# 18B Differences Between BWROG EPG Revision 4 and ABWR EPG

## 18B.1 Introduction

Appendix 18B presents the differences and bases for the differences between the NRC approved BWROG EPG Revision 4 document* and the ABWR EPGs. For a given difference identified, the ABWR EPG step, BWROG EPG Revision 4 step, and the basis for the difference is given. The numbers used for the ABWR EPG steps correspond to those of the ABWR EPG Guidelines given in Appendix 18A.

* NRC letter, A. C. Thadani to D. Grace, Safety Evaluation of "BWR Owner's Group-Emergency Procedure Guidelines, Revision 4", dated September 12,1988 (NEDO-31331, March 1987).

## Table 18B-1 Differences Between BWROG EPG Revision 4 and ABWR EPG

| ABWR EPG Step | BWROG EPG Rev. 4 Step | Differences from BWROG Rev. 4 EPG | Basis for Differences |
|---|---|---|---|
| Caution #1 | Caution #1 | • Fuel zone and wide range instruments are deleted from item number 2 and 3, respectively. | • ABWR RPV water level instrumentation for the fuel zone and the wide range instruments have instrument leg temperature sensors and, along with reactor pressure signal, are used for compensating for instrument leg water density variations due to temperature variations both inside the drywell and in the secondary containment. The compensation algorithm also accounts for differences in reference leg and instrument leg vertical drops both inside the drywell and in the secondary containment. The compensated outputs are displayed to the operator in the control room. In addition, the instrument runs inside the drywell are required to have specified parallel slopes and approximately equal vertical drops to further minimize the effect on indicated level due to drywell temperature variations.<br><br>The narrow range and shutdown range instruments have no such temperature compensation. However, instrument leg runs inside the drywell have similar requirements as those of the fuel zone and wide range instruments. The effect of temperature on indicated water level is expected to be small, but is to be evaluated on plant-specific basis based upon the actual installation details, and therefore is retained in the Caution statement. |
| Caution #2 | Caution #2 | • Deleted | • ABWR does not have reactor water level instrumentation with heated reference legs. |
| Caution #3 | Caution #3 | • Deleted HPCI from the caution. | • ABWR does not have the steam-driven high pressure injection system HPCI. |
| Caution #5 | Caution #5 | • Changed HPCS to HPCF. | • The ABWR high pressure ECCS injection system is HPCF. |

## Table 18B-1 Differences Between BWROG EPG Revision 4 and ABWR EPG (Continued)

| ABWR EPG Step | BWROG EPG Rev. 4 Step | Differences from BWROG Rev. 4 EPG | Basis for Differences |
|---|---|---|---|
| RC/L-2 Override Statement | RC/L-2 Override Statement | • Changed the word "RPV" in the phrase "…terminate injection into the RPV from sources external to the primary containment…", to "primary containment". | • A system is injecting water into the primary containment if all the following criteria are satisfied:<br>(1) The suction source of the system is outside the primary containment.<br>(2) The system penetrates the primary containment.<br>(3) The system discharge is adding to the primary containment water inventory (i. e., a system is injecting into the RPV and either the RPV has an unisolated leak inside the primary containment or the safety/relief valves are open to the primary containment.<br>The function of the Primary Containment Water Limit is to preclude containment failure. A systems that injects into the RPV is a subset of those systems that can inject into the primary containment. It has always been the intent of the existing wording to direct the termination of all injection into the primary containment from sources external to the primary containment. The new wording of the injection termination statement is also intended to allow RPV injection to continue if no water is leaving the RPV into the primary containment. |
| RC/L–2 | RC/L–2 | • Deleted HPCI from list of systems.<br>• Specified the high pressure ECCS as HPCF.<br>• Deleted LPCS from the list of systems. | • The ABWR does not have the steam-driven HPCI System.<br>• In the ABWR, the high pressure ECCS injection system consists of two separate loops, HPCF(B) and HPCF(C); both inject inside the shroud in the RPV.<br>• The ABWR does not have LPCS. |

## Table 18B-1 Differences Between BWROG EPG Revision 4 and ABWR EPG (Continued)

| ABWR EPG Step | BWROG EPG Rev. 4 Step | Differences from BWROG Rev. 4 EPG | Basis for Differences |
|---|---|---|---|
| | | • Deleted phrase, "LPCI with injection through the heat exchangers as soon as possible", and changed LPCI to RHR and throughout this document. | • The ABWR RHR System consists of three separate subsystems. The low pressure injection mode is a mode of the RHR System. RHR(A) injects water from the suppression pool to the RPV through a feedwater line. RHR(B) and RHR(C) inject water from the suppression pool to the RPV outside of the shroud in the RPV. For all three subsystems, the heat exchangers are normally in the flow path. There is no timer to keep the heat exchanger bypass valves from closing as in a typical BWR/6 design, and hence the phrase, "with injection through the heat exchangers as soon as possible", is not necessary. |
| | | • Added bypass of RCIC area high temperature isolation interlock. | • Isolation of RCIC due to high area temperature can be caused by loss of ventilation as well as process leaks. If area temperature is high enough to cause an isolation and RCIC is still needed for core cooling, it is appropriate also to bypass this isolation function. Adequate instructions are provided in Secondary Containment Control to isolate unnecessary systems which may be injecting into the RCIC room. If RCIC is needed for core cooling, Secondary Containment Control allows its continued use; otherwise, it is to be isolated. |
| | | • Deleted RHR service water crosstie from the list of systems. | • The ABWR does not have RHR service water crosstie. |

## Table 18B-1 Differences Between BWROG EPG Revision 4 and ABWR EPG (Continued)

| ABWR EPG Step | BWROG EPG Rev. 4 Step | Differences from BWROG Rev. 4 EPG | Basis for Differences |
|---|---|---|---|
| RC/L–2 (continued) | RC/L–2 (continued) | • Changed the phrase, "prevent automatic RPV depressurization by resetting the ADS timer", to "prevent automatic initiation of ADS". | • In the ABWR ADS design, there are no timer reset switches comparable to those in some operating plants. Two ADS inhibit switches are available to override automatic initiation of ADS. There are two sets of conditions that will automatically initiate ADS: (a) after a time delay of 29 seconds upon receipt of high drywell pressure and low RPV water level signals, and (b) upon receipt of low RPV water level signals after an eight-minute time delay plus an additional delay of 29 seconds. These automatic ADS initiations can be inhibited by actuating two ADS inhibit switches on the main control console if actuated within the stated time delays. The instruction for such action is to be specified in plant-specific emergency procedures. |
| | | • Specified the firewater addition system, ECCS keep-full systems and SLC (test tank) as alternate injection systems. | • Use of the Fire Protection System and the firewater addition mode of RHR(C) is described in Subsection 5.4.7.1.1.I0. Water can be injected into the RPV via piping connection to RHR(C) header. Fire water addition using the Fire Protection System backed up by an external connection outside of the reactor building at ground level for connecting portable water injection sources (such as a fire truck). The ABWR RCIC System does not have a line fill pump that can take water from the suppression pool or the condensate storage tank and therefore is not included in the list of ECCS keep-full systems. The SLC test tank is a source of water that can be aligned to inject into the RPV with the SLC pumps, with makeup to the tank provided by a makeup water system. |
| RC/P Override Statement | RC/P Override Statement | • Deleted LPCS, and<br>• Changed LPCI to LPCF. | • The ABWR does not have a LPCS.<br>• See basis under RC/L-2 above. |

## Table 18B-1 Differences Between BWROG EPG Revision 4 and ABWR EPG (Continued)

| ABWR EPG Step | BWROG EPG Rev. 4 Step | Differences from BWROG Rev. 4 EPG | Basis for Differences |
|---|---|---|---|
| RC/P-2 Override, second box statement | RC/P-2 Override, second box statement | • Changed phrase, "open MSIVs, bypassing pneumatic system and low RPV water level isolation interlocks if necessary', to read as follows: "open MSIVs, bypassing low RPV water level isolation interlocks if necessary." | • The ABWR pneumatic supply to the MSIVs is not isolated by a containment isolation signal (low RPV water level or high drywell pressure) as in some operating plants. |
| RC/P-1 | RC/P-1 | • Deleted IC from step | • ABWR does not have isolation condensers. |
| RC/P-2 | RC/P-2 | • Deleted IC and HPCI | • ABWR does not have these systems. |
| RC/P-4 | RC/P-4 | • Changed LPCI to LPCF mode of the RHR system. | • See basis under RC/L-2 above. |
| RC/Q-2 | RC/Q-2 | • ARI is specified in this step instead of RC/Q-5. | • Initiation of ARI will open scram header valves (separate from those actuated by the Reactor Protection System, RPS), and initiate the FMCRD Run-In function. Two dedicated switches on the operator's control console are used for ARI initiation as a backup to the automatic ARI initiation based on an ATWS signal. ARI logic is separate from that of RPS. |

## Table 18B-1 Differences Between BWROG EPG Revision 4 and ABWR EPG (Continued)

| ABWR EPG Step | BWROG EPG Rev. 4 Step | Differences from BWROG Rev. 4 EPG | Basis for Differences |
|---|---|---|---|
| RC/Q-3 | RC/Q-3 | • Deleted phrase, “and the MSIVs are open”. | • In the ABWR, a turbine trip is initiated when the MSIVs are closed and hence this phrase is superfluous, since the turbine-generator cannot be online with the MSIVs closed. |
| | | • Changed phrase “Confirm or initiate recirculation flow runback to minimum”, to “Confirm or initiate recirculation pump runback to minimum speed”. | • New phrase is a more explicit instruction to reduce recirculation flow by runback of the internal recirculation pumps to their minimum speeds. |
| RC/Q-5 | RC/Q-5 | • Deleted step. | • ARI is specified in Step RC/Q-2 because ARI initiation will not trip recirculation pumps with a potential for tripping of the main turbine at high RPV water level (Level 8) |
| RC/Q-6 | RC/Q-6 | • Added as an alternate condition for boron injection: “Either: When periodic neutron flux oscillations in excess of [25% (Large Oscillation Threshold)] peak-to peak commence and continue, or” | • This symptom is indicative of a power instability and becomes a condition for boron injection to eliminate any threat to fuel clad integrity during such oscillations during a failure to scram condition. |
| | | • Deleted: “but only if the reactor cannot be shutdown” as a condition for boron injection when suppression pool temperature approaches the Boron Injection Initiation Temperature. | • In the absence of power oscillations fuel and RPV integrity are not directly challenged, even under failure to scram conditions, as long as the core is submerged. However, suppression pool heatup can challenge the containment and remains the second condition for boron injection. Since failure to scram conditions may present severe plant safety consequences, the requirement to initiate boron injection is independent of any anticipated success of control rod insertions. |

## Table 18B-1 Differences Between BWROG EPG Revision 4 and ABWR EPG (Continued)

| ABWR EPG Step | BWROG EPG Rev. 4 Step | Differences from BWROG Rev. 4 EPG | Basis for Differences |
|---|---|---|---|
| RC/Q-6 | RC/Q-6 | • Deleted HPCI and Hydro pump from second paragraph. | • The ABWR does not have these systems. |
| RC/Q-6.1 Override | RC/Q-6.1 Override | • Delete “confirm automatic trip of or”. | • ABWR does not have automatic trip of pump on low SLC tank level. Level indication only. |
| RC/Q-7.2 | RC/Q-7.2 | • Deleted the following phrases: “drain the scram discharge volume”, “Increase CRD cooling water differential pressure”, and “Vent control rod drive overpiston volumes”. | • These steps are applicable to the conventional hydraulic locking-piston drives and are not applicable to the ABWR FMCRDs. |
| Primary Containment Control Entry Conditions | Primary Containment Control Entry Conditions | • Deleted the phrase: “Containment temperature above [90°F(containment temperature LCO)]”. | • This entry condition is applicable only to BWRs with Mark III containments. Refer to basis for deleting the CN/T subsection given below. |
| — | CN/T | • Deleted entire section. | • The control functions specified in this section, operation of containment cooling, initiation of suppression pool sprays, and preforming an RPV depressurization when containment temperature cannot be maintained below a prescribed limit, are control functions that are already specified in subsection SP/T of the ABWR EPGs. Subsection CN/T of the BWROG EPGs is developed specifically for the BWR/6 Mark III containment where temperature can be controlled by the previously stated control functions. The ABWR containment, although it incorporates the concept of a Mark III suppression pool, is analogous to a Mark II BWR containment for the purpose of controlling the wetwell space temperature. |

## Table 18B-1 Differences Between BWROG EPG Revision 4 and ABWR EPG (Continued)

| ABWR EPG Step | BWROG EPG Rev. 4 Step | Differences from BWROG Rev. 4 EPG | Basis for Differences |
|---|---|---|---|
| DW/T, DW/T-1 | DW/T, DW/T-1 | • Added phrase: "shutdown the reactor" at the end of Step DW/T, and added a second part to DW/T-1, "When drywell temperature cannot be maintained below [103°C (Saturation temperature corresponding to high drywell pressure scram setpoint)], enter [procedure developed from the RPV Control Guideline] at [Step RC-1 and execute it concurrently with this procedure". | • The BWROG EPGs assumed that other plant procedure steps will shut down the plant at the Technical Specification LCO limit. Adding the instruction to shut down the reactor allows shutdown by running back the recirculation pumps and inserting control rods, and then proceed to scram the reactor as specified in the second paragraph of Step DW/T-1. Adding these steps does not change the intent of the EPGs and makes DW/T consistent with the other primary containment sections. |
| DW/T-2 | DW/T-2 | • Replaced "drywell sprays" with "containment sprays".<br>• Replaced phrase, "elevation of bottom of internal suppression chamber to drywell vacuum breakers less vacuum breaker opening pressure in feet of water", with the phrase, "elevation of the bottom of suppression pool-to-lower-drywell vent". | • In the ABWR, drywell and suppression pool sprays are initiated simultaneously. They may not be independently operated.<br>• In the ABWR containment, vents are provided connecting the upper drywell to the lower drywell. When the wetwell-to-drywell vacuum breakers open, flow is from the wetwell to the lower drywell and then from the lower drywell to the upper drywell through these vents. The vacuum breakers are located above the vents. It is appropriate to preserve the operability of the vacuum breaker function and spray the containment only when suppression pool water level is below the bottom of the suppression pool to lower drywell vents to preclude drywell differential pressure capability to be exceeded. |

## Table 18B-1 Differences Between BWROG EPG Revision 4 and ABWR EPG (Continued)

| ABWR EPG Step | BWROG EPG Rev. 4 Step | Differences from BWROG Rev. 4 EPG | Basis for Differences |
|---|---|---|---|
| DW/T-2 (continued) | DW/T-2 (continued) | • Deleted phrase "recirculation pumps" from instruction to shutoff recirculation pumps and drywell cooling fans prior to containment spray initiation. | • The ABWR has internal recirculation pumps, driven by motors located below the RPV in the lower portion of the drywell. Containment sprays can not spray the internal recirculation pumps. An explicit instruction to shut down the recirculation pumps is not required. |
| | | • Specify RHR pumps used for containment spray as "RHR subsystems B and C". | • RHR subsystems B and C provide simultaneous drywell and suppression pool spray capability. Initiation of containment sprays is by manual control action. It is possible to initiate spray when RHR B or C is operating in other modes by opening spray valves. |
| | | • Specified the use of the Firewater Addition System if RHR(B) and RHR(C) are not available for containment sprays. | • The firewater addition system is described in Subsection 5.4.7.1.1.10. The specific purpose of the Fire Addition System is to provide makeup to the RPV to extend the station blackout capability of the ABWR, but it can be used for drywell and wetwell sprays if no other systems are available for sprays. |
| DW/T-3 | DW/T-3 | • Deleted phrase: "enter [procedure developed from the RPV Control Guideline] at [Step RC-1 and execute it concurrently with this procedure". | • This phrase has been moved to Step DW/T-1. Reactor scram is specified under the same instruction in DW/T-1 prior to reaching the temperature as stated in Step DW/T-2. |

## Table 18B-1 Differences Between BWROG EPG Revision 4 and ABWR EPG (Continued)

| ABWR EPG Step | BWROG EPG Rev. 4 Step | Differences from BWROG Rev. 4 EPG | Basis for Differences |
|---|---|---|---|
| PC/P | PC/P | • Added instruction to permit venting via the ACS drywell bleed, exhausting through SGTS and RBHVAC only if containment pressure is less than the design pressure of these systems. Also, venting through these systems is to be terminated if containment pressure exceeds the design pressure of these systems or if offsite release rate exceeds the release rate LCO. | • Normal containment pressure control venting is performed using the small ACS drywell bleed line only if containment pressure is less than the design pressure of these “soft vent” systems to preclude damage to these system equipment, and venting through these system for pressure control is allowed if radioactivity release rate is less than the LCO limit. |
| | | • Combined overrides to terminate sprays based on suppression chamber or drywell pressure. | • See basis for Step PC/P-1 |
| PC/P-l | PC/P-1 | • Deleted entire step. | • In the ABWR, drywell and suppression pool sprays are initiated simultaneously. They may not be independently operated. The containment spray initiation instruction is contained in Step PC/P-2 which follows. |

## Table 18B-1 Differences Between BWROG EPG Revision 4 and ABWR EPG (Continued)

| ABWR EPG Step | BWROG EPG Rev. 4 Step | Differences from BWROG Rev. 4 EPG | Basis for Differences |
|---|---|---|---|
| PC/P-2 | PC/P-2 | • Replaced “drywell” sprays with “containment” sprays. | • See bases for DW/T-2 above. |
| | | • Replaced phrase, “elevation of bottom of internal suppression chamber to drywell vacuum breakers less vacuum breaker opening pressure in feet of water”, with the phrase, “elevation of the bottom of suppression pool-to-lower-drywell vent”. | • See bases for DW/T-2 above. |
| | | • Deleted phrase “recirculation pumps” from instruction to shutoff recirculation pumps and drywell cooling fans prior to containment spray initiation. | • See bases for DW/T-2 above. |
| | | • Specified RHR pumps used for containment spray as “RHR subsystems B and C” and specified using the Firewater Addition System for sprays if RHR B & C are not available for sprays. | • See bases for DW/T-2 above. |

## Table 18B-1 Differences Between BWROG EPG Revision 4 and ABWR EPG (Continued)

| ABWR EPG Step | BWROG EPG Rev. 4 Step | Differences from BWROG Rev. 4 EPG | Basis for Differences |
|---|---|---|---|
| PC/P-4 | PC/P-4 | • Deleted entire step. | • In the ABWR, primary containment venting for pressure control is not to be performed. Primary containment overpressure protection is provided by blowout diaphragms (Subsection 6.2.5.2.6). The blowout diaphragms are chosen to actuate in the range of 0.59 to 0.65 MPaG, prior to reaching the service Level C pressure of 0.67 MPaG for the primary containment. Venting is not performed so that radioactivity release to the environment can be minimized. |
| PC/P-5 | PC/P-5 | • Revised entire step to read as follows: "When primary containment pressure reaches the range of [ 0.59 to 0.65 MPaG (Rupture diaphragm pressure range)] and the rupture diaphragms are actuated, do not isolate the containment vent path until directed by [procedure developed for post accident recovery]". | • The rupture diaphragm pressure actuation pressure is in the range of 0.59 to 0.65 MPaG. When the rupture diaphragms are actuated, the vent path is not to be isolated until directed by post-accident recovery procedure. If isolation of the vent path is specified after the rupture diaphragms are actuated, potential exists for the need for subsequent re-opening should containment pressure increase. Failure to open valves in the vent path for any reason can lead to containment failure. If the vent paths are isolated after rupture diaphragm actuation, subsequent containment spray initiation has the potential for containment implosion because most of the non-condensable gases would have been released during the initial burst, and the containment would be saturated with steam. Although instructions are specified to terminate sprays when containment pressure drops to the high drywell scram setpoint value, the risk of containment implosion outweighs the benefit of isolating the vent paths. In addition, with the vent path open, any radioactivity release after the initial burst when the rupture diaphragms actuate is expected to be small. For these reasons, isolation of vent path is best specified in post-accident recovery procedures. |

## Table 18B-1 Differences Between BWROG EPG Revision 4 and ABWR EPG (Continued)

| ABWR EPG Step | BWROG EPG Rev. 4 Step | Differences from BWROG Rev. 4 EPG | Basis for Differences |
|---|---|---|---|
| PC/P-6 | PC/P-6 | • Combined suppression pool and drywell spray initiation steps into one step.<br><br>• Specified that containment sprays may be augmented by the Firewater Addition System within specified containment pressure and level limits. | • In the ABWR, drywell and suppression pool sprays are initiated simultaneously. They may not be independently operated. The lower of the elevation of the bottom of suppression pool-to-lower-drywell vent (11.70m) and the elevation of the suppression pool spray nozzles (18.90m) is used as the allowable pool water elevation for containment spray initiation.<br><br>• In the ABWR, venting the containment is not to be performed, since containment integrity is assured by the rupture diaphragms as discussed above under basis for PC/P-4. The Firewater Addition System may be aligned to spray the wetwell and the drywell. The limits are imposed for consistency with the MPCWLL specified in Step SP/L-3.3 which requires termination of injection from sources external to containment above these limits. |

## Table 18B-1 Differences Between BWROG EPG Revision 4 and ABWR EPG (Continued)

| ABWR EPG Step | BWROG EPG Rev. 4 Step | Differences from BWROG Rev. 4 EPG | Basis for Differences |
|---|---|---|---|
| SP/L-1 | SP/L-1 | • Deleted all references to Suppression Pool Makeup System (SPMS). | • ABWR does not have SPMS which dumps water from the containment pools to the suppression pool in a BWR/6. ABWR uses the SPCU as the normal system for makeup to the suppression pool from the condensate storage tank. |
| | | • Added phrase: “If suppression pool water level cannot be maintained above [7.0 m (minimum suppression pool water level LCO)], enter [procedure developed from the RPV Control Guideline] at [Step RC-1 and execute it concurrently with this procedure”. | • This step is added for scramming the reactor when suppression pool water level cannot be maintained above the low level LCO limit. The BWROG EPGs assumed that other plant procedure steps will require a scram. Specifying this step here does not change the intent of the EPGs and makes it consistent with other sections of the Primary Containment Control Guidelines. Scramming the reactor at this point will allow the operator to use the turbine bypass valves to depressurize the reactor and will make the transient less severe in the subsequent depressurization required in Step SP/L-2. |
| | | • Specified RCIC, HPCF, SPCU, and Fire Protection System and the Firewater Addition mode of RHR(C) as systems that can makeup to the suppression pool, and RHR for rejecting water from the suppression pool. | • More explicit information is provided on the systems that can be used to control suppression pool water level. SPCU is the normal system that can be aligned to take suction from the condensate storage tank and add water to the suppression pool. |

## Table 18B-1 Differences Between BWROG EPG Revision 4 and ABWR EPG (Continued)

| ABWR EPG Step | BWROG EPG Rev. 4 Step | Differences from BWROG Rev. 4 EPG | Basis for Differences |
|---|---|---|---|
| SP/L-2 | SP/L-2 | • Deleted phrase: "enter [procedure developed from the RPV Control Guideline] at [Step RC-1 and execute it concurrently with this procedure". | • This phrase has been moved to Step SP/L-1 as discussed above under Step SP/L-1. |
| SP/L-2.2 | SP/L-2.2 | • Deleted entire step on maintaining pool level above HPCI exhaust line and instruction to execute concurrently with Step SP/L-2.1. | • ABWR does not have the steam-driven HPCI system. |
| SP/L-3 | SP/L-3 | • Deleted references to SPMS. | • ABWR does not have SPMS. |

## Table 18B-1 Differences Between BWROG EPG Revision 4 and ABWR EPG (Continued)

| ABWR EPG Step | BWROG EPG Rev. 4 Step | Differences from BWROG Rev. 4 EPG | Basis for Differences |
|---|---|---|---|
| SP/L-3.1 | SP/L-3.1 | • Replaced the phrase "terminate injection into the RPV from sources external to the primary containment: with the phrase, "terminate injection into the primary containment from sources external to the primary containment". | • A system is injecting water into the primary containment if all the following criteria are satisfied:<br><br>(1) The suction source of the system is outside the primary containment.<br>(2) The system penetrates the primary containment.<br>(3) The system discharge is adding to the primary containment water inventory (i.e., a system is injecting into the RPV and either the RPV has an unisolated leak inside the primary containment or the safety/relief valves are open to the primary containment).<br><br>• The function of the Primary Containment Water Limit is to preclude containment failure. Systems that inject into the RPV is a subset of those systems that can inject into the primary containment. It has always been the intent of the existing wording to direct the termination of all injection into the primary containment. The new wording of the injection termination statement is also intended to allow RPV injection to continue if no water is leaving the RPV into the primary containment. |

## Table 18B-1 Differences Between BWROG EPG Revision 4 and ABWR EPG (Continued)

| ABWR EPG Step | BWROG EPG Rev. 4 Step | Differences from BWROG Rev. 4 EPG | Basis for Differences |
|---|---|---|---|
| SP/L-3.2 | SP/L-3.2 | • Replaced phrase, "elevation of bottom of internal suppression chamber to drywell vacuum breakers less vacuum breaker opening pressure in feet of water", with the phrase, "elevation of the bottom of suppression pool-to-lower-drywell vent". | • For the ABWR, it is appropriate to control suppression pool water level below the suppression pool-to-lower drywell vents to maintain operability of the wetwell vacuum breaking function. Refer to discussion of basis for step DW/T-2. |
| | | • Replaced the phrase "terminate injection into the RPV from sources external to the primary containment" with the phrase, "terminate injection into the primary containment form sources external to the primary containment". | • See basis for SP/L-3.1 above. |
| SP/L-3.3 | SP/L-3.3 | • Replaced the phrase "terminate injection into the RPV from sources external to the primary containment" with the phrase, "terminate injection into the primary containment from sources external to the primary containment". | • See basis for SP/L-3.1 above. |

## Table 18B-1 Differences Between BWROG EPG Revision 4 and ABWR EPG (Continued)

| ABWR EPG Step | BWROG EPG Rev. 4 Step | Differences from BWROG Rev. 4 EPG | Basis for Differences |
|---|---|---|---|
| PC/H-1 Override, second bullet item | PC/H-1 Override, second bullet item | • Deleted phrase, "hydrogen mixing systems and" throughout this document.<br><br>• Deleted instruction to vent the containment. | • The ABWR does not have hydrogen recombiners.<br><br>• Containment venting is not to be performed in the ABWR because containment integrity is assured by the rupture diaphragms as discussed under basis for PC/P-4. |
| PC/H-1 | PC/H-1 | • Added instruction not to bypass the high radiation isolation and high drywell pressure isolation interlocks. | • It is required by this step to maintain offsite radioactivity release rates below the LCO. Therefore, the radiation isolation interlocks (which typically have setpoints which are less than or equal to the LCO) should remain operable. The instruction not to bypass the high radiation isolation interlock is consistent with the instruction given in the override statement of Steps PC/H-1.1 to PC/H-1.2 to isolate the primary containment vent and purge when offsite release rate reaches the LCO.<br><br>The basis for the instruction to not bypass the high drywell pressure isolation interlock is given under the basis for the override statement of Steps PC/H-1.1 to PC/H-1.2 in this table. |

## Table 18B-1 Differences Between BWROG EPG Revision 4 and ABWR EPG (Continued)

| ABWR EPG Step | BWROG EPG Rev. 4 Step | Differences from BWROG Rev. 4 EPG | Basis for Differences |
|---|---|---|---|
| PC/H-1.1 to 1.2 Override | PC/H-1.1 to 1.2 Override | • Added instruction to isolate containment venting if containment pressure exceeds the design pressure of SGTS and RBHVAC Systems. | • Containment venting at relatively low containment pressure is permitted only if containment pressure is less than the design pressure of these “soft vent” systems (RBHVAC, SGTS) to preclude structural damage to these system equipment. The vent path is automatically isolated on high containment pressure. Bypassing this isolation interlock and opening the vent path for venting and purging will defeat the purpose of the rupture disks. At such low hydrogen concentration (0.1%), it is inappropriate to bypass the high containment pressure isolation and open the vent path which can damage plant equipment that may be needed later for post-accident recovery.<br><br>In case there is a LOCA and ECCS is available, boiling in the reactor is suppressed by the injection of cold water into the reactor, stopping hydrogen generation by radiolysis. Even if the containment is isolated on high pressure, hydrogen concentration is expected to not exceed 0.5%, precluding the need for vent and purge.<br><br>If no pumps are available after a LOCA, containment pressure will increase to a pressure that will actuate the rupture disks in about 24 hours, prior to reaching an explosive mixture.<br><br>In severe accident scenarios with core damage, the containment vent paths will be automatically isolated by a high radiation signal. According to the BWROG EPGs, venting at low hydrogen concentration is not allowed in the presence of high radiation. |

## Table 18B-1 Differences Between BWROG EPG Revision 4 and ABWR EPG (Continued)

| ABWR EPG Step | BWROG EPG Rev. 4 Step | Differences from BWROG Rev. 4 EPG | Basis for Differences |
|---|---|---|---|
| PC/H-1.2 | PC/H-1.2 | • Changed the step to read as follows: "Vent the primary containment using the ACS bleed line and purge the primary containment with nitrogen in accordance with [procedure for primary containment purging]." | • Nitrogen purge flow is established in order to lower the containment hydrogen concentration. Venting of the containment is restricted to the use of the small drywell bleed line. The use of nitrogen only for the purging operation will maintain the existing inerted atmosphere. Detailed instructions for conducting the purging is beyond the scope of the EPGs and thus the identification of a plant-specific procedure is enclosed in brackets. |
| PC/H-1.3 | PC/H-1.3 | • Deleted step. | • Since venting is restricted to using the drywell bleed line, purging with the ACS using air (by means of the large air purge lines) is not appropriate. |
| PC/H-2.1 | PC/H-2.1 | • Deleted step. | • The ABWR does not have hydrogen recombiners. |
| PC/H-2.2 | PC/H-2.2 | • Deleted step. | • See basis for PC/H-2.1 above. |
| PC/H-3.1 | PC/H-3.1 | • Deleted step. | • The ABWR does not have hydrogen recombiners. |
| PC/H-3.2 | PC/H-3.2 | • Deleted step. | • The ABWR does not have recombiners. |

## Table 18B-1 Differences Between BWROG EPG Revision 4 and ABWR EPG (Continued)

| ABWR EPG Step | BWROG EPG Rev. 4 Step | Differences from BWROG Rev. 4 EPG | Basis for Differences |
|---|---|---|---|
| PC/H-4 | PC/H-4 | • Deleted instruction for vent and purging of the primary containment when oxygen and hydrogen concentrations reaches the level specified in this step. | • Venting at this step through SGTS and RBHVAC (“soft vents”) with high oxygen and hydrogen concentrations is not to be performed to preclude potential structural damage to these equipment due to combustion or explosions. |
| | | • Deleted phrase, “enter [procedure developed from the RPV Control Guideline] at [Step RC-1] and execute it concurrently with this procedure”. | • This phrase has been moved to Step PC/H-2.1. Refer to the bases for Step PC/H-2.1. |
| | | • Combined overrides to terminate sprays based on suppression chamber or drywell pressure. | • See bases for Step PC/H-4.1. |
| PC/H-4.1 | PC/H-4.1 | • Deleted step. | • In the ABWR, drywell and suppression pool sprays are initiated simultaneously. They may not be independently operated. The containment spray initiation instruction is contained in Step PC/H-4.4. |
| PC/H-4.2 | PC/H-4.2 | • Deleted step. | • Venting is not to be performed as discussed above under basis for Step PC/H-4. |
| PC/H-4.3 | PC/H-4.3 | • Deleted step. | • Purging is not applicable because the venting instructions have been deleted. |

## Table 18B-1 Differences Between BWROG EPG Revision 4 and ABWR EPG (Continued)

| ABWR EPG Step | BWROG EPG Rev. 4 Step | Differences from BWROG Rev. 4 EPG | Basis for Differences |
|---|---|---|---|
| PC/H-4.4 | PC/H-4.4 | • Deleted reference to recirculation pumps and specified RHR pumps used for containment spray as RHR subsystems B and C; added instruction to use FAS if RHR B and C are not available. | • See discussion for step DW/T-2. |
| | | • Replaced phrase, "elevation of bottom of internal suppression chamber to drywell vacuum breakers less vacuum breaker opening pressure in feet of water", with the phrase, "elevation of the bottom of suppression pool-to-lower-drywell vent". | • See discussion for step DW/T-2. |
| PC/H-5 | PC/H-5 | • Combined overrides to terminate sprays based on suppression chamber or drywell pressure. | • See bases for Step PC/H-5.1 |
| PC/H-5.1 | PC/H-5.1 | • Deleted step. | • In the ABWR, drywell and suppression chamber sprays are initiated simultaneously. They may not be independently operated. The containment spray initiation instruction is contained in Step PC/H-5.2. |

## Table 18B-1 Differences Between BWROG EPG Revision 4 and ABWR EPG (Continued)

| ABWR EPG Step | BWROG EPG Rev. 4 Step | Differences from BWROG Rev. 4 EPG | Basis for Differences |
|---|---|---|---|
| PC/H-5.2 | PC/H-5.2 | • Deleted reference to recirculation pumps.<br>• Replaced phrase, "elevation of bottom of internal suppression chamber to drywell vacuum breakers less vacuum breaker opening pressure in feet of water", with the phrase, "elevation of the bottom of suppression pool-to-lower-drywell vent".<br>• Changed "drywell" sprays to "containment" sprays. | • See discussion of basis for step DW/T-2.<br>• See discussion of basis for step DW/T-2.<br>• See bases for Step PC/H-5.1 |

## Table 18B-1 Differences Between BWROG EPG Revision 4 and ABWR EPG (Continued)

| ABWR EPG Step | BWROG EPG Rev. 4 Step | Differences from BWROG Rev. 4 EPG | Basis for Differences |
|---|---|---|---|
| SC/T-3, SC/R-1, SC/L-1 | SC/T-3, SC/R-1, SC/L-1 | • Added phrase, "protect primary containment integrity", to each of these three steps. | • The existing steps in BWROG EPGs SC/T-3, SC/R-1, and SC/L-1 already prioritize the secondary containment's importance with respect to the reactor core. By requiring the isolation of only those systems not required to assure adequate core cooling, regardless of their current effect on the secondary containment, the EPGs have set the protection of the reactor core ahead of secondary containment. When a decision between the possible loss of adequate core cooling and a loss of primary containment integrity must be made, the EPGs choose to maintain primary containment integrity. Therefore, it directly follows that the primary containment takes precedence over the secondary containment. Those systems that are required to protect primary containment integrity must not be isolated in Secondary Containment Control. |
| RR-1 Override Statement | RR-1 Override Statement | • Deleted phrases, "or isolated due to high radiation," and "defeating isolation interlocks if necessary." | • The Turbine Building HVAC has no high radiation interlock. |
| RR-1 | RR-1 | • Added phrase, "If the radioactivity release rate continues to increase, enter [procedure developed from the RPV Control Guideline] at [Step RC-1] and execute it concurrently with this procedure". | • If offsite release continues to increase, it is appropriate to scram the reactor [at RC-1]. This will also allow the operator to use the turbine bypass valves to depressurize the reactor, making the depressurization as required in RR-2 a less severe transient. |

## Table 18B-1 Differences Between BWROG EPG Revision 4 and ABWR EPG (Continued)

| ABWR EPG Step | BWROG EPG Rev. 4 Step | Differences from BWROG Rev. 4 EPG | Basis for Differences |
|---|---|---|---|
| RR-2 | RR-2 | • Deleted phrase, "enter [procedure developed from the RPV Control Guideline] at [Step RC-1] and execute it concurrently with this procedure". | • This phrase has been moved to Step RR-1 as discussed above. |
| C1 second Override Statement | C1 second Override Statement | • Changed the word "RPV" in the phrase "... terminate injection into the RPV from sources external to the primary containment...", to "primary containment". | • A system is injecting water into the primary containment if all the following criteria are satisfied:<br><br>(1) The suction source of the system is outside the primary containment.<br>(2) The system penetrates the primary containment.<br>(3) The system discharge is adding to the primary containment water inventory (i.e., a system is injecting into the RPV and either the RPV has an unisolated leak inside the primary containment or the safety/relief valves are open to the primary containment).<br><br>The function of the Primary Containment Water Limit is to preclude containment failure. Systems that inject into the RPV are a subset of those systems that can inject into the primary containment. It has always been the intent of the existing wording to direct the termination of all injection into the primary containment from sources external to the primary containment. The new wording of the injection termination statement is also intended to allow RPV injection to continue if no water is leaving the RPV into the primary containment. |

## Table 18B-1 Differences Between BWROG EPG Revision 4 and ABWR EPG (Continued)

| ABWR EPG Step | BWROG EPG Rev. 4 Step | Differences from BWROG Rev. 4 EPG | Basis for Differences |
|---|---|---|---|
| C1-1 | C1-1 | • Deleted step. | • ABWR does not have isolation condensers. |
| C1-2 | C1-2 | • Added Feedwater to list of systems. | • ABWR has three motor-driven feedpumps and hence the feedwater system is added to the list of motor-driven injection subsystems. |
| | | • HPCS specified as HPCF(B) and HPCF(C). | • In ABWR, the high pressure ECCS injection system is termed High Pressure Core Flooder(HPCF), having two separate loops B & C. |
| | | • Deleted phrase, “with injection through the heat exchangers as soon as possible”. | • In the ABWR design, the RHR heat exchangers are normally in the flow path for all modes of operation. There are no timers to keep the heat exchanger bypass valves from closing as in a typical BWR/6 design. Therefore, it is not necessary to retain the phrase, “with injection through the heat exchangers as soon as possible”. |
| | | • Deleted LPCS and RHR service water crosstie. | • ABWR does not have LPCS or RHR service water crosstie. |
| | | • Specified the Firewater Addition System, ECCS keep-full systems and SLC (test tank) as alternate injection systems. | • See basis RC/L-2. |
| C2-1.1 | C2-1.1 | • Deleted LPCS. | • ABWR does not have LPCS. |
| C2-1.2 | C2-1.2 | • Deleted step. | • ABWR does not have isolation condensers. |

## Table 18B-1 Differences Between BWROG EPG Revision 4 and ABWR EPG (Continued)

| ABWR EPG Step | BWROG EPG Rev. 4 Step | Differences from BWROG Rev. 4 EPG | Basis for Differences |
|---|---|---|---|
| C2-1 | C2-1 | • Revised conditional steps to read as follows:<br>• All control rods are inserted to or beyond [4.2%(Maximum Subcritical Banked Withdrawal Position)], or,<br>• It has been determined that the reactor will remain shutdown under all conditions without boron, or<br>• All injection into the RPV except from boron injection systems, CRD, and RCIC has been terminated and prevented. | • The restructuring of this step simplifies the original wording and improves operator understanding. The logic for operator actions is unchanged by this restructuring of the original conditional statements in the BWROG EPGs, Step C2-1. |
| C2-1.4 | – | • Added instruction to execute steps C2-1.4 and C2-1.5 concurrently. | • The ABWR ADS valves can be opened using nitrogen in stored bottles. Local manual action would be required to align the stored nitrogen to open the ADS valves. This action should be taken concurrently with other actions to depressurize the reactor as specified in Step C2-1.5. Refer Section 6.7 for a description of the ADS capability using nitrogen bottles. |
| C2-1.5 | C2-1.4 | • Renumbered as C2-1.5 in ABWR EPG. | • Renumbered due to addition of C2-1.4 in ABWR EPG. |
| | | • Deleted RHR steam condensing mode, HPCI steamline, & IC tube side vent. | • ABWR does not have RHR steam condensing mode, HPCI, or isolation condensers. |
| | | • Deleted [and RPV... pressure] | • SRVs are direct acting and have a reopening pressure of 0 MPaG. |

## Table 18B-1 Differences Between BWROG EPG Revision 4 and ABWR EPG (Continued)

| ABWR EPG Step | BWROG EPG Rev. 4 Step | Differences from BWROG Rev. 4 EPG | Basis for Differences |
|---|---|---|---|
| C3-1 | C3-1 | • Deleted references to IC. | • ABWR does not have isolation condensers. |
| C4 second Override Statement | C4 second Override Statement | • Change the word "RPV" in the phrase "... terminate injection into the RPV from sources external to the primary containment...", to "primary containment". | • A system is injecting water into the primary containment if all the following criteria are satisfied:<br><br>(1) The suction source of the system is outside the primary containment, and<br>(2) The system penetrates the primary containment, and<br>(3) The system discharge is adding to the primary containment water inventory (i.e., a system is injecting into the RPV and either the RPV has an unisolated leak inside the primary containment or the safety relief valves are open to the primary containment.<br><br>The function of the Primary Containment Water Limit is to preclude containment failure. Systems that inject into the RPV is a subset of those systems that can inject into the primary containment. It has always been the intent of the existing wording to direct the termination of all injection into the primary containment. The new wording of the injection termination statement is also intended to allow RPV injection to continue if no water is leaving the RPV into the primary containment. |

## Table 18B-1 Differences Between BWROG EPG Revision 4 and ABWR EPG (Continued)

| ABWR EPG Step | BWROG EPG Rev. 4 Step | Differences from BWROG Rev. 4 EPG | Basis for Differences |
|---|---|---|---|
| C4-1.2 | C4-1.2 | • Deleted IC and RHR steam condensing from step. | • ABWR does not have isolation condensers and RHR steam condensing mode. |
| C4-1.3 | C4-1.3 | • Deleted phrase, “LPCI with injection through the heat exchangers as soon as possible”, and added RHR to list of systems in the first part of the step. | • In the ABWR design, the RHR heat exchangers are normally in the flow path for all modes of operation. There are no timers to keep the heat exchanger bypass valves from closing as in a typical BWR/6 design. Therefore, it is not necessary to retain the phrase, “with injection through the heat exchangers as soon as possible.” In addition, the ABWR LPCF mode of RHR(A) injects into a feedwater line, and RHR(B) and RHR(C) injects outside of the shroud in the RPV, and hence, are suitable systems to be used in this step for systems injecting outside of the shroud. |
| | | • Defined HPCS as HPCF(B) and HPCF(C). | • In the ABWR, the high pressure ECCS injection system consists of two separate loops, HPCF(B) and HPCF(C); both inject inside the shroud in the RPV. |
| | | • Deleted LPCS and RHR service water crosstie from the list of systems used in the second part of this step. | • The ABWR does not have LPCS or RHR service water crosstie. |

## Table 18B-1 Differences Between BWROG EPG Revision 4 and ABWR EPG (Continued)

| ABWR EPG Step | BWROG EPG Rev. 4 Step | Differences from BWROG Rev. 4 EPG | Basis for Differences |
|---|---|---|---|
| C4-1.3 | C4-1.3 | • Inserted the phrase, "PRIMARY CONTAINMENT FLOODING IS REQUIRED", prior to the phrase, "enter [procedure developed from Contingency #6]". | • EPG Steps C1-4.2, C4-1.3, C4-3.1, and C5-3.2 establish requirements for flooding the primary containment to assure adequate core cooling. When flooding of the containment is required, operator actions for controlling suppression pool water level are transferred to Contingency #6. As the status or condition of a specific parameter degrades and either approaches or exceeds limiting values, control of that parameter may be transferred from one contingency to another. This is accomplished by identifying the requirement for a contingency action, denoting this in capital letters, and then effecting the transfer of control explicit direction in the appropriate guideline sections and contingencies that address the affected parameter(s). Step C1-4.2 presently includes the upper case phrase, "PRIMARY CONTAINMENT FLOODING IS REQUIRED". Steps C4-1.3, C4-3.1, and C5-3.2 are made consistent with the stated approach and with Step C1-4.2 by the inserted phrase "PRIMARY CONTAINMENT FLOODING IS REQUIRED". |
| C4-2 | C4-2 | • Changed HPCS to HPCF and throughout the remainder of this document. | • In the ABWR, the high pressure ECCS injection system consists of two separate loops, HPCF(B) and HPCF(C), both inject inside the shroud in the RPV. |
| | | • Deleted IC and RHR steam condensing from step. | • ABWR does not have isolation condensers and RHR steam condensing mode. |

## Table 18B-1 Differences Between BWROG EPG Revision 4 and ABWR EPG (Continued)

| ABWR EPG Step | BWROG EPG Rev. 4 Step | Differences from BWROG Rev. 4 EPG | Basis for Differences |
|---|---|---|---|
| C4-3.1 | C4-3.1 | • Defined HPCS as HPCF(B) and HPCF(C). | • See C4-1.3 basis above. |
| | | • Deleted LPCS and RHR service water crosstie from the list of systems. | • See C4-1.3 basis above. |
| | | • Deleted phrase, “LPCI with injection through the heat exchangers as soon as possible”, and added RHR to list of systems. | • See C4-1.3 basis above. |
| C4-3.2 Override Statement | C4-3.2 Override Statement | • Inserted phrase, “PRIMARY CONTAINMENT FLOODING IS REQUIRED”, prior to instruction to enter C6. | • See basis for C4-1.3 above. |
| C-5 Override Statement, third bullet item | C-5 Override Statement, third bullet item | • Changed the word “RPV” in the phrase “... terminate injection into the RPV from sources external to the primary containment... “, to “primary containment”. | • Refer to basis for RC/L-2 Override statement. |

## Table 18B-1 Differences Between BWROG EPG Revision 4 and ABWR EPG (Continued)

| ABWR EPG Step | BWROG EPG Rev. 4 Step | Differences from BWROG Rev. 4 EPG | Basis for Differences |
|---|---|---|---|
| C5-2 | C5-2 | • Changed the phrase, "if any MSIV is open, bypass low RPV water level pneumatic system and MSIV isolation interlocks and restore the pneumatic supply to the containment, and," to read as follows: "if any MSL is not isolated, bypass low RPV water level interlocks to maintain the main condenser as a heat sink".<br><br>• Part of Rev. 4 Step C5-2 moved and added as a separate step: "If any MSL is not isolated, bypass low RPV water level interlocks to maintain the main condenser as a heat sink."<br><br>• Subsequent steps and references to them are renumbered for consistency with the added Step C5-2. | • The pneumatic system supply to the MSIVs in the ABWR has no low RPV water isolation and no high drywell pressure isolation and, therefore, the instruction to bypass isolation interlocks and restore the pneumatic supplies (having been isolated) is not appropriate.<br><br>• RPV water level is lowered in subsequent steps to minimize both reactor power and core inlet subcooling. Bypassing low RPV water level interlocks is specified to avoid RPV depressurization that could be required as a result of loss of the main condenser. Increased emphasis is placed on maintaining the main condenser as a heat sink to address mitigation of ATWS. |

## Table 18B-1 Differences Between BWROG EPG Revision 4 and ABWR EPG (Continued)

| ABWR EPG Step | BWROG EPG Rev. 4 Step | Differences from BWROG Rev. 4 EPG | Basis for Differences |
|---|---|---|---|
| C5-3 | C5-2 | • Moved the instruction: "If any MSIV is open, bypass RPV low water level ... [to the containment], and " to Step C5-2 with changes noted above. | • This instruction was specified previously as the new Step C5-2 and becomes unnecessary in this step. |
| C5-4 | C5-4 | • Entire C5-4 step and the "If while executing..." phrase above the step are deleted. | • This step is only applicable for plants with SLC injecting into the bottom of the RPV. The ABWR SLC injects via HPCF(B) into the core. Therefore, this step is not applicable to the ABWR. |
| | — | • Step added: "If RPV water level is above [164.9 cm (Maximum Power Control RPV Water Level)] and the reactor is not shutdown: Lower RPV water level to below [164.9 cm (Maximum Power Control RPV Water Level)] by terminating and preventing all injection into the RPV except from boron injection systems and CRD. | • Reducing RPV water level to the Maximum Power Control RPV Water Level assures that water injected through the feedwater sparger will fall a sufficient distance through a steam environment such that its subcooling will be significantly reduced by the time it reaches the RPV water level surface. Raising the enthalpy of the water entering the lower plenum and core inlet is expected to prevent or mitigate large periodic oscillations induced by neutronic /thermal-hydraulic instabilities. |

## Table 18B-1 Differences Between BWROG EPG Revision 4 and ABWR EPG (Continued)

| ABWR EPG Step | BWROG EPG Rev. 4 Step | Differences from BWROG Rev. 4 EPG | Basis for Differences |
|---|---|---|---|
| C5-5 | C5-3 | • Added bypass of RCIC area high temperature isolation interlock. | • See basis for RC/L-2. |
| | | • HPCI is deleted. | • The ABWR does not have the HPCI system. |
| | | • The phrase, “LPCI with injection through the heat exchangers as soon as possible”, is deleted, and added RHR (LPCF) to the list of systems. | • In the ABWR design, the RHR heat exchangers are normally in the flow path for all modes of operation. There are no timers to keep the heat exchanger bypass valves from closing as in a typical BWR/6 design. Therefore, it is not necessary to retain the phrase, “with injection through the heat exchangers as soon as possible.” In addition, the ABWR LPCF mode of RHR(A) injects into a feedwater line, and RHR(B) and RHR(C) injects outside of the shroud in the RPV and, hence, are suitable systems to be used in this step for systems injecting outside of the shroud. |
| | | • This step was restructured and reworded for control of water level as part of the change package to address ATWS/ stability concerns for the ABWR. The control bands specified are: (a) if level was deliber- ately lowered in Step C5-3 or C5-4, control between the Minimum Steam Cooling RPV Water Level (MSCRWL) and the lowered level or (b) if level was not | • These changes provide for control of RPV water level in three different ranges: (1) between MSCRWL and lowered level from Step C5-3, (2) between MSCRWL the Maximum Power Control RPV Water Level from Step C5-4, or (3) between MSCRWL and the high level trip setpoint if the water level was not lowered in either Step C5-3 or Step C5-4. Range (1) allows power reduction, range (2) provides power reduction and prevents or mitigates power oscillations, and range (3) provides the maximum possible band for water level control in the absence of power oscillations. |

## Table 18B-1 Differences Between BWROG EPG Revision 4 and ABWR EPG (Continued)

| ABWR EPG Step | BWROG EPG Rev. 4 Step | Differences from BWROG Rev. 4 EPG | Basis for Differences |
|---|---|---|---|
| C5-5 (continued) | C5-3 (continued) | deliberately lowered, control between MSCRWL and the high level setpoint. In contrast, the previous control bands were respectively: (a) between MSCRWL and the lowered level and (b) between top of active fuel and the high level trip setpoint. Specific changes to address power instabilities are listed as follows:<br><br>• After “Maintain RPV water level”, added: “between [-79.5 cm (Minimum Steam Cooling RPV Water Level)] and”.<br><br>• After “If RPV water level was deliberately lowered in Step [C5-”, change the “2” to “3 or C5-4” and delete “between [-79.5 cm (Minimum Steam Cooling RPV Water Level)] and”.<br><br>• After “If RPV water level was not deliberately lowered in Step [C5-”, changes the “2” to “3 or C5-4” and delete “between | |

## Table 18B-1 Differences Between BWROG EPG Revision 4 and ABWR EPG (Continued)

| ABWR EPG Step | BWROG EPG Rev. 4 Step | Differences from BWROG Rev. 4 EPG | Basis for Differences |
|---|---|---|---|
| C5-5 (continued) | C5-3 (continued) | [0 cm(top of active fuel)] and".<br><br>• Delete: "If RPV water level was not deliberately lowered in [Step C5-2] and RPV water level cannot be maintained above [0 cm(top of active fuel)], maintain RPV water level between [-79.5 cm (Minimum Steam Cooling RPV Water Level)] and [484.4 cm (high level trip setpoint)]. | |
| C5-5.2 | C5-3.2 | • Specified HPCF.<br><br>• Deleted LPCS, and<br><br>• Deleted RHR service water crosstie.<br><br>• Inserted phrase, "PRIMARY CONTAINMENT FLOODING IS REQUIRED", prior to instruction to enter C6. | • The systems given are systems that inject inside the shroud. The ABWR HPCF systems inject inside the shroud and thus are appropriate in this step.<br><br>• The ABWR does not have LPCS.<br><br>• The ABWR does not have RHR service water crosstie.<br><br>• See basis for C4-1.3 above. |

## Table 18B-1 Differences Between BWROG EPG Revision 4 and ABWR EPG (Continued)

| ABWR EPG Step | BWROG EPG Rev. 4 Step | Differences from BWROG Rev. 4 EPG | Basis for Differences |
|---|---|---|---|
| C5-5.2 (continued) | C5-3.2 (continued) | • After "....maintain RPV water level above", deleted: "[0 cm (top of active fuel)]", and added: "[-79.5 cm (Minimum Steam Cooling RPV Water Level)]". | • See basis for C4-1.3 above. |
| | | • Delete: "If RPV water level cannot be restored and maintained above [0 cm(top of active fuel)], restore and maintain RPV water level above [-79.5 cm (Minimum Steam Cooling RPV Water Level)]". | • See basis for C4-1.3 above. |
| C6-1 | C6-1 | • Step deleted. | • ABWR does not have Suppression Pool Makeup System (SPMS). |

## Table 18B-1 Differences Between BWROG EPG Revision 4 and ABWR EPG (Continued)

| ABWR EPG Step | BWROG EPG Rev. 4 Step | Differences from BWROG Rev. 4 EPG | Basis for Differences |
|---|---|---|---|
| C6-2 Override Statement | – | • Override statement is added for Step C6-2 to terminate containment flooding when drywell water level reaches the bottom of the RPV, if RPV water level is below TAF and containment radiation level indicates that substantial core damage has occurred. | • Containment flooding is terminated when the drywell water level reaches the bottom of the RPV during severe accident conditions when most of the core has melted and dropped to the lower drywell. Flooding is terminated to avoid covering the wetwell vent path which has the containment rupture diaphragms. This will avoid potential discharging of water through the containment vent path should the rupture diaphragms actuate. Flooding of the lower drywell under these conditions provides sufficient scrubbing. The wetwell vent is located at an elevation above the bottom of the RPV. The bottom of the RPV is chosen for flooding termination because it provides a convenient reference. The Core Damage Radiation Level (CDRL) is set at a level which will distinguish between an accident which has led to the melting of most of the fuel, and an accident which results in damage of a few fuel pins. Therefore, if the core is still mostly intact in the reactor pressure vessel but all the fuel pins have a failure, the CDRL will not be reached, and subsequent steps in this Contingency will direct flooding of the containment to a level above TAF. Since the goal of this Contingency is to flood the containment to prevent core damage, and not to prevent further core damage once core damage has started, it is appropriate to minimize radiation release after core damage has occurred.<br><br>(Continued on next page.) |

## Table 18B-1 Differences Between BWROG EPG Revision 4 and ABWR EPG (Continued)

| ABWR EPG Step | BWROG EPG Rev. 4 Step | Differences from BWROG Rev. 4 EPG | Basis for Differences |
|---|---|---|---|
| C6-2 Override Statement (continued) | – | | (continued)<br>If the core has melted sufficiently to fail the vessel, and corium has fallen to the floor of the lower drywell, then most of the core will have been molten, and the noble gases and most of the volatile fission products will have been released. This will lead to the CDRL being reached. Under these conditions, there will be little additional release of fission products from the fuel remaining in the vessel. On the other hand, there will be a high concentration of fission products on the upper vessel internals. These will slowly be revaporized due to self-heating. Therefore, if a vent is opened in the vessel (necessary if containment is to be flooded to TAF), the release of fission products from the containment would be very similar to that if all of the fuel had melted and relocated to the lower drywell. Thus, it is not desirable to vent the RPV under these conditions. |
| C6-2 | C6-2 | • Changed HPCS to HPCF.<br>• LPCS deleted.<br>• LPCI deleted.<br>• SPCU added.<br>• RHR service water crosstie deleted.<br>• The Firewater Addition system is specified. | • See basis in Step C4-2.<br>• ABWR does not have LPCS.<br>• LPCI mode of RHR cannot take suction from sources external to the primary containment.<br>• Suppression Pool Cleanup System can be aligned to take suction from the CST and inject into the suppression pool.<br>• ABWR does not have RHR service water crosstie.<br>• The FAS can be aligned to inject into the RPV, providing some core cooling capability. |

## Table 18B-1 Differences Between BWROG EPG Revision 4 and ABWR EPG (Continued)

| ABWR EPG Step | BWROG EPG Rev. 4 Step | Differences from BWROG Rev. 4 EPG | Basis for Differences |
|---|---|---|---|
| C6-3 & C6-4 Override Statement | C6-3 & C6-4 Override Statement | • Added phrase "only if containment radiation is below Core Damage Radiation Level or cannot be determined." | • See bases for C6-2 Override above. |
| C6-3 | C6-3 | • Deleted phrase "lowest recirculation piping", and added "RPV", and deleted phrase "then irrespective of the offsite radioactivity release rate". | • ABWR does not have external recirculation system. The recirculation pumps are internal to the RPV and, thus, when primary containment water level reaches the bottom of the RPV, it is appropriate to vent the RPV as elevation of the bottom of the RPV is the lowest point that can be postulated to have a break. Venting of the RPV is permitted only if the containment radiation level is below that indicative of core damage to preclude releasing radioactivity outside of the primary containment. |
| | | • Deleted "Flood vent valves", "HPCI steam line", "IC tube side vents". | • ABWR does not have flood vent valves, HPCI system, and isolation condensers. |
| | | • Deleted "RHR" from the list of systems for venting of the RPV. | • ABWR RHR System does not have a steam condensing mode and therefore is not suitable for venting the RPV. |
| C6-4 | C6-4 | • Changed HPCS to HPCF. | • See basis in Step C4-2. |
| | | • LPCS was deleted. | • ABWR does not have LPCS. |
| | | • RHR service water crosstie was deleted. | • ABWR does not have RHR service water crosstie. |
| | | • The Firewater Addition system is specified. | • The FAS can inject into the RPV and flood the containment from an external water source, if required to maintain the specified water level band. |