

~~H_F=0.71m~~

NPSH available = ~~10.78 + 3.46 – 10.78 – 0.71 = 2.75m~~**10.77 + 3.46 - 10.77 - $(H_F + H_{ST})$ =3.46 - $(H_F + H_{ST})$**

NPSH required = ~~2.4m~~**2.0m**

Margin =~~0.35m~~**1.46 - $(H_F + H_{ST})$**= NPSH available – NPSH required

*** NPSH Reference level is 1m above the pump floor level**

**** The final system design will meet the required NPSH with adequate margin.**

Table 6.2-2c Net Suction Head (NPSH) Available to HPCF Pumps

A. Suppression pool is at its minimum depth, El. –3740 mm.

B. ~~Centerline of pump suction~~**NPSH Reference level** is at El. –7200 mm*.

C. Suppression pool water is at its maximum temperature for the given operating mode, 100°C.

D. Pressure is atmospheric above the suppression pool.

E. Minimum suction strainer area as committed to by Appendix 6C methods.

NPSH available = $H_{ATM} + H_S - H_{VAP} -$ ~~H_F~~**$(H_F + H_{ST})$**

Where:

H_{ATM}=Atmospheric head

H_S = Static head

H_{VAP} = vapor pressure head

H_F = Maximum Frictional head ~~including strainer allowed~~**excluding strainer frictional head**

H_{ST} = Strainer frictional head

Minimum Expected NPSH

HPCF Pump Runout is 890 m^3/h.

Maximum suppression pool temperature is 100°C

H_{ATM} = ~~10.78m~~**10.77m**

H_S = 3.46m

H_{VAP} = ~~10.78m~~**10.77m**

~~H_F = 0.91m~~

NPSH available = ~~10.78 + 3.46 – 10.78 – 0.91 = 2.55m~~**10.77 + 3.46 - 10.77 - $(H_F + H_{ST})$ = 3.46 - H_F + H_{ST})**

NPSH required = ~~2.2m~~**1.7 m**

Margin = ~~0.35~~1.76 - **$(H_F + H_{ST})$** = NPSH available – NPSH required

***NPSH Reference level is 1m above the pump floor level**

**** The find system design will meet the required NPSH with adequate margin.**

Table 6.2-5 Reactor Coolant Pressure Boundary (RCPB) Influent Lines Penetrating Drywell

Drywell	Inside Drywell	Outside Drywell
Influent Line		
5. Reactor water cleanup, reactor vessel head spray	~~MOV~~ **CV**	**MOV**
6. Recirculating internal pump seal purge water supply	~~CV~~N/A	~~CV~~EFCV

Note:
EFCV - Excess flow check valve

Table 6.2-6 Reactor Coolant Pressure Boundary (RCPB) Effluent Lines Penetrating Drywell

Inside Drywell	Outside Drywell	Drywell
Effluent Line		
1. Main steam	~~GOV~~AOV	GOV

Note:
AOV-Air operated valve. Air to open, and Air and/or spring to close.

Table 6.2-7 Containment Isolation Valve Information
Reactor Recirculation System RIP Purge

Valve No.	B31-F008A-H/J/K
Line Size	~~15A~~20A

Table 6.2-7 Containment Isolation Valve Information*

MPL	System	Page
~~T49~~	~~Flammability Control~~	~~Page 6.2-155 and 6.2-156~~

Table 6.2-7 Containment Isolation Valve Information
Standby Liquid Control System

Valve No.	*C41-F008*	*C41-F006A*	*C41-F006B*
Type C Leak Test	~~No (w)~~ **Yes**	~~No (w)~~ **Yes**	~~No (w)~~ **Yes**

Table 6.2-7 Containment Isolation Valve Information ~~(Continued)~~

Containment Atmospheric Monitoring

Valve No.	**D23-F001A/B**	**D23-F004A/B**	**D23-F005A/B**	**D23-F006A/B**	**D23-F007A/B**	**D23-F008A/B**
Normal Position	Open	Close/**Open**	Close/**Open**	Close/**Open**	Close/**Open**	Close/**Open**
Containment Isolation Signal(c)	~~N/A~~ **RM**	~~N/A~~ **RM**	~~N/A~~ **RM**	~~N/A~~ **RM**	~~N/A~~ **RM**	~~N/A~~ **RM**

Table 6.2-7 Containment Isolation Valve Information ~~(Continued)~~
Residual Heat Removal System Wetwell Spray

Valve No.	**E11-F019B**	**E11-F019C**
Post-accident Position	Close/**Open**	Close/**Open**
Closure Time (s)	~~20~~ ~~34~~20	~~20~~ ~~34~~20

Residual Heat Removeal System Drywell Spray

Valve No.	**E11-F017B**	**E11-F018B**	**E11-F017C**	**E11-F018C**
Post-accident Position	Close/**Open**	Close/**Open**	Close/**Open**	Close/**Open**

Residual Heat Removal System Minimum Flow Line

Valve No.	**E11-F021A**	**E11-F021B**	**E11-F021C**
Shutdown Position	~~Open~~ **Close**	~~Open~~ **Close**	~~Open~~ **Close**

Residual Heat Removal System S/P Cooling

Valve No.	**E11-F008A**		**E11-F008B**		**E11-F008C**
Line Size	~~200A~~ **250A**		~~200A~~ **250A**		~~200A~~ **250A**

Residual Heat Removal System S/P Suction (LPFL)

Valve No.	**E11-F001A**	**E11-F001B**	**E11-F001C**
Post-accident Position	~~Close~~ **Open**	~~Close~~ **Open**	~~Close~~ **Open**

Residual Heat Removal System Inboard Shutdown Cooling

Valve No.	**E11-F010A**	**E11-F010B**	**E11-F010C**
Shutdown Position	~~Close~~Open/Close	~~Close~~Open/Close	~~Close~~Open/Close

Table 6.2-7 Containment Isolation Valve Information
Residual Heat Removal System Outboard Shutdown Cooling

Valve No.	E11-F011A	E11-F011B	E11-F011C
Shutdown Position	~~Close~~Open/Close	~~Close~~Open/Close	~~Close~~Open/Close

Table 6.2-7 Containment Isolation Valve Information ~~(Continued)~~

Residual Heat Removal System Injection and Testable Check

Valve No.	E11-F005B	E11-F006B	E11-F005C	E11-F006C
Post-accident Position	Close/**Open**	Close/**Open**	Close/**Open**	Close/**Open**

High Pressure Core Flooder System S\P Suction

Valve No.	E22-F006B	E22-F006C
Post-Accident Position	Close/**Open**	Close/**Open**
Containment Isolation Signal (c)	~~N/A~~ **RM**	~~N/A~~ **RM**

High Pressure Core Flooder System Test and Minimum Flow

Valve No.	E22-F009B	E22-F010B	E22-F009C	E22-F010C
Containment Isolation Signal (c)	~~N/A~~ **RM**	~~N/A~~ **RM**	~~N/A~~ **RM**	~~N/A~~ **RM**

High Pressure Core Flooder System Injection

Valve No.	E22-F003B	E22-F004B	E22-F003C	E22-F004C
Post-Accident Position	Close/**Open**	Close/**Open**	Close/**Open**	Close/**Open**

Nuclear Boiler System Main Steam Lines A, B, C and D

Valve No.	B21-F008A/B C/D	B21-F009A/B C/D
ESF	~~Yes~~ **No**	~~Yes~~ **No**
Type C Leak Test	Yes(e)~~(t)~~	Yes(e)~~(t)~~
Primary Actuation	*N_2 to open* *N_2 and/or Spring to close*	~~N_2~~Air to open ~~N_2~~Air and/or Spring to close
Containment Isolation Signal (c)	C, ~~D~~, E, F, H, N, BB, RM	C, ~~D~~, E, F, H, N, BB, RM

Table 6.2-7 Containment Isolation Valve Information ~~(Continued)~~

Nuclear Boiler System Main Steam Line Drains

Valve No.	B21-F011	B21-F012
ESF	~~Yes~~ **No**	~~Yes~~ **No**
Type C Leak Test	Yes(e)~~(t)~~	Yes(e)~~(t)~~
Normal Position	~~Open/**Close**~~ *Open*	~~Open/**Close**~~ *Open*
Containment Isolation Signal (c)	C, ~~D~~, E, F, H, N, BB, RM	C, ~~D~~, E, F, H, N, BB, RM
Power Source (Div)	~~II I~~ II	~~I II~~ I

Nuclear Boiler System Feedwater Line A and B

Valve No.	B21-F004A/B	B21-F003A/B
Type C Leak Test	Yes ~~(t)~~	Yes ~~(t)~~
Shutdown Position	~~Close~~Open/Close	~~Close~~Open/Close
Post-Accident Position	~~Close~~Open/Close	~~Close~~Open/Close

Reactor Core Isolation Cooling System Steam Supply

Valve No.	E51-F035	E51-F048	E51-F036
Type C Leak Test	Yes(e) ~~(t)~~	Yes(e) ~~(t)~~	Yes ~~(t)~~
Post-Accident Position	~~Close~~Open/Close	~~Close~~Open/Close	~~Close~~Open/Close

Reactor Core Isolation Cooling System S/P Suction

Valve No.	**E51-F006**
Post-Accident Position	~~Close~~Close/Open

Reactor Core Isolation Cooling System Turbine Exhaust

Valve No.	**E51-F039**	**E51-F038**
Type C Leak Test	Yes(e) ~~(t)~~	Yes~~(t)~~
Shutdown Position	*Open*	~~Open~~Close

Table 6.2-7 Containment Isolation Valve Information (Continued)

Reactor Core Isolation Cooling System Vacuum Pump Discharge

Valve No.	E51-F047	E51-F046
Tier 2 Figure	5.4-8 (Sheet 1)	5.4-8 (Sheet 1)
Applicable Basis	GDC 56	GDC 56
Fluid	Steam	Steam
Line Size	50A	50A
ESF	Yes	Yes
Leakage Class	(a)	(a)
Location	O	O
Type C Leak Test	No(l)	No(l)
Valve Type	Gate	Check
Operator	Motor	Self
Primary Actuation	Electrical	N/A
Secondary Actuation	Manual	N/A
Normal Position	Open	Close
Shutdown Position	Open	Open
Post-Accident Position	Close	Close
Power Fail Position	As is	N/A
Containment Isolation Signal (c)	RM	N/A
Closure Time (s)	<10	Instantaneous
Power Source (Div)	I	N/A

See page 6.2-167 for notes

Table 6.2-7 Containment Isolation Valve Information (Continued)

Atmospheric Control System

Valve No.	T31-F001	T31-F002	T31-F003	T31-F004	T31-F005	T31-F006	T31-F007
Line Size	550A 500A*550A*	550A 500A*550A*	550A 500A*550A*	550A 500A*550A*	50A	550A 500A*550A*	250A
Containment Isolation Signal (c)	A, K, XX, YY, **RM**	A, K, XX, YY, **RM**	A, K, XX, YY, **RM**	A, K, XX, YY, **RM**	A, K, XX, YY, **RM**	A, K, XX, YY, **RM**	RM

Atmospheric Control System

Valve No.	**T31-F008**	**T31-F009**	**T31-F025**	**T31-F039**	**T31-F040**	**T31-F041**
Line Size	~~550A~~ ~~**500A**~~*550*	~~550A~~ ~~**500A**~~*550A*	400A	50A	50A	50A
Leakage Class	~~(b)~~ **(a)**	~~(b)~~ **(a)**	~~(b)~~ **(a)**	~~(b)~~ **(a)**	~~(b)~~ **(a)**	~~(b)~~ **(a)**
Type C Leak Test	Yes **(b)**	Yes **(b)**~~)~~	Yes **(b)**	Yes **(b)**	Yes~~(c)~~	Yes~~(c)~~
Containment Isolation Signal (c)	A, K, XX, YY, **RM**	A, K, XX, YY, **RM**	A, K, XX, YY, **RM**	A, K, XX, YY, **RM**	A, K, XX, YY, **RM**	A, K, XX, YY, **RM**
Closure Time (s)	<20	<~~20~~ **15**	<20	<15	<15	<15

Atmospheric Control System

Valve No.	**T31-F731**	**T31-~~F033A/B~~** **F733A/B**	**T31-F~~035A-D~~** **F735A-D**	**T31-F010**	**T31-F011**
Line Size	20A	20A	20A	250A	~~550A~~ ~~**500A**~~*550A*
Containment Isolation Signal (c)	RM	RM	RM	RM	A, K XX, YY, **RM**

Atmospheric Control System

Valve No.	**T31-F805A/B**	**T31-D001**	**T31-D002**
Type C Leak Test	No(m)	No~~(P)~~ **(p)**	No~~(P)~~ **(p)**

Table 6.2-7 Containment Isolation Valve Information ~~*(Continued)*~~
~~Flammability Control System~~

~~Valve No.~~	~~T49-F001C~~	~~T49-F001B~~	~~T49-F002A~~	~~T49-F002E~~
~~Tier 2 Figure~~	~~6.2-40 (Sheet 2)~~	~~6.2-40 (Sheet 1)~~	~~6.2-40 (Sheet 1)~~	~~6.2-40 (Sheet 2)~~
~~Applicable Basis~~	~~GDC 56~~	~~GDC 56~~	~~GDC 56~~	~~GDC 56~~
~~Fluid~~	~~DW Atmosphere~~	~~DW Atmosphere~~	~~DW Atmosphere~~	~~DW Atmosphere~~
~~Line Size~~	~~100A~~	~~100A~~	~~100A~~	~~100A~~
~~ESF~~	~~Yes~~	~~Yes~~	~~Yes~~	~~Yes~~
~~Leakage Class~~	~~(a)~~	~~(a)~~	~~(a)~~	~~(a)~~
~~Location~~	~~O~~	~~O~~	~~O~~	~~O~~
~~Type C Leak Test~~	~~No(u)~~	~~No(u)~~	~~No(u)~~	~~No(u)~~
~~Valve Type~~	~~Gate~~	~~Gate~~	~~Gate~~	~~Gate~~
~~Operator~~	~~Motor~~	~~Motor~~	~~Pneumatic~~	~~Pneumatic~~
~~Primary Actuation~~	~~Electrical~~	~~Electrical~~	~~Electrical~~	~~Electrical~~
~~Secondary Actuation~~	~~Manual~~	~~Manual~~	~~Manual~~	~~Manual~~
~~Normal Position~~	~~Close~~	~~Close~~	~~Close~~	~~Close~~
~~Shutdown Position~~	~~Close~~	~~Close~~	~~Close~~	~~Close~~
~~Post-Accident Position~~	~~Open~~	~~Open~~	~~Open~~	~~Open~~
~~Power Fail Position~~	~~As is~~	~~As is~~	~~As is~~	~~As is~~
~~Containment Isolation Signal(c)~~	~~A,K~~	~~A,K~~	~~A,K~~	~~A,K~~
~~Closure Time (s)~~	~~<30~~	~~<30~~	~~<30~~	~~<30~~
~~Power Source (Div)~~	~~III~~	~~II~~	~~I, III~~	~~I, II~~
~~See page 6.2-167 for notes~~				

Table 6.2-7 Containment Isolation Valve Information ~~(Continued)~~
~~Flammability Control System~~

~~Valve No.~~	~~T49-F006A~~	~~T49-F006E~~	~~T49-F007C~~	~~T49-F007B~~
~~Tier 2 Figure~~	~~6.2-40 (Sheet 1)~~	~~6.2-40 (Sheet 2)~~	~~6.2-40 (Sheet 2)~~	~~6.2-40 Sheet 1)~~
~~Applicable Basis~~	~~GDC 56~~	~~GDC 56~~	~~GDC 56~~	~~GDC 56~~
~~Fluid~~	~~WW Atmosphere~~	~~WW Atmosphere~~	~~WW Atmosphere~~	~~WW Atmosphere~~
~~Line Size~~	~~150A~~	~~150A~~	~~150A~~	~~150A~~
~~ESF~~	~~Yes~~	~~Yes~~	~~Yes~~	~~Yes~~
~~Leakage Class~~	~~(a)~~	~~(a)~~	~~(a)~~	~~(a)~~
~~Location~~	~~O~~	~~O~~	~~O~~	~~O~~
~~Type C Leak Test~~	~~No(u)~~	~~No(u)~~	~~No(u)~~	~~No(u)~~
~~Valve Type~~	~~Gate~~	~~Gate~~	~~Gate~~	~~Gate~~
~~Operator~~	~~Pneumatic~~	~~Pneumatic~~	~~Motor~~	~~Motor~~
~~Primary Actuation~~	~~Electrical~~	~~Electrical~~	~~Electrical~~	~~Electrical~~
~~Secondary Actuation~~	~~Manual~~	~~Manual~~	~~Manual~~	~~Manual~~
~~Normal Position~~	~~Close~~	~~Close~~	~~Close~~	~~Close~~
~~Shutdown Position~~	~~Close~~	~~Close~~	~~Close~~	~~Close~~
~~Post-Accident Position~~	~~Open~~	~~Open~~	~~Open~~	~~Open~~
~~Power Fail Position~~	~~As is~~	~~As is~~	~~As is~~	~~As is~~
~~Containment Isolation Signal(c)~~	~~A,K~~	~~A,K~~	~~A,K~~	~~A,K~~
~~Closure Time (s)~~	~~<30~~	~~<30~~	~~<30~~	~~<30~~
~~Power Source (Div)~~	~~I, III~~	~~I, II~~	~~III~~	~~II~~
~~See page 6.2-167 for notes~~				

Table 6.2-7 Containment Isolation Valve Information (Continued)

Reactor Water Cleanup System

Valve No.	G31-F071	G31-F072
Tier 2 Figure	5.4-12 (Sheet 1)	5.4-12 (Sheet 1)
Applicable Basis	GDC55	GDC55
Fluid	RPV H_2O	RPV H_2O
Line Size	20A	20A
ESF	No	No
Leakage Class	(a)	(a)
Location	I	O
Type C leak Test	Yes	Yes
Valve Type	Globe	Globe
Operator	Pneumatic	Pneumatic
Primary Actuation	Electrical	Electrical
Secondary Actuation	Manual	Manual
Normal Position	Close	Close
Shutdown Position	Close	Close
Post-accident Position	Close	Close
Power Fail Position	Close	Close
Containment Isolation Signal(c)	C,E,F,H,N,BB,RM	C,E,F,H,N,BB,RM
Closure Time(s)	<15	<15
Power Source (Div)	II	I
See page 6.2-167 for notes		

Suppression Pool Cleanup System

Valve No.	G51-F001	G51-F002	G51-F006	G51-F007
Applicable Basis	GDC 56 5756	GDC 56 5756	GDC 56 5756	GDC 56 5756
ESF	Yes No	Yes No	Yes No	Yes No
Type C Leak Test	No(p) (r)(q)	No(p) (r)(q)	No(q)(r)	No(q)(r)
Shutdown Position	Open /**Close**	Open /**Close**	Open /**Close**	Open /**Close**
Post-Accident Position	Close	Close	N/A Close	Close
Containment Isolation Signal(c)	A,K,**X,RM**	A,K,**X,RM**	A,K,**X,RM**	A,K,**X,RM**
Closure Time (s)	<30 45<30	<30 45<30	Inst.	<30 60<30

Reactor Building Cooling Water System

Valve No.	P21-F075A /F076A	P21-F081A /F080A	P21-F075B /F076B	P21-F081B /F080B
Applicable Basis	GDC 57 **56**	GDC 57 **56**	GDC 57 **56**	GDC 57 **56**
Leakage Class	(b) **(a)**	(b) **(a)**	(b) **(a)**	(b) **(a)**
Type C Leak Test	No(s) (t)	No(s) (t)	No(s) (t)	No(s) (t)
Post-Accident Position	Close/**Open**	Close/**Open**	Close/**Open**	Close/**Open**

Table 6.2-7 Containment Isolation Valve Information (Continued)

HVAC Normal Cooling Water System

Valve No.	P24-F053	P24-F054	P24-F0142	P21P24-F0141
Applicable Basis	GDC 57 **56**	GDC 57 **56**	GDC 57 **56**	GDC 57 **56**
Leakage Class	(b) **(a)**	(b) **(a)**	(b) **(a)**	(b) **(a)**
Containment Isolation Signal(c)	CX,K,**RM**	N/A	CX,K,**RM**	CX,K,**RM**
Power Source (Div)	I	N/A	I II *I*	III I *II*

Table 6.2-7 Containment Isolation Valve Information (Continued)
Service Air System

Valve No.	P51-F131	P52-F132
Applicable Basis	GDC ~~57~~ 56	GDC ~~57~~56
See page 6.2-167 for notes		

Instrument Air System

Valve No.	P52-F276	P52-F277
Applicable Basis	GDC ~~57~~ **56**	GDC ~~57~~ **56**

High Pressure Nitrogen Gas Supply System

Valve No.	P54-F007A/F008A	P54-F007B/F008B	P54-F200/F209
Applicable Basis	GDC ~~57~~ **56**	GDC ~~57~~ **56**	GDC ~~57~~ **56**
Leakage Class	~~(b)~~ **(a)**	~~(b)~~ **(a)**	~~(b)~~ **(a)**
Type C Leak Test	No~~(r)~~ **(s)**	No~~(r)~~ **(s)**	No~~(r)~~ **(s)**
Containment Isolation Signal(c)	~~GG(Y)~~N/A	~~GG(Y)~~N/A	~~GG(Y)~~N/A

Leak Detection & Isolation System

Valve No.	E31-F002	E31-F003	E31-F004	E31-F005	E31-F009/ F010
Type C Leak Test	Yes(e)	Yes(e)	Yes(e)	Yes(e)	Yes(e) ~~(t)~~
Containment Isolation Signal(c)	B,K,**RM**	B,K,**RM**	B,K,**RM**	B,K,**RM**	N/A

Table 6.2-7 Containment Isolation Valve Information ~~(Continued)~~

Radwaste System

Valve No.	**K17-F003**	**K17-F004**	**K17-F103**	**K17-F104**
Applicable Basis	GDC ~~57~~ **56**	GDC ~~57~~ **56**	GDC ~~57~~ **56**	GDC ~~57~~ **56**
Type C Leak Test	No~~(v)~~ (w)	No~~(v)~~ (w)	No~~(v)~~ (w)	No~~(v)~~ (w)
Containment Isolation Signal(c)	A/~~FF~~ ,**K,RM**	FF,**A,K,RM**	A/~~FF~~ ,**K,RM**	FF,**A,K,RM**

Table 6.2-7 Breathing Air System

Valve No.	~~P56-F001~~P81-F251	~~P56-F002~~P81-F252
Tier 2 Figure	9.3-10	9.3-10
Applicable Basis	GDC 56	GDC 56
Fluid	Air	Air
Line Size	40A	40A
ESF	No	No
Leakage Class	~~(a)~~(b)	~~(a)~~(b)
Location	O	I
Type C Leak Test	Yes	Yes
Valve Type	Globe	~~Check~~Globe
Operator	~~Manual~~HW	~~None~~HW
Primary Actuation	~~Electrical~~ Manual	~~Electrical~~Manual
Secondary Actuation	~~Manual~~NA	~~Manual~~ NA
Normal Position	Close	Close
Shutdown Position	Close/Open	Close/Open
Post-Accident Position	Close	Close
Power Fail Position	~~As is~~NA	~~As is~~NA
Containment Isolation Signal(c)	NA	NA
Closure Time (s)	NA	NA
Power Source (Div)	NA	NA
See page 6.2-167 for notes		

Table 6.2-7 Containment Isolation Valve Information (Continued)
Neutron Monitoring System

Valve No.	C51-XXXA	C51-XXXB	C51-XXXC	C51-XXX
Tier 2 Figure	7.6-2 (Sheet 3)	7.6-2 (Sheet 3)	7.6-2 (Sheet 3)	7.6-2 (Sheet 3)
Applicable Basis	GDC57	GDC57	GDC57	GDC57
Fluid	N_2	N_2	N_2	N_2
Line Size	OD15	OD15	OD15	20A
ESF	No	No	No	No
Leakage Class	(a)	(a)	(a)	(a)
Location	O	O	O	O
Type C leak Test	No	No	No	No
Valve Type	Ball	Ball	Ball	Ball
Operator	Motor	Motor	Motor	Globe
Primary Actuation	Electrical	Electrical	Electrical	Solenoid
Secondary Actuation	N/A	N/A	N/A	N/A
Normal Position	Close	Close	Close	Close
Shutdown Position	Close	Close	Close	Close
Post-accident Position	Close	Close	Close	Close
Power Fail Position	Close	Close	Close	Close
Containment Isolation Signal(c)	A,K	A,K	A,K	A,K
Closure Time(s)	<3	<3	<3	Instantaneous
Power Source (Div)	N/A	N/A	N/A	N/A
See page 6.2-167 for notes				

Notes:
(c) Isolation Signal Codes

Signal	Description
D	~~High radiation main steamline.~~
~~M~~	~~Line bleak in RHR shutdown.~~
T	High pressure RCIC turbine exhaust ~~diaphragm~~

(v) ~~Flammability control is a closed loop, safety grade system required to be functional post-accident. Whatever is leaking (if any) is returned to the primary containment. In addition, during ILRT, these valves are opened and the lines are subjected to Type A test.~~Not Used

Table 6.2-8 Primary Containment Penetration List*

Penetration Number	Name	Elevation (mm)	Azimuth (deg)	Offset (mm)	Diameter (mm)	Barrier Type	Testing†‡
X-5	L/D Personnel Hatch	-650	0	0	2400/~~5000~~ 4300	Door	B
X-6	L/D Equipment Hatch	-900	180	0	2400/~~5000~~ 4300	Door	B
X-10A	Mainsteam Line	16300	0	1400	1200	Valve	~~A~~ C
X-10B	Mainsteam Line	16300	0	4200	1200	Valve	~~A~~ C
X-10C	Mainsteam Line	16300	0	-4200	1200	Valve	~~A~~ C
X-10D	Mainsteam Line	16300	0	-1400	1200	Valve	~~A~~ C
X-11	Mainsteam Drain	13650	0	5200	500	Valve	~~A~~ C
X-12A	Feedwater Line	13810	0	2800	950	Valve	~~A~~ C
X-12B	Feedwater Line	13810	0	-2800	950	Valve	~~A~~ C
X-22	Borated Water Injection	15250	275	0	450	Valve	A
X-30B	Drywell Spray	14680	260	-3400	200	Valve	A
X-30C	Drywell Spray	14680	100	3400	200	Valve	A
X-31A	HPCF (B)	14630	260	0	600	Valve	A
X-31B	HPCF (C)	14630	100	0	600	Valve	A
X-32A	LPFL (B) RHR (B)	14610	260	-2000	650	Valve	A
X-32B	LPFL (C) RHR (C)	14610	100	-1800	650	Valve	A
X-33A	RHR Suction (A)	14550	80	-800	750	Valve	A
X-33B	RHR Suction (B)	14550	260	1800	750	Valve	A
X-33C	RHR Suction (C)	14550	100	2000	750	Valve	A
X-37	RCIC Turbine Steam	~~14450~~ **14414**	80	1200	550	Valve	~~A~~ C
X-38	RPV Head Spray	14450	310	1500	550	Valve	~~A~~ C
X-50	CUW Pump Feed	14480	310	0	600	Valve	~~A~~ C
X-60	MUWP Suction	13500	290	0	200	Valve	~~A~~ C
X-61	RCW Suction (A)	~~13500~~13700	45	-3000	200	Valve	A
X-62	RCW Return (A)	~~13500~~13700	45	-2000	200	Valve	A
X-63	RCW Suction (B)	13500	225	3400	200	Valve	A
X-64	RCW Return (B)	13500	225	2400	200	Valve	A
X-65	HNCW Suction	13500	225	250	350	Valve	~~A~~ C
X-66	HNCW Return	13500	225	1400	350	Valve	~~A~~ C
X-69	SA	19000	42	0	90	Valve	~~A~~ C

Table 6.2-8 Primary Containment Penetration List*

X-70	IA	9000 19000	46	0	200	Valve	A C
X-71A	ADS Accumulator (A)	19000	50	0	200	Valve	A
X-71B	ADS Accumulator (B)	19000	296.5	1000	200	Valve	A
X-72	Relief Valve Accumulator	19000	296.5	2000	200	Valve	A
X-80	Drywell Purge Suction	13700	68	0	550 500 550	Valve	A C
X-81	Drywell Purge Exhaust	19000	216	0	550 500 550	Valve	A C
X-82	FCS Suction Spare	14850	225	-600	150	Welded Cap	A C A
X-90	Spare	20100	46 50	0	400	Welded Cap	C A
X-91	Spare	20100	296.5	1000	400 300	Welded Cap	C A
X-92	Spare	16400 14700	45 55 45	12700 -1000	400 300	Welded Cap	C A
X-93	Spare	14700	135	-500	400	Welded Cap	C A
X-94	**Spare**	**16400**	**300**	**-500**	**400**	Welded Cap	C A
X-95	**Spare**	**9400**	**45**	**-400**	**400**	Welded Cap	C A
X-100A	RIP Power	13500 16400 13500	55 51 55	-1100	450	O-ring	B
X-100B	RIP Power	13500 16400 13500	180	2650 2725	450	O-ring	B
X-100C	RIP Power	13500 16400 13500	180	-6550	450 300	O-ring	B
X-100D	RIP Power	13500 16400 13500	280	0	450	O-ring	B
X-100E	RIP Power	13500 16400 13500	180 281 180	-2650 -2725	450	O-ring	B
X-100F	RIP Power	16400 13500	51 280	2800 1350	450	O-ring	B
X-101A	LP Power	16400	45 51 45	0	300 450	O-ring	B
X-101B	LP Power	16400	180	50 125	300 450	O-ring	B
X101C	LP Power	16400	180	1350 -1425	300	O-ring	B
X-101D	FMCRD Power	19000 20100 19000	279.5 279 81	1350 -1350	300	O-ring	B

Table 6.2-8 Primary Containment Penetration List* (Continued)

Penetration Number	Name	Elevation (mm)	Azimuth (deg)	Offset (mm)	Diameter (mm)	Barrier Type	Testing†‡
X-101E	FMCRD Power	~~19000~~ ~~20100~~ 19000	~~81~~260.5	-1350	300	O-ring	B
X-101F	FMCRD Power	19000	279.5 ~~260.5~~	1350 ~~-1350~~	300	O-ring	B
X-101G	FMCRD Power	~~19000~~ ~~20100~~19000	99	~~-1350~~ 1350	300	O-ring	B
X-101J	LP Power	16700	180	5250	300	O-ring	B
X-101K	LP Power	16400	45	3900	300	O-ring	B
X-102A	I & C	16400	~~45~~ ~~51~~45	-1350	300	O-ring	B
X-102B	I & C	16400	180	~~1350~~ 1425	~~300~~ 450	O-ring	B
X-102C	I & C	~~16400~~ ~~7630~~16400	~~180~~ ~~220~~180	~~-2650~~ -2725	300	O-ring	B
X-102D	I & C	~~16100~~ ~~13500~~16100	~~280~~ ~~51~~280	~~0~~1350	300	O-ring	B
X-102E	I & C	~~19000~~ ~~13500~~19000	~~99~~ ~~180~~99	-1350	300	O-ring	B
X-102F	I & C	~~19000~~ ~~13500~~19000	~~273.5~~ ~~180~~279.5	-1350	300	O-ring	B
X-102G	I & C	13500	~~180~~ ~~281~~180	~~-1350~~ -1175	300	O-ring	B
X102-H	I & C	13500	180	-5250	300	O-ring	B
X102-J	I & C	13500	55	1100	300	O-ring	B
X-103A	I & C	~~16400~~ ~~6500~~6000	~~45~~ ~~32~~340.5	~~1350~~0	~~300~~ 150	O-ring	B
X-103B	I & C	~~16400~~ ~~6500~~6000	~~180~~ ~~306~~211	~~50~~0	~~300~~ 150	O-ring	B
X-103C	I & C	~~16400~~ ~~7630~~6000	~~180~~ ~~213~~134	~~-525~~0	~~300~~ 150	O-ring	B
X-103D	I & C	~~16400~~ ~~7630~~6000	~~180~~ ~~138~~295	~~2650~~5600	~~300~~ 150	O-ring	B
X-103E	I & C	~~16400~~ ~~7630~~6000	~~45~~ ~~150~~211	~~2700~~1350	300	O-ring	B
X-104A	FMCRD Position Indicator	~~19000~~ ~~20100~~19000	81	0	300	O-ring	B
X-104B	FMCRD Position Indicator	~~19000~~ ~~20100~~19000	260.5	0	300	O-ring	B
X-104C	FMCRD Position Indicator	20100	99	~~0~~1350	~~300~~ 450	O-ring	B

Table 6.2-8 Primary Containment Penetration List* (Continued)

Penetration Number	Name	Elevation (mm)	Azimuth (deg)	Offset (mm)	Diameter (mm)	Barrier Type	Testing†‡
X-104D	FMCRD Position Indicator	20100	279.5	~~0~~1350	~~300~~ 450	O-ring	B
X-104E	FMCRD Position Indicator	~~19000~~ ~~20100~~19000	~~99~~81	~~0~~1350	300	O-ring	B
X-104F	FMCRD Position Indicator	~~19000~~ ~~20100~~19000	260.5	1350	~~300~~ 450	O-ring	B
X-104G	FMCRD Position Indicator	~~19000~~ ~~20100~~19000	~~81~~99	~~1350~~0	300	O-ring	B
X-104H	FMCRD Position Indicator	~~19000~~ ~~20100~~19000	279.5	0	~~300~~ 450	O-ring	B
X-105A	Neutron Detection	~~20100~~ ~~19000~~20100	81	~~-1350~~ ~~0~~1350	~~300~~ 450	O-ring	B
X-105B	Neutron Detection	~~20100~~ ~~19000~~20100	260.5	~~-1350~~ ~~1300~~1350	~~300~~ 450	O-ring	B
X-105C	Neutron Detection	~~20100~~ ~~19000~~20100	99	~~-5250~~ ~~0~~ -1350	~~300~~ 450	O-ring	B
X-105D	Neutron Detection	~~20100~~ ~~19000~~20100	279.5	~~-1350~~ ~~1300~~ -1350	~~300~~ 450	O-ring	B
~~X-105E~~	~~Neutron Detection~~	~~19000~~	~~81~~	~~-1300~~	~~450~~	~~O-ring~~	~~B~~
~~X-105F~~	~~Neutron Detection~~	~~19000~~	~~260.5~~	~~0~~	~~450~~	~~O-ring~~	~~B~~
~~X-105G~~	~~Neutron Detection~~	~~19000~~	~~99~~	~~1300~~	~~450~~	~~O-ring~~	~~B~~
~~X-105H~~	~~Neutron Detection~~	~~19000~~	~~279.5~~	~~0~~	~~450~~	~~O-ring~~	~~B~~
X-106A	**Div I Instrumentation**	~~13500~~16400	~~61~~45	~~1370~~1350	**300**	**O-ring**	**B**
X-106B	**Div II Instrumentation**	**13500**	**180**	~~1157~~125	**300**	**O-ring**	**B**
X-106C	**Div III Instrumentation**	~~13500~~16400	**180**	~~-1157~~ -6200	**300**	**O-ring**	**B**
X-106D	**Div IV Instrumentation**	~~13500~~16100	~~281~~280	~~-1370~~0	**300**	**O-ring**	**B**
X-106F	*Div NON Instrumentation*	*16400*	*180*	*2725*	*300*	*O-ring*	*B*
X-106G	*Div NON Instrumentation*	*16400*	*45*	*2700*	*300*	*O-ring*	*B*
X-106H	*Div NON Instrumentation*	*14700*	*55*	*1000*	*300*	*O-ring*	*B*
X-106J	*Div NON Instrumentation*	*20100*	*260.5*	*-1350*	*300*	*O-ring*	*B*

Table 6.2-8 Primary Containment Penetration List* (Continued)

Penetration Number	Name	Elevation (mm)	Azimuth (deg)	Offset (mm)	Diameter (mm)	Barrier Type	Testing†‡
X-107A	**Group B Instr**	~~13500~~16400	~~281~~180	~~-1370~~ -4950	**300**	**O-ring**	**B**
X-107B	**Power and Control**	**13500**	**180**	~~-4850~~ 1425	**450**	**O-ring**	**B**
X-110	~~FCS Suction~~ Spare	~~13500~~ 20100	~~55~~99	~~1000~~0	300	~~O-ring~~ Welded Cap	~~B~~ ~~C~~A
X-111	Spare	~~13500~~ ~~15000~~20100	~~280~~260.5	~~1350~~0	300	O-ring	B
X-112	Spare	~~13500~~ ~~19000~~20100	~~180~~ ~~81~~279.5	~~-5250~~0	300	O-ring	B
~~X-113~~	~~Spare~~	~~13500~~ ~~19000~~	~~180~~ ~~261~~	~~1350~~	~~300~~	~~O-ring~~	~~B~~
X-130A	I & C	13500	45	0	300	Valve ~~O-ring~~	~~B~~A
X-130B	I & C	13500	212	0	300	Valve ~~O-ring~~	~~B~~A
X-130C	I & C	13500	124	0	300	Valve ~~O-ring~~	~~B~~A
X-130D	I & C	13500	295	0	300	Valve ~~O-ring~~	~~B~~A
X-140A	I & C	12935~~13500~~	45	-2500 ~~-27000~~	250~~300~~	Valve ~~O-ring~~	~~B~~A
X-140B	I & C	13500	300	0	300	Valve ~~O-ring~~	~~B~~A
X-141A	I & C	13500	63.5	0	300	Valve ~~O-ring~~	~~B~~A

Table 6.2-8 Primary Containment Penetration List* (Continued)

Penetration Number	Name	Elevation (mm)	Azimuth (deg)	Offset (mm)	Diameter (mm)	Barrier Type	Testing†‡
~~X-141B~~ X-141B	~~I & C~~ I & C	~~13500~~ 13500	~~275~~ 275	~~0~~ 0	~~300~~ 300	~~O-ring~~ Valve	~~B~~A
X-142A	I & C	20100	38	0	90	Valve ~~O-ring~~	~~B~~A
X-142B	I & C	20100	244	0	90	Valve ~~O-ring~~	~~B~~A
X-142C	I & C	20100	116	0	90	Valve ~~O-ring~~	~~B~~A
X-142D	I & C	20100	296.5	2000	90	Valve ~~O-ring~~	~~B~~A
X-143A	I & C	14700	45	0	90	Valve ~~O-ring~~	~~B~~A
X-143B	I & C	14700	212	0	90	Valve ~~O-ring~~	~~B~~A
X-143C	I & C	14700	124	0	90	Valve ~~O-ring~~	~~B~~A
X-143D	I & C	14700	300	0	90	Valve ~~O-ring~~	~~B~~A
X-144A	I & C	12700~~12650~~	45	0	90	Valve ~~O-ring~~	~~B~~A
X-144B	I & C	12700~~12650~~	212	0	90	Valve ~~O-ring~~	~~B~~A
X-144C	I & C	12700~~12650~~	124	0	90	Valve ~~O-ring~~	~~B~~A
X-144D	I & C	12700~~12650~~	300	0	90	Valve ~~O-ring~~	~~B~~A
X-146A	I & C	19000	38	0	300	Valve ~~O-ring~~	~~B~~A
X-146B	I & C	19000	248	0	300	Valve ~~O-ring~~	~~B~~A
X-146C	I & C	19000	112	0	300	Valve ~~O-ring~~	~~B~~A
X-146D	I & C	19000	296.5	0	300	Valve ~~O-ring~~	~~B~~A
X-147	I & C	20100	248	0	90~~100~~	Valve ~~O-ring~~	~~B~~A
X-160	LDS Monitor	20100	46~~42~~	0	250	Valve ~~O-ring~~	~~B~~A
X-161A	CAMS I & C	~~14700~~ 20100	~~45~~ 42.75	~~-1000~~ 0	250	~~O-ring~~ Welded Cap	~~B~~ ~~C~~ A
X-161B	CAMS I & C	~~14700~~ 20100	~~290~~ 292.5	0	250	~~O-ring~~ Welded Cap	~~B~~ ~~C~~ A

Table 6.2-8 Primary Containment Penetration List* (Continued)

Penetration Number	Name	Elevation (mm)	Azimuth (deg)	Offset (mm)	Diameter (mm)	Barrier Type	Testing†‡
X-162A	~~CAMS I & C~~ Sample/Return Drywell Gas	19000	116	0	250	~~O-ring~~ Valve	~~B~~ A
X-162B	~~CAMS I & C~~ Sample/Return Drywell Gas	19000	244	0	250	~~O-ring~~ Valve	~~B~~ A
X-170	I & C	13400	310	0	200	Valve ~~O-ring~~	~~B~~A
~~X-171~~ X-171	~~I & C~~ I & C	~~14700~~ 16400	~~55~~ 45	~~-1000~~ -2700	~~300~~ 250	~~O-ring~~ Valve	~~B~~A
X-177	I & C	15900	135	-500	250	Valve ~~O-ring~~	~~B~~A
X-200B	Wetwell Spray	8900	258	0	100	Valve	A
X-200C	Wetwell Spray	8900	102	0	100	Valve	A
X-201	RHR Pump Suction (A)	-7200 ~~-7085~~	36	0	450	Valve	A
X-202	RHR Pump Suction (B)	-7200 ~~-7085~~	216	0	450		A
X-203	RHR Pump Suction (C)	-7200 ~~-7085~~	144	0	450	Valve	A
X-204	RHR Pump Test (A)	~~1200~~800	~~86~~ ~~266~~ 85	0	250	Valve	A
X-205	RHR Pump Test (B)	~~1200~~800	~~266~~ 265	0	250	Valve	A
X-206	RHR Pump Test (C)	~~1200~~800	~~94~~ 95	0	250	Valve	A
X-210	HPCF Pump Suction (B)	-7085	252	0	400	Valve	A
X-211	HPCF Pump Suction (C)	-7085	108	0	400	Valve	A
X-213	RCIC Turbine Exhaust	~~5800~~ 5848	60	0	550	Valve	~~A~~C
X-214	RCIC Pump Suction	-7050	72	0	200	Valve	A
~~X-215~~	~~RCIC Vacuum Pump~~	~~2000~~	~~70~~	~~0~~	~~250~~		~~A~~
X-216	SPCU Pump Suction	-7450	283	0	200	Valve	A
X-217	SPCU Return	1700	340	0	250	Valve	A
~~X-220~~	~~MSIV Leak-off~~	~~9200~~	~~45~~	~~-2000~~	~~250~~		~~B~~
X-240	Wetwell Purge Suction	9200	45	1200	~~550~~ ~~600~~550	Valve	~~A~~C

Table 6.2-8 Primary Containment Penetration List* (Continued)

Penetration Number	Name	Elevation (mm)	Azimuth (deg)	Offset (mm)	Diameter (mm)	Barrier Type	Testing†‡
X-241	Wetwell Purge Exhaust	9200	~~230~~221	0	~~550~~ ~~500~~550	Valve	~~A~~C
X-242	~~FCS Return~~ Spare	1500	225	-1000	150	Welded Cap	~~AC~~A
X-250	~~Spare~~ Breathing Air	~~8500~~ ~~20100~~19000	~~45~~ ~~60~~ 296.5	~~0~~3000	~~400~~ ~~40~~ 200	Valve	~~A~~C
~~X-251~~	~~Spare~~	~~-9000~~	~~213~~	~~0~~	~~400~~		~~A~~
X-252	~~FCS Return~~ Spare	1500	50	0	300	Welded Cap	~~B~~ ~~C~~A
~~X-253~~	~~Spare~~	~~2650~~	~~135~~	~~1000~~	~~300~~		~~B~~
X-254	Spare	2650	225	-1000	300	Welded Cap	~~B~~A
~~X-255~~	~~Spare~~	~~1200~~	~~282~~	~~0~~	~~300~~		~~B~~
~~X-300A~~	~~I & C~~	~~-7300~~	~~134~~	~~0~~	~~300~~	~~O-ring~~	~~B~~
~~X-300B~~	~~I & C~~	~~-7300~~	~~211~~	~~0~~	~~300~~	~~O-ring~~	~~B~~
~~X-320~~ X-320	~~I & C~~ I & C	~~-8900~~8900	~~74~~74	~~-0~~0	~~90~~90	~~O-ring~~ Valve	~~B~~A
X-321A	I & C	~~-2050~~2200	~~97.5~~112	0	300	~~O-ring~~ Valve	~~B~~ A
X-321B	I & C	~~6000~~2200	~~262.5~~248	0	300	~~O-ring~~ Valve	~~B~~ A
X-322A	I & C	400	78	0	90	~~O-ring~~ Valve	~~B~~ A
X-322B	I & C	400	258	0	90	~~O-ring~~ Valve	~~B~~ A
X-322C	I & C	400	102	0	90	~~O-ring~~ Valve	~~B~~ A
X-322D	I & C	400	282	0	90	~~O-ring~~ Valve	~~B~~ A
X-322E	I & C	~~2000~~1400	~~94~~106	0	90	~~O-ring~~ Valve	~~B~~ A
X-322F	I & C	~~2000~~1400	~~266~~282	0	90	~~O-ring~~ Valve	~~B~~ A
X-323A	I & C	-5200	30	0	90	Valve ~~O-ring~~	~~B~~A
X-323B	I & C	-5200	210	0	90	Valve ~~O-ring~~	~~B~~A
X-323C	I & C	~~-5200~~-5500	~~156~~138	0	90	Valve ~~O-ring~~	~~B~~A

Table 6.2-8 Primary Containment Penetration List* (Continued)

Penetration Number	Name	Elevation (mm)	Azimuth (deg)	Offset (mm)	Diameter (mm)	Barrier Type	Testing†‡
X-323D	I & C	-5200	304	0	90	Valve ~~O-ring~~	~~B~~A
X-323E	I & C	-7500	100	0	90	Valve ~~O-ring~~	~~B~~A
X-323F	I & C	-7500	230	0	90	Valve ~~O-ring~~	~~B~~A
X-331A	CAMS Gamma Det.	~~7300~~9700	~~30~~76.5	0	250	~~O-ring~~ Welded Cap	~~B~~ ~~C~~A
X-331B	CAMS Gamma Det.	~~7300~~9700	~~207~~231	0	250	~~O-ring~~ Welded Cap	~~B~~ ~~C~~A
X-332A	CAMS Sampling Ret.	~~8900~~9700	~~94~~97	0	300	~~O-ring~~ Valve	~~B~~ A
X-332B	CAMS Sampling Ret.	~~8900~~9700	~~266~~261	0	300	~~O-ring~~ Valve	~~B~~ A
X-342	I & C	9500	266	0	90	Valve ~~O-ring~~	~~B~~A
X-600A	TIP Drive	~~1580~~1693	0	~~-450~~-700	~~50~~ 40	Valve	A
X-600B	TIP Drive	~~1580~~1693	0	0	~~50~~ 40	Valve	A
X-600C	TIP Drive	~~1580~~1693	0	~~450~~700	~~50~~ 40	Valve	A
~~X-600D~~ X-600D	~~TIP Drive Purge~~ TIP Drive Purge	~~1580~~1693	~~0~~	~~730~~420	~~50~~ 40	Valve	~~A~~A
X-700A	RIP Purge Water Supply	~~-590~~-265	180	~~-1780~~ -1750	~~35~~ ~~25~~ 15	Valve	A
X-700B	RIP Purge Water Supply	~~-590~~-265	180	~~-1640~~ -1610	~~35~~ ~~25~~ 15	Valve	A
X-700C	RIP Purge Water Supply	~~-590~~-515	180	~~-1500~~ -1750	~~35~~ ~~25~~ 15	Valve	A
X-700D	RIP Purge Water Supply	~~-760~~-515	180	~~-1780~~ -1610	~~35~~ ~~25~~ 15	Valve	A
X-700E	RIP Purge Water Supply	~~-760~~-765	180	~~-1640~~ -1610	~~35~~ ~~25~~ 15	Valve	A
X-700F	RIP Purge Water Supply	~~-760~~-265	180	~~-1500~~ -1470	~~35~~ ~~25~~ 15	Valve	A
X-700G	RIP Purge Water Supply	~~-930~~-15	180	~~-1780~~ -1330	~~35~~ ~~25~~ 15	Valve	A
X-700H	RIP Purge Water Supply	~~-930~~-15	180	~~-1640~~ -1470	~~35~~ ~~25~~ 15	Valve	A
X-700J	RIP Purge Water Supply	~~-1100~~-15	180	~~-1780~~ -1610	~~35~~ ~~25~~ 15	Valve	A

Table 6.2-8 Primary Containment Penetration List* (Continued)

Penetration Number	Name	Elevation (mm)	Azimuth (deg)	Offset (mm)	Diameter (mm)	Barrier Type	Testing†‡
X-700K	RIP Purge Water Supply	~~-1100~~-15	180	~~-1640~~ -1750	~~35~~ ~~25~~ 15	Valve	A
X-710	CRD Insertion (Total ~~103~~102	~~1210~~1285	180	~~1780~~ 1680	~~60~~32	Valve	A
X-740	Spare	~~250~~85	180	~~1840~~ 1750	100	Welded Cap	~~A~~ ~~C~~A
X-750A	I&C (Core Diff Press.)	~~-250~~ ~~-900~~ 1135	180	~~-1780~~ -910	~~40~~20	~~O-ring~~ Valve	~~B~~A
X-750B	I&C (Core Diff Press.)	~~250~~985	180	~~1640~~ 1330	~~40~~20	~~O-ring~~ Valve	~~B~~A
X-750C	I&C (Core Diff Press.)	~~250~~1285	180	~~1640~~ -910	~~40~~20	~~O-ring~~ Valve	~~B~~A
X-750D	I&C (Core Diff Press.)	~~250~~985	180	~~1780~~ 1470	~~40~~20	~~O-ring~~ Valve	~~B~~A
X-751A	I&C (RIP Diff Press.)	~~420~~985	180	~~1780~~ -1470	~~40~~20	~~O-ring~~ Valve	~~B~~A
X-751B	I&C (RIP Diff Press.)	~~420~~1285	180	~~1640~~ 910	~~40~~20	~~O-ring~~ Valve	~~B~~A
X-751C	I&C (RIP Diff Press.)	~~420~~985	180	~~1640~~ -1330	~~40~~20	~~O-ring~~ Valve	~~B~~A
X-751D	I&C (RIP Diff Press.)	~~420~~1135	180	~~1780~~ 910	~~40~~20	~~O-ring~~ Valve	~~B~~A
X-780A	Spare	~~-250~~235	180	~~-1500~~ -1190	~~40~~20	Welded Cap	~~B~~ ~~C~~A
X-780B	Spare	~~-590~~235	180	~~1640~~ 1190	~~40~~20	Welded Cap	~~B~~ ~~C~~A
X-610	CRD Insertion (Total ~~102~~103)	~~1210~~1285	0	~~1780~~ 1680	~~60~~32	Valve	A
X-620	Low Conductivity Drain	~~-590~~ ~~-650~~-700	0	~~-1920~~ 1750	~~75~~ ~~65~~65		A
X-621	High Conductivity Drain	~~-590~~ ~~-650~~-450	0	~~-1920~~ 1750	~~150~~ ~~65~~150		A
X-650A	I&C (Core Diff Press.)	~~250~~985	0	~~1640~~ 1330	~~40~~20	~~O-ring~~ Valve	~~B~~A
X-650B	I&C (Core Diff Press.)	~~250~~1285	0	~~-1710~~ -910	~~40~~20	~~O-ring~~ Valve	~~B~~A
X-650C	I&C (Core Diff Press.)	~~-250~~985	0	~~1780~~ 1470	~~40~~20	~~O-ring~~ Valve	~~B~~A
X-650D	I&C (Core Diff Press.)	~~-250~~1135	0	~~-1570~~ -910	~~40~~20	~~O-ring~~ Valve	~~B~~A
X-651A	I&C (RIP Diff Press.)	~~-420~~1285	0	~~1640~~ 910	~~40~~20	~~O-ring~~ Valve	~~B~~A

Table 6.2-8 Primary Containment Penetration List* (Continued)

Penetration Number	Name	Elevation (mm)	Azimuth (deg)	Offset (mm)	Diameter (mm)	Barrier Type	Testing†‡
X-651B	I&C (RIP Diff Press.)	-420985	0	-1710 -1330	4020	O-ring Valve	BA
X-651C	I&C (RIP Diff Press.)	-4201135	0	1780 910	4020	O-ring Valve	BA
X-651D	I&C (RIP Diff Press.)	-420985	0	1570 -1470	4020	O-ring Valve	BA
X-680A	Spare	-25085	0	1500 -1750	4020	Welded Cap	BA
X-680B	Spare	-250 -59085	0	-1430 1750	4020		B

Table 6.2-9 Secondary Containment Penetration List* (Continued)

Penetration Number	Name	Elevation (mm)	Diameter (mm)
50	HNCW	12300	~~200~~ 250
51	HNCW	12300	~~200~~ 250
60	BAS	-1700	80
61	BAS	-1700	80

Table 6.2-10 Potential Bypass Leakage Paths

Penetration Number	Name	Diameter (mm)	Termination Region	Leakage Barriers	Potential Bypass Path
X-5	L/D Personnel Hatch	2400/~~5000~~ **4300**	S	C/M-J	No
X-6	L/D Equipment Hatch	2400/~~5000~~ **4300**	S	C/M-J	No
X-32~~B~~**A**	LPFL (B) RHR (B)	650	S	E/C/L	No
X-32~~C~~**B**	LPFL (C) RHR (C)	650	S	E/C/L	No
X-69	SA	90	E	**E/D/**~~H~~	No
~~X-80~~	~~Drywell Purge Suction~~	~~550~~**500**	~~E~~	~~E/C/J~~	~~Yes~~
~~X-81~~	~~Drywell Purge Exhaust~~	~~550~~**500**	~~E~~	~~E/C/J~~	~~Yes~~
X-82	~~FCS Suction~~ **Spare**	**150**	**S**	**E/C/J**	**No**
X-91	Spare	~~400~~ **300**	P	B/A	No
X-92	Spare	~~400~~ **300**	P	B/A	No
X-94	Spare	400	S	B/A	No
X-95	Spare	400	S	B/A	No
X-100C	IP Power	~~450~~ **300**	S	C/J	No
X-100F	RIP Power	450	S	C/J	No
X-101A	LP Power	~~300~~ **450**	S	C/J	No
X-101B	LP Power	~~300~~ **450**	S	C/J	No
X-101J	LP Power	300	S	C/J	No
X-101K	LP Power	300	S	C/J	No
X-102B	I & C	~~300~~ **450**	S	C/J	No
X-102H	I & C	300	S	C/J	No
X-102J	I & C	300	S	C/J	No
X-103A	I & C	~~300~~ **150**	S	C/J	No
X-103B	I & C	~~300~~ **150**	S	C/J	No
X-103C	I & C	~~300~~ **150**	S	C/J	No
X-103D	**I & C**	**150**	S	C/J	No
X-103E	I & C	300	S	C/J	No
X-104C	FMCRD Pos. Indicator	~~300~~ **450**	S	C/J	No
X-104D	FMCRD Pos. Indicator	~~300~~ **450**	S	C/J	No
X-104F	FMCRD Pos. Indicator	~~300~~ **450**	S	C/J	No
X-104H	FMCRD Pos. Indicator	~~300~~ **450**	S	C/J	No
X-105A	Neutron Detection	~~300~~ **450**	S	C/J	No
X-105B	Neutron Detection	~~300~~ **450**	S	C/J	No
X-105C	Neutron Indicator	~~300~~ **450**	S	C/J	No
X-105D	Neutron Indicator	~~300~~ **450**	S	C/J	No

Table 6.2-10 Potential Bypass Leakage Paths

Penetration Number	Name	Diameter (mm)	Termination Region	Leakage Barriers	Potential Bypass Path
~~X-105E~~	~~Neutron Indicator~~	~~450~~	~~S~~	~~C/J~~	~~No~~
~~X-105F~~	~~Neutron Indicator~~	~~450~~	~~S~~	~~C/J~~	~~No~~
~~X-105G~~	~~Neutron Indicator~~	~~450~~	~~S~~	~~C/J~~	~~No~~
~~X-105H~~	~~Neutron Indicator~~	~~450~~	~~S~~	~~C/J~~	~~No~~
X-106A	Div I Instrumentation	300	S	C/J	No
X-106B	Div II Instrumentation	300	S	C/J	No
X-106C	Div III Instrumentation	300	S	C/J	No
X-106D	Div IV Instrumentation	300	S	C/J	No
X-106F	Div IV Instrumentation	300	S	C/J	No
X-106G	Div IV Instrumentation	300	S	C/J	No
X-106H	Div IV Instrumentation	300	S	C/J	No
X-106J	Div IV Instrumentation	300	S	C/J	No
X-107A	Group B Instr	300	S	C/J	No
X-107B	Power and Control	300	S	C/J	No
X-110	~~FCS Suction~~ **Spare**	~~150~~300	S	**E/C/J**	**No**
~~X-113~~	~~Spare~~	~~300~~	~~P~~	~~B/A~~	~~No~~
X-140A	I & C	~~300~~250	S	C/J	No
X-162A	~~CAMS I&C~~Sample/Return Drywell Gas	250	S	C/J	No
	~~CAMS I&C~~Sample/Return Drywell Gas	250	S	C/J	No
~~X-141B~~X-141B	~~I & C~~I & C	~~300~~300	~~S~~S	~~C/J~~C/J	~~No~~No
X-~~172~~177	I & C	250	S	C/J	No
~~X-171~~X-171	~~I&C~~I & C	~~300~~250	~~S~~S	~~C/J~~C/J	~~No~~No
X-200~~A~~B	Wetwell Spray	100	S	C/H	No
X-200~~B~~C	Wetwell Spray	100	S	C/H	No
~~X-220~~	~~MSIV Leakage~~	~~250~~	~~S~~	~~C/G~~	~~No~~
~~X-215~~	~~RCIC Vacuum Pump Ex.~~	~~250~~	~~S~~	~~C/G~~	~~No~~
X-240	Wetwell Purge Suction	~~550~~ ~~500~~550	E	E/C/J	Yes
X-241	Wetwell Purge Exhaust	~~550~~ ~~500~~550	E	E/C/J	Yes
X-242	~~FCS Suction~~ **Spare**	**150**	**S**	**E/C/J**	**No**
X-250	~~Spare~~Breathing Air	200	~~P~~E	~~B/A~~E/D	No
~~X-251~~	~~Spare~~		~~P~~	~~B/A~~	~~No~~

Table 6.2-10 Potential Bypass Leakage Paths (Continued)

Penetration Number	Name	Diameter (mm)	Termination Region	Leakage Barriers	Potential Bypass Path
X-252	~~FCS Suction~~ Spare	~~150~~300	S	E/C/J	No
~~X-253~~	~~Spare~~	~~300~~	~~S~~	~~B/A~~	~~No~~
~~X-254~~X-254	~~Spare~~Spare	~~300~~300	~~S~~S	~~B/A~~B/A	~~No~~No
~~X-255~~	~~Spare~~	~~300~~	~~S~~	~~B/A~~	~~No~~
~~X-300A~~	~~I&C~~	~~300~~	~~S~~	~~C/J~~	~~No~~
~~X-300B~~	~~I&C~~	~~300~~	~~S~~	~~C/J~~	~~No~~
~~X-320~~X-320	~~I&C~~I&C	~~90~~90	~~S~~S	~~C/J~~C/J	~~No~~No
~~X-334~~	~~I&C~~	~~90~~	~~S~~	~~C/J~~	~~No~~
~~X-341~~	~~I&C~~	~~90~~	~~S~~	~~C/J~~	~~No~~
X-610	CRD Insertion (Total ~~102~~103)	~~60~~32	S	C/J	No
X-620	LCW Drain	~~75~~65	S	C/J	No
X-621	HCW Drain	~~150~~150	S	C/J	No
X-650A	I&C Core Diff Press.	~~40~~20	S	C/J	No
X-650B	I&C Core Diff Press.	~~40~~20	S	C/J	No
X-650C	I&C Core Diff Press.	~~40~~20	S	C/J	No
X-650D	I&C Core Diff Press.	~~40~~20	S	C/J	No
X-651A	I&C RIP Diff Press.	~~40~~20	S	C/J	No
X-651B	I&C RIP Diff Press.	~~40~~20	S	C/J	No
X-651C	I&C RIP Diff Press.	~~40~~20	S	C/J	No
X-651D	I&C RIP Diff Press.	~~40~~20	S	C/J	No
X-~~660A~~600A	TIP Drive	~~50~~40	S	C/J	No
X-~~660B~~600B	TIP Drive	~~50~~40	S	C/J	No
X-~~660C~~600C	TIP Drive	~~50~~40	S	C/J	No
X-~~660D~~600D	TIP Drive Purge	~~50~~40	S	C/J	No
~~X-660D~~	~~TIP Drive Purge~~	~~50~~	~~S~~	~~C/K~~	~~No~~
X-680A	Spare	~~40~~20	S	C/K	No
X-680B	Spare	~~40~~20	S	C/K	No
X-700A	RIP Purge Water Supply	~~35~~ ~~25~~15	S	C/H	No
X-700B	RIP Purge Water Supply	~~35~~ ~~25~~15	S	C/H	No
X-700C	RIP Purge Water Supply	~~35~~ ~~25~~15	S	C/H	No

Table 6.2-10 Potential Bypass Leakage Paths (Continued)

Penetration Number	Name	Diameter (mm)	Termination Region	Leakage Barriers	Potential Bypass Path
X-700D	RIP Purge Water Supply	35 2515	S	C/H	No
X-700E	RIP Purge Water Supply	35 2515	S	C/H	No
X-700F	RIP Purge Water Supply	35 2515	S	C/H	No
X-700G	RIP Purge Water Supply	35 2515	S	C/H	No
X-700H	RIP Purge Water Supply	35 2515	S	C/H	No
X-700J	RIP Purge Water Supply	35 2515	S	C/H	No
X-700K	RIP Purge Water Supply	35 2515	S	C/H	No
X-710	CRD Insertion (Total 102)	32	S	C/L	No
X-740	Spare	100	S	B/A	No
X-750A	I&C (Core Diff Press.)	18020	S	C/J	No
X-750B	I&C (Core Diff Press.)	18020	S	C/J	No
X-750C	I&C (Core Diff Press.)	18020	S	C/J	No
X-750D	I&C (Core Diff Press.)	18020	S	C/J	No
X-751A	I&C (RIP Diff Press.)	18020	S	C/J	No
X-751B	I&C (RIP Diff Press.)	18020	S	C/J	No
X-751C	I&C (RIP Diff Press.)	18020	S	C/J	No
X-751D	I&C (RIP Diff Press.)	18020	S	C/J	No
X-780A	Spare	18020	S	B/A	No
X-780B	Spare	18020	S	B/A	No

Figure 6.2-2 ~~Feedwater Line Break — RPV SideBreak Area~~Not Used

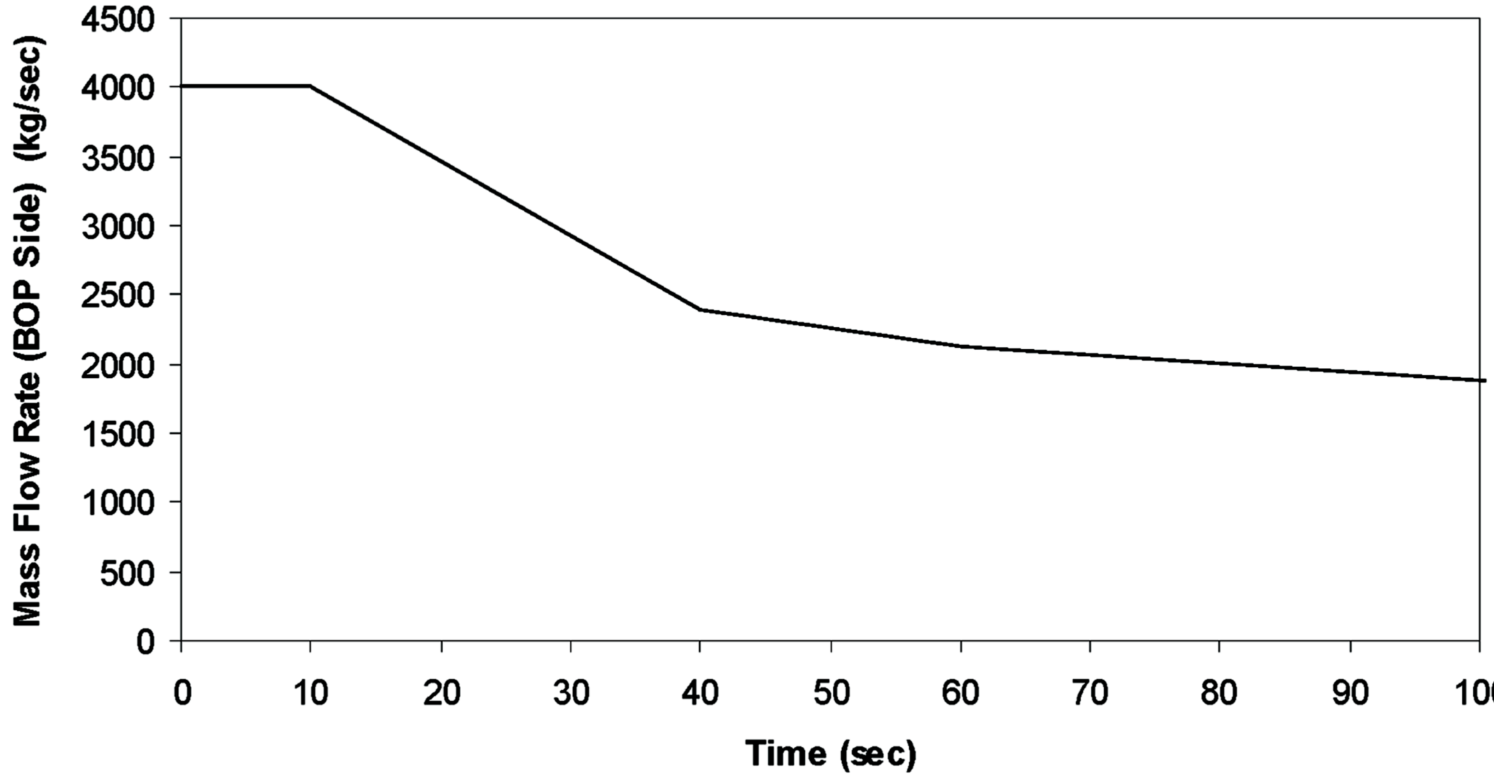

Figure 6.2-3 Feedwater Line Break Flow—Feedwater System Side of Break

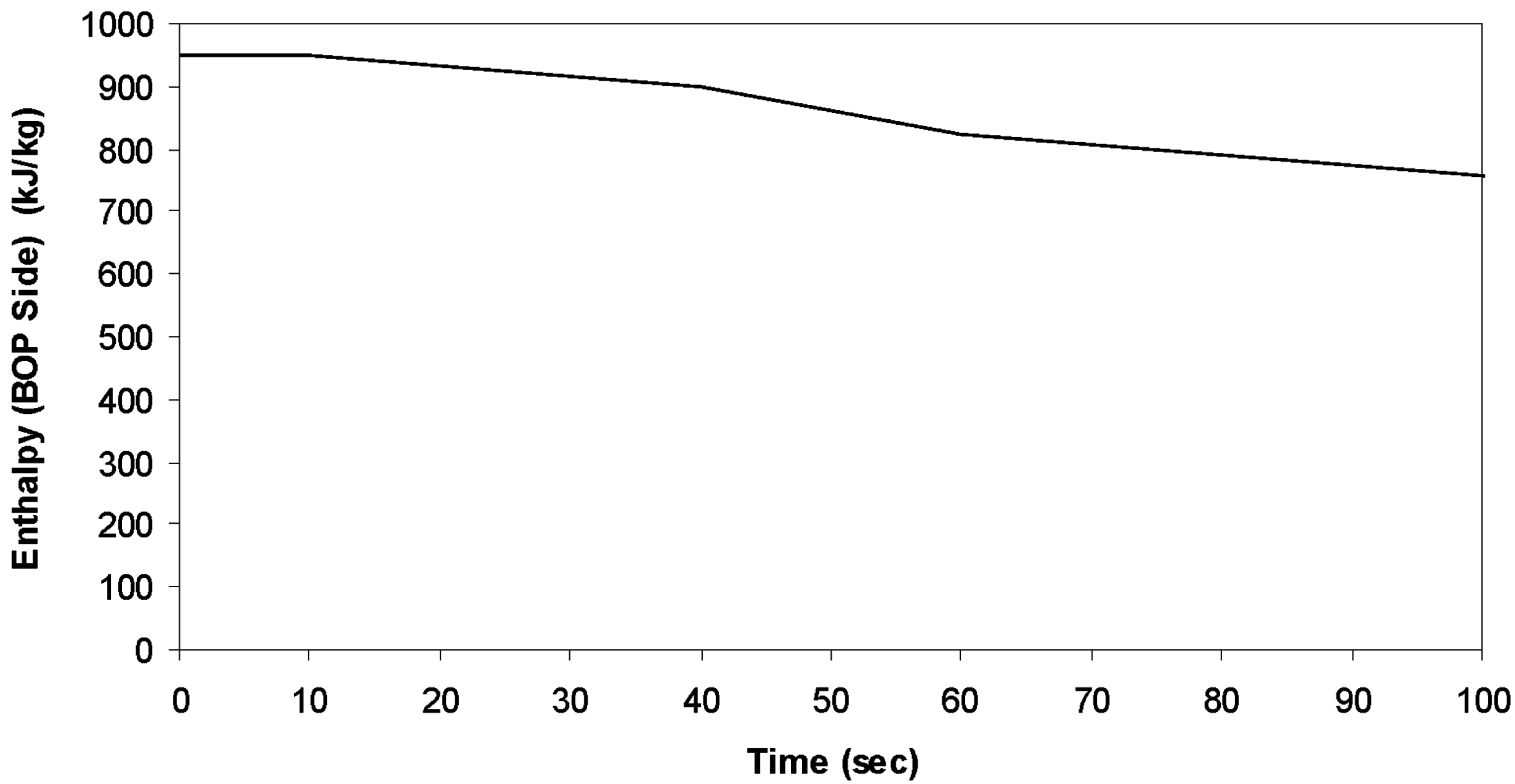

Figure 6.2-4 Feedwater Line Break Flow Enthalpy—Feedwater System Side of Break

Figure 6.2-5 ~~Lower Drywell Air Transfer Percentage for Model Assumption Versus Actual Case~~Not Used

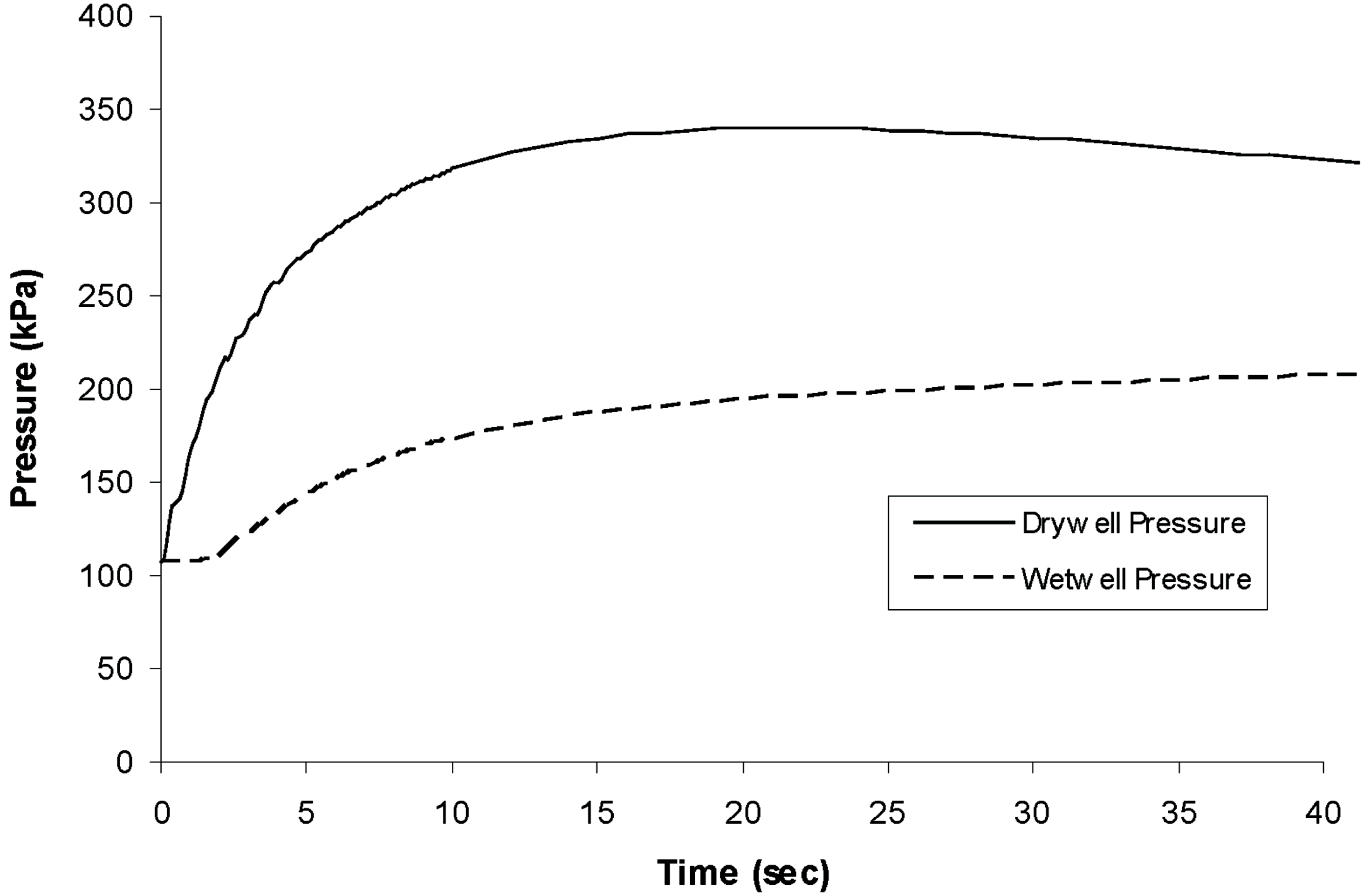

Figure 6.2-6 Pressure Response of the Primary Containment for Feedwater Line Break

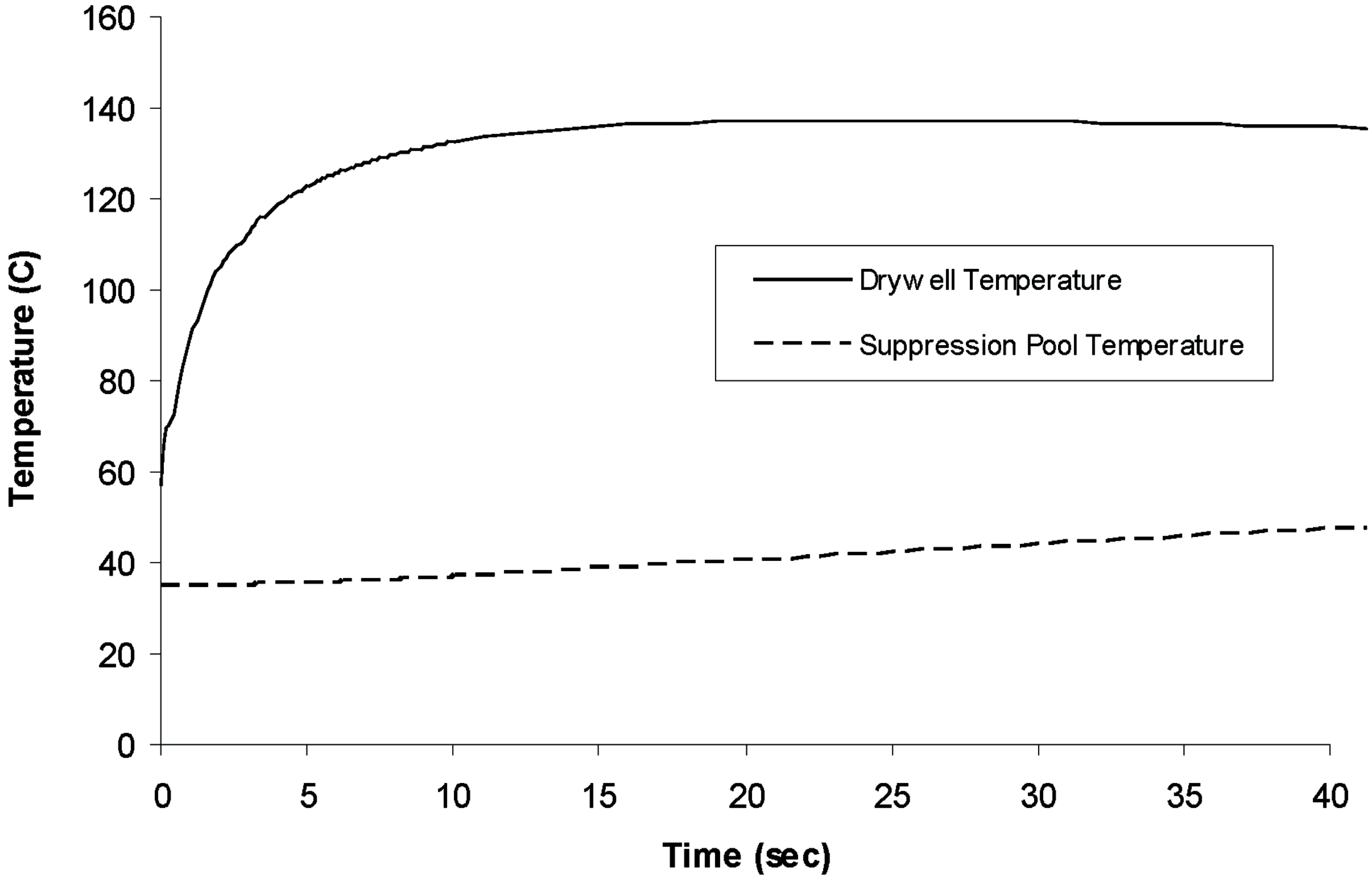

Figure 6.2-7 Temperature Response of the Primary Containment for Feedwater Line Break

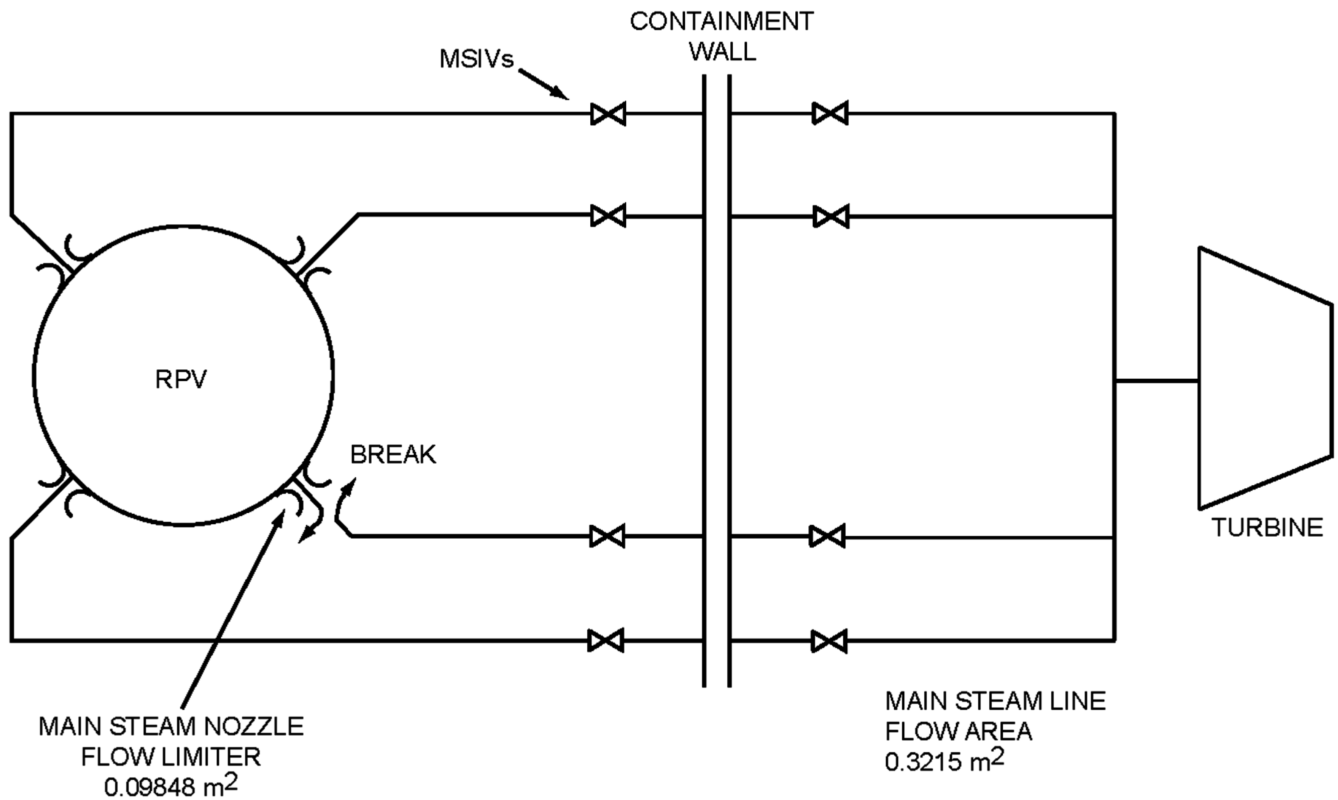

Figure 6.2-9 ABWR Main Steamlines with a Break

Figure 6.2-10 ~~MSLB Area as a Function of Time~~Not Used

Figure 6.2-11 ~~Feedwater Specific Enthalpy as a Function of Integrated Feedwater Flow Mass~~Not Used

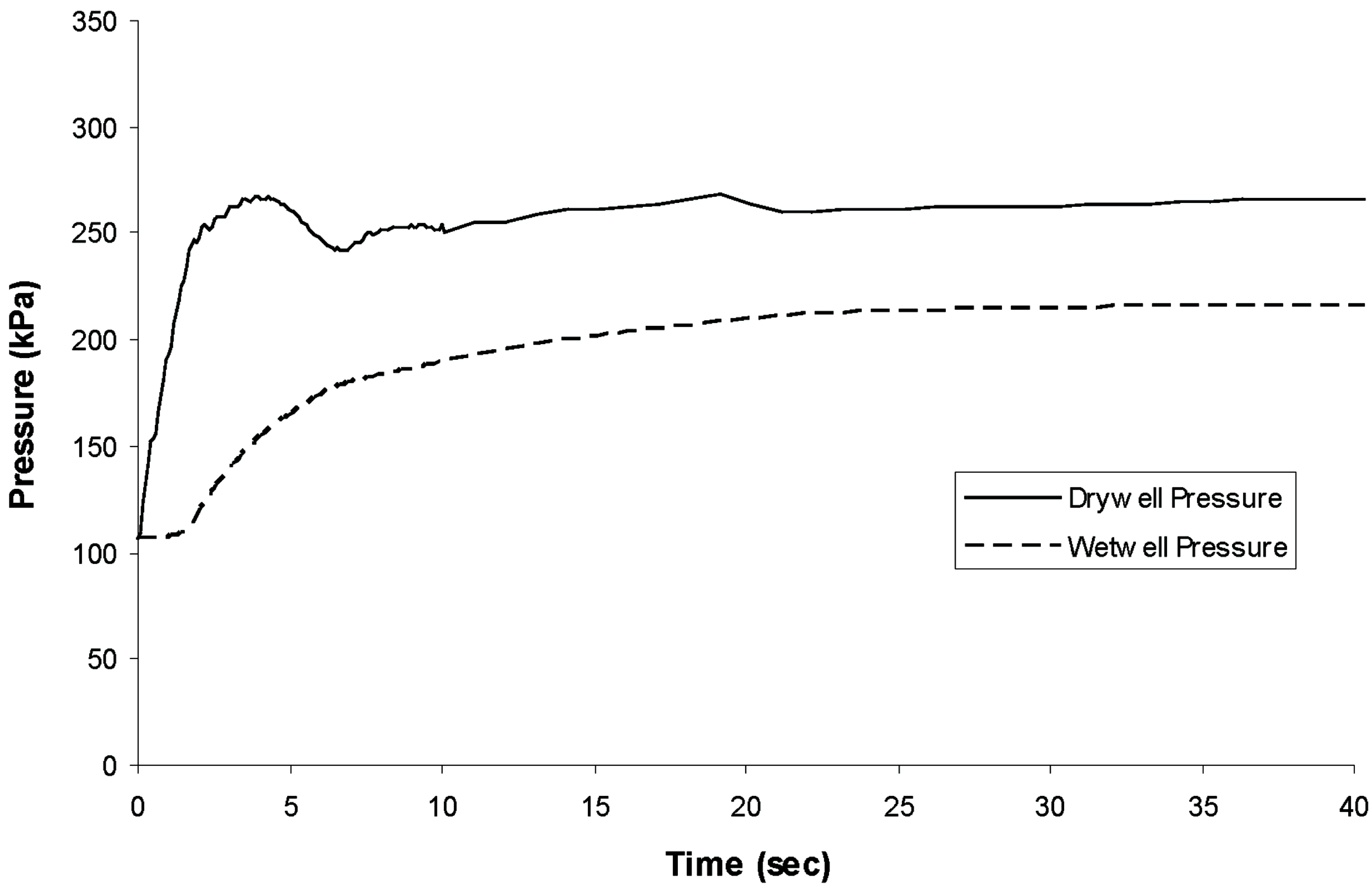

Figure 6.2-12 Pressure Time History for MSLB ~~with Two-Phase Blowdown Starting When the RPV Collapsed Level Reaches the Main Steam Nozzle~~

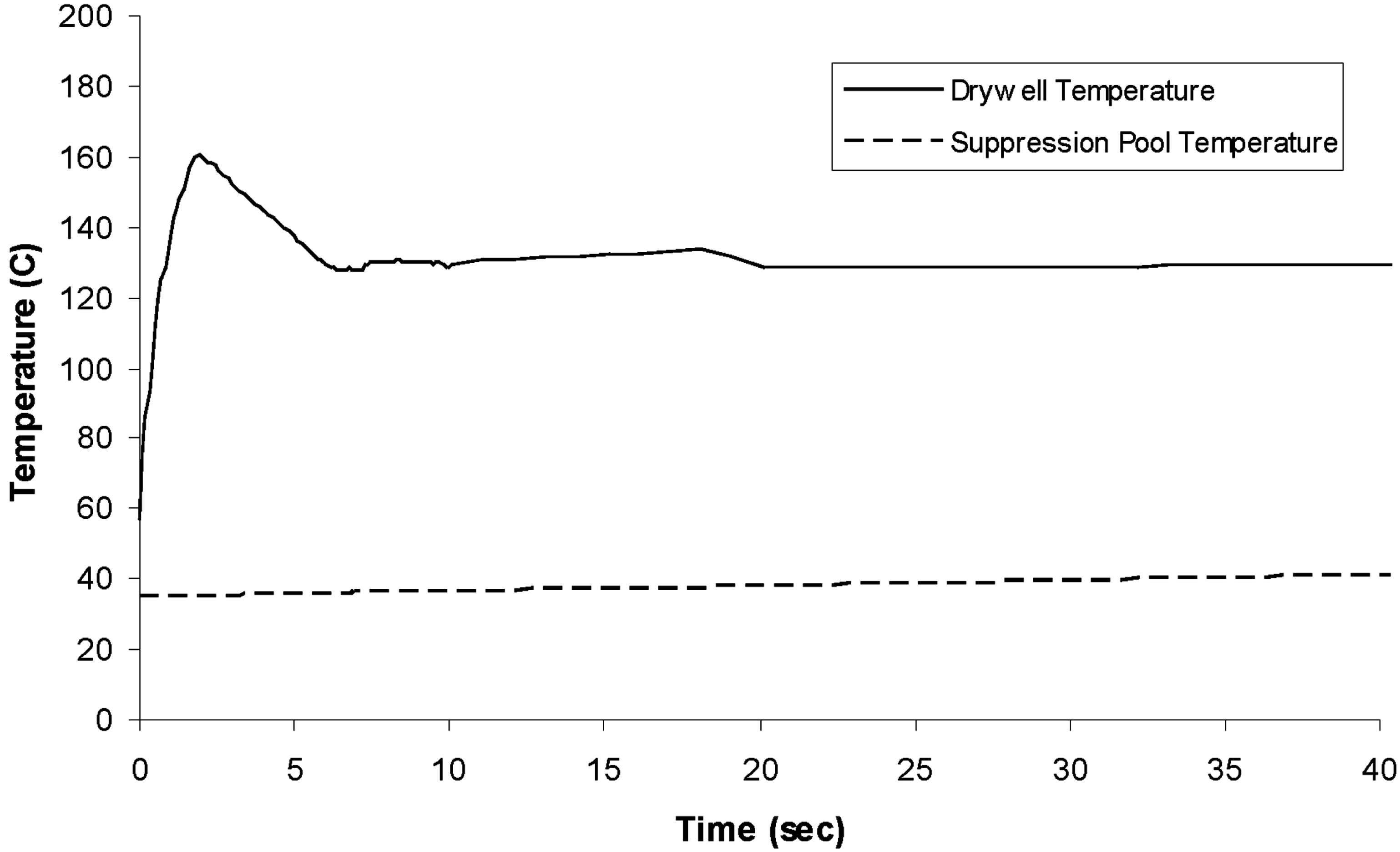

Figure 6.2-13 Temperature Time History for MSLB ~~with Two-Phase Blowdown Starting When the RPV CollapsedLevel Reaches the Main Steam Nozzle at 2 Seconds~~

Figure 6.2-14 ~~Pressure Time History for MSLB with Two-Phase Blowdown Starting at One Second~~Not Used

Figure 6.2-15 ~~Temperature Time History for MSLB with Two-Phase Blowdown Starting at One Second~~Not Used

Figures 6.2-38, 6.2-39, and 6.2-40 are revised and are located in Chapter 21:

Figure 6.2-38 Plant Requirements, Group Classification and Containment Isolation Diagram (Sheets 1 – 2)

STD DEP T1 2.4-3

~~The design departure describing the alternate design RCIC for ABWR was provided in ABWR Licensing Topical Report NEDE-33299P, "Advanced Boiling Water Reactor (ABWR) With Alternate RCIC Turbine-Pump Design," dated December 2006. This~~ The alternate RCIC design eliminates the barometric condenser and discharge piping to the containment.

STD DEP T1 2.14-1

~~The design departure describing the elimination of the hydrogen recombiners from the certified design was provided in ABWR Licensing Topical Report NEDE-33330P, "Advanced Boiling Water Reactor (ABWR) Hydrogen Recombiner Requirements Elimination," *Revision 1* dated September 2007.~~The FCS is eliminated in accordance with NRC rules and regulations.

STD DEP 9.3-2

This departure ~~adds a new~~uses an existing spare containment penetration for the Breathing Air System. The breathing air line has a ~~check~~manually operated valve inside the containment and a manually operated valve outside containment which will be closed during normal operation.

~~**Figure 6.2-39 Atmospheric Control System P&ID (Sheets 1 – 3)**~~

~~STD DEP 6.2-1~~

~~The ACS line size has been changed from 550A to 500 mm.~~

Figure 6.2-40 ~~Flammability Control System P&ID (Sheets 1 – 2)~~Not Used

STD DEP T1 2.14-1

~~The design departure describing the elimination of the hydrogen recombiners from the certified design was provided in ABWR Licensing Topical Report NEDE-33330P, "Advanced Boiling Water Reactor (ABWR) Hydrogen Recombiner Requirements Elimination," *Revision 1* dated September 2007.~~ The FCS is eliminated in accordance with NRC rules and regulations.

Figure 6.2-41 ~~Hydrogen and Oxygen Concentrations in Containment After Design Basis LOCA~~Not Used