19.9 COL License Information

A review was conducted to determine actions which will be completed by the COL applicant.

This section represents the results of that review.

19.9.1 Post Accident Recovery Procedure for Unisolated CUW Line Break

An unisolated reactor water cleanup system (CUW) line break, although very unlikely to occur (Subsection 19E.2.3.3), could lead to reactor building flooding and eventual depletion of ECCS water sources if the break can not be isolated. Attempting to control RPV water level in the normal range during post accident recovery operation could lead to a continuous coolant outflow through the break since the CUW suction nozzle and the RPV drain line connection to the suction line are below the normal RPV water level.

For a CUW break outside of the containment, the Secondary Containment Control Guideline of the symptom-based Emergency Procedure Guideline (EPGs), Appendix 18A, provides the appropriate initial operator actions for isolation of CUW, scram the reactor, and depressurization of the reactor. The RPV Control Guideline of the EPGs (Steps RC/P-5, RC/L-3) provides the direction for proceeding to cold shutdown in accordance with a procedure which the COL applicant will develop. This COL applicant procedure for post accident recovery will be developed using the following guidance:

(1) After RPV depressurization, attempt to close the CUW isolation valves and the CUW remote manual shutoff valve. If at least one of the three CUW valves can be closed, control RPV water level in the normal range and initiate shutdown cooling operation.

(2) If the CUW remote manual shutoff valve can not be closed and at least one of the two CUW isolation valves can not be closed, control RPV water level between the top of the active fuel and 38 cm above the top of the active fuel. (The RPV drain line connects to the CUW suction line at this elevation). When practical, enter the CUW room and/or the containment and affect the necessary repairs. When at least one of the two CUW isolation valves can be closed, control water level in the normal range and initiate shutdown cooling.

(3) When practical, enter the CUW room and/or the containment and affect the necessary repairs. When at least one of the two CUW isolation valves can be closed, control water level in the normal range and initiate shutdown cooling.

19.9.2 Confirmation of CUW Operation Beyond Design Bases

CUW can be used to remove decay heat under accident conditions by bypassing the regenerative heat exchanger as noted in Subsection 19.3.1.3.1(1)(b). This causes the nonregenerative heat exchanger to remove additional heat. However, this could lead to exceeding the design temperature limits of the CUW nonregenerative heat exchanger and some portions of the piping of the CUW and the reactor building cooling water (RCW) systems.

When the design of the CUW and RCW systems (including piping and support structures) is completed, the COL applicant must confirm that if the CUW is operating in the heat removal mode, the following areas will remain functional while operating outside their design basis temperature values:

(1) The CUW nonregenerative heat exchanger

(2) The CUW piping downstream of the regenerative heat exchanger

(3) The RCW piping downstream of the nonregenerative heat exchanger

(4) The feedwater piping downstream of CUW injection

(5) Piping supports for the above piping

When the CUW is used to remove decay heat by bypassing the regenerative heat exchanger, steps should also be taken to prevent boiling in the shell side of the nonregenerative heat exchanger (NRHX) by increasing the reactor building closed cooling water (RBCCW) flow through the NRHX. To accomplish this the plant emergency procedures should consider the following steps:

(1) Terminate RBCCW flow to the RHR heat exchangers.

(2) Bypass the hot water heat exchanger in the RBCCW line.

(3) Bypass the flow control valve which controls RBCCW flow through the NRHX.

19.9.3 Event Specific Procedures for Severe External Flooding

Internal flooding is addressed in Appendix 19R. The site selection process will take into account the worst case predicted flood. Then grade level and flood control methods (e.g., site grading) will be determined based on this predicted flood level. The grade level floor will be 0.3 meters above this predicted flood level. Therefore, external flooding should not be a major concern for the ABWR. To further reduce the susceptibility of external floods, plant and site specific procedures will be developed by the COL applicant for severe external flooding using the following guidelines:

(1) Check that the door between the turbine and service buildings is closed.

(2) As an additional protection, consider placing sandbags at the external doors above the design flood level to the

    (a) Reactor building,

(b) Control building,

(c) Service building,

(d) Pump house at the ultimate heat sink,

(e) Diesel generator fuel oil transfer pits, and

(f) Radwaste building.

(3) Close and dog all external water tight doors in the reactor and control buildings.

(4) Shut the plant down.

(5) Use power from the diesel generators or CTG if offsite power is lost.

Underground passages between buildings would not be affected because they are required to be watertight.

19.9.4 Confirmation of Seismic Capacities Beyond the Plant Design Bases

The seismic analysis assumed seismic capacities for some equipment for which information was not available. It is expected that these capacities can be achieved, but determination of actual seismic capacities must be deferred to the COL applicant when sufficient design detail is available. The actions specified in Subsection 19H.5 will be taken by the COL applicant.

19.9.5 Plant Walkdowns

The COL applicant shall develop procedures for the plant walkdown to seek seismic vulnerabilities which will be conducted by the COL applicant as outlined in Subsection 19H.5.1.

Similar walkdowns will be conducted by the COL applicant for internal fire and flooding events.

19.9.6 Confirmation of Loss of AC Power Event

The COL applicant will confirm the frequency estimate for the loss of AC power event. This review will address site-specific parameters (as indicated in the staff's licensing review basis document) such as specific causes (e.g., a severe storm) of the loss of power, and their impact on a timely recovery of AC power.

19.9.7 Procedures and Training for Use of AC-Independent Water Addition System

Specific, detailed procedures will be developed by the COL applicant for use of the AC-independent Water Addition System (including use of the fire truck) to provide vessel injection, wetwell spray, drywell spray, and suppression pool makeup water, if necessary. Training will be included in the COL applicant's crew training program.

The procedures to be developed by the applicant will address operation of the ACIWA for vessel injection or drywell spray operation. Operation of the ACIWA System in the vessel injection mode requires valves F005, F101, and F102 to be opened and valve F592 to be closed. Reactor depressurization to below ACIWA System operating pressure is required prior to ACIWA operation in the vessel injection mode. Operation of the ACIWA in the drywell spray mode requires valves F017, F018, F101, and F102 to be opened and valve F592 to be closed. These valves are shown on Figure 5.4-10. The diesel fire pump will start automatically when the ACIWA is properly aligned for vessel injection or drywell spray. If the normal firewater system water supply is unavailable, the alternate water supply can be made available b y opening the manual valve between the diesel driven fire pump and the alternate water supply. This valve is shown in Figure 9.5-4. If it is necessary to use a fire truck for vessel injection or drywell spray, valve F103 must be opened in addition to operation of the valves discussed above for ACIWA operation. The valve for operation of the ACIWA using the fire truck is also shown on Figure 5.4-10. All of the valves required for ACIWA operation are manually operable.

If it is necessary to operate the ACIWA, radiation levels may be elevated in the rooms where the valves required for ACIWA operation are located. The applicant will make dose rate calculations for the specific configuration being constructed. These calculation will include the specific piping layout, shielding considerations, the potential for systems within the room to have recently been operated and thus contain radioactive coolant, and any other factors that significantly affect the dose rates. These dose rate calculations will be considered in the development of the specific plant procedures for ACIWA operation.

19.9.8 Actions to Avoid Common-Cause Failures in the Essential Communications Function (ECF) and Other Common-Cause Failures

To reduce the potential for significant ECF common cause failures, (Subsection 19N.4.12), the COL applicant will take the following actions:

(1) To eliminate remote interface function (RIF) miscalibration as a credible source of ECF common cause failure, administrative procedures will be established to perform cross-channel checking of RIF outputs at the main control room safety system logic and control instrumentation, as a final check point of RIF calibration work.

(2) To prevent any unidentified ECF faults/failure modes (e.g., an undetected software fault) from propagating to other ECF divisions, the plant operating procedures will include the appropriate detailed procedures necessary to assure that the ABWR plant operations are maintained in compliance with the governing Technical Specifications during the periods of divisional ECF failure. This will assure that such unidentified faults are effectively eliminated as a credible source of ECF common cause failure.

These procedures will also include the appropriate symptom-based operator actions to assure that adequate core cooling is maintained in the hypothetical event of an entire ECF system failure.

(3) To eliminate maintenance/test errors as a credible source of ECF common-cause failure, administrative procedures will be established which will not permit the same technician to work on multiple divisions of the ECF.

A maintenance procedure must be established so that if a sensor is found out of tolerance, before it is recalibrated, the calibration instrument is first checked. In addition, the same technician will not be allowed to calibrate sensors in different divisions.

19.9.9 Actions to Mitigate Station Blackout Events

It was necessary to make several assumptions in the assessment of plant performance under station blackout conditions as noted in Subsection 19E.2.1.2. The following actions will be taken by the COL applicant to confirm these assumptions:

(1) Confirm that the minimum condensate storage tank volume is 570 cubic meters.

(2) Develop battery loading profiles to define appropriate load shedding during station blackout to ensure that the RCIC System can be operated for approximately 8 hours (See Subsection 8.3.2.1.3.1).

(3) Perform analyses to confirm that RCIC room temperature will not exceed equipment design temperature without room cooling for at least 8 hours.

(4) Perform analyses to confirm that control room temperature will not exceed equipment design temperature for at least 8 hours without room cooling.

(5) Develop procedures for the emergency replenishment of gas supply for safety-related, pneumatically operated components. A discussion of the types of actions which could be taken is in Subsection 19E.2.1.2.2.2(2)(b).

(6) Develop procedures to provide backup DC power to ADS valves to keep the valves open as long as possible to keep the reactor vessel depressurized if such action was necessary during a Station Blackout. See the discussion in Subsection 19E.2.1.2.2.2(a).

In the detailed procedures which supplement the Emergency Procedure Guidelines, include the manual valve operation which is noted in Subsection 19.7.3(3a).

19.9.10 Actions to Reduce Risk of Internal Flooding

In the unlikely event of significant flooding from internal sources (addressed in Appendix 19R) such as the ultimate heat sink, suppression pool, condensate storage tank, or fire water system, actions will be completed by the COL applicant to ensure that the following can be performed to mitigate flooding in the turbine, control, and reactor buildings:

(1) Training on isolation of potential flooding sources.

(2) Maintenance of pump trip and valve isolation capability of potential unlimited flood sources should be controlled to assure that flood mitigation capability exists at all times. If pump trip and valve isolation capability is unavailable, procedures to monitor applicable piping lines for leakage must be implemented and replacement/repair of failed components must be completed as soon as possible or other mitigative features must be implemented.

(3) Sizing of floor drains must be adequate to accommodate all potential flood rates. In sizing the floor drains, the following considerations must be addressed:

(a) The maximum volume and flow rate of potential flood sources on each floor must be calculated based on ANSI/ANS 58.2, "Design Basis For Protection Of Light Water Nuclear Power Plants Against The Effects Of Postulated Pipe Rupture."

(b) The floor drain sizing must be able to drain the highest flow rate in that area without allowing flood buildup to reach installed equipment in another area containing equipment from a different train or division (i.e. less than 200mm).

(c) The size and number of floor drains should address the probability of some drains becoming clogged with debris.

(4) Procedures for maintenance of watertight integrity of buildings and rooms especially during shutdown conditions.

(5) Procedure to ensure that if flooding occurs in an ECCS divisional room that the watertight door to the affected room will not be opened until watertight integrity of the remaining ECCS rooms is assured.

(6) Complete a site specific PRA-based analysis for potential flood sources, the potential for flooding in the UHS pump house, and required mitigation features.

(7) Procedure to open doors or hatches to divert water from safety-related equipment following postulated floods.

(8) NOT USED.

(9) Ensure that seals on radwaste tunnels between building are adequate to prevent interbuilding flooding.

(10) Ensure that the RSW pump house is designed to prevent interdivisional flooding and water in excess of 2000 meters of RSW piping cannot gravity drain to the control building.

19.9.11 Actions to Avoid Loss of Decay Heat Removal and Minimize Shutdown Risk

To reduce the potential for losing shutdown decay heat removal capability (addressed in Appendix 19Q), procedures will be prepared by the COL applicant for the following:

(1) Recovery of failed operating RHR System.

(2) Rapid implementation of standby RHR Systems if the initially operating RHR system cannot be restored.

(3) Ensuring that instrumentation associated with the following functions is kept available if the system is not in maintenance:

- RPV isolation valves,
- ADS,
- HPCF,
- LPFL,
- RPV water level, pressure, and temperature,
- RHR System alarms,
- EDG,
- Refueling interlock,
- Flood detection and valve/pump trip circuits.

(4) Use of alternate means of decay heat removal using non-safety grade equipment such as reactor water cleanup, fuel pool cooling, or the main condenser.

(5) Use of alternate means for inventory control using non-safety grade equipment such as AC-independent water addition, CRD pump (i.e., increasing CRD flow), and main feedwater and condensate.

(6) Recovery from loss of offsite power.

(7) Boiling as a means of decay heat removal in Mode 5 with the RPV head removed including available makeup sources.

(8) Conducting suppression pool maintenance, especially as it relates to reduced availability of ECCS suction sources.

(9) Fire/flood watches during periods of degraded safety division physical integrity.

(10) Ensuring that at least one division of safety equipment is not in maintenance and its physical barriers are intact at all times.

(11) Fire fighting during shutdown.

(12) Use of remote shutdown panel while the plant is shutdown.

To reduce other risks during shutdown, procedures will be prepared by the COL applicant for the following:

(1) Firefighting with part of the fire protection system in maintenance,

(2) Outage planning using guidance from NUMARC-91-06,

(3) Use of freeze seals and RIP and CRD replacement.

(4) Verification of correct fuel loading during refueling.

(5) Maintenance of secondary containment during Modes 3 and 4, when necessary.

19.9.12 Procedures for Operation of RCIC from Outside the Control Room

In the PRA fire analysis (Subsection 19M.2.1, Task 11), credit is taken for operation of RCIC from outside the control room. The COL applicant will develop procedures and conduct training for such RCIC operation.

The procedure should be developed along the following lines:

(1) Station operation personnel and provide communication at areas for manual operation of the RCIC suction valves (CST suction and suppression pool suction), RCIC turbine trip and throttle valve, RCIC turbine steam admission valve, outboard steam isolation valve, RPV injection valve, turbine speed control panel, and the Remote Shutdown System.

(2) Manually open the RPV Injection Valve at the local motor control center or by the hand-wheel at the valve if the electrical power is not available.

(3) Manually close the drain valves from the steam supply to RCIC turbine and turbine drains to the drain tank.

(4) Manually open the turbine steam supply valve at the motor control center or by the hand-wheel at the valve if the electrical power is not available.

(5) If power supply is available, manually start the RCIC room air-handling unit from the motor control center.

(6) Start RHR A or B Loop in Suppression Pool Cooling mode from the Remote Shutdown Panel.

(7) Monitor RCIC operation at the Remote Shutdown Panel.

(8) Manually switch the pump suction valve from CST to the Suppression Pool when CST water level drops below the low level setpoint.

(9) Control reactor water level by switching RCIC into partial flow ON/OFF at the local control panel.

(10) Monitor RPV water level at the Remote Shutdown System. Maintain RPV water level between Level 3 (low level) and Level 8 (high level).

19.9.13 ECCS Test and Surveillance Intervals

The test and surveillance intervals are assumed in the PRA. The COL applicant will develop a plan and implement procedures for identifying significant departures from these assumptions.

19.9.14 Accident Management

As noted in Section 19.11, the human actions for which credit has been taken in this PRA have been compiled (Subsection 19D.7) and checked against the emergency procedure guidelines. In addition, COL action items address human actions (Section 19.9). All of the human actions identified should be reviewed by the COL applicant so that detailed procedures can be developed and the appropriate training conducted.

Directions and guidance for operation of the Containment Overpressure System (COPS) shutoff valves should be developed. Appropriate care should be taken in the development of these procedures to ensure that the recovery of containment heat removal or containment sprays do not induce late containment structural failure. If a suppression pool water level of at least one meter above the top of the top horizontal connecting vent can be maintained following COPS operation, the COL applicant may wish to consider leaving the shutoff valves open until after recovery of Containment Heat Removal since the fission product release will be dominated by the initial noble gas release. In addition, the procedure for closure of the shutoff valves should include steps for the re-introduction of nitrogen into the containment. In developing accident mitigation strategies, the COL applicant may wish to examine the potential benefits of drywell spray operation if the containment fails in the drywell. Source term calculations indicate the release to the atmosphere may be substantially decreased by initiating drywell sprays after fission product release begins.

For human actions which are taken that rely on instrumentation which may be operating outside of the qualification range, the expected performance of the instrumentation should be determined and additional guidance provided to the operator if needed.

Accident management strategies should consider the potential for recriticality during the recovery. Recriticality could occur either as a result of boron dilution in an ATWS event or as a result of control blade relocation during the recovery of a badly damaged core. A possible strategy could be a caution for the operators and/or technical support staff to monitor the power level (perhaps indirectly via the rate of containment pressurization) and enter ATWS procedures as necessary.

19.9.15 Manual Operation of MOVs

As noted in Subsection 19.7.3 (3)(a), manual operation of MOVs can be used to improve the availability of decay heat removal. The COL applicant will implement procedures for such an operation.

19.9.16 High Pressure Core Flooder Discharge Valve

The HPCF loop B pump discharge valve is in the drywell. Plant procedures should include independent verification that the valve is locked-open following maintenance.

19.9.17 Capability of Containment Isolation Valves

To insure that containment isolation valve capability does not reduce the containment capability, the COL applicant will demonstrate that the stresses of containment isolation valves, when subjected to severe accident loadings of 0.77 MPa internal pressure and 260°C (500°F) temperature in combination with dead loads, do not exceed ASME Section III service level C limits. In addition, the ultimate pressure capability at 260°C (500°F) will be shown to be at least 1.03 MPa.

19.9.18 Procedures to Insure Sample Lines and Drywell Purge Lines Remain Closed During Operation

As noted in Subsection 19.8.4.3, it is important that these lines be normally closed during plant operation. The COL applicant will develop procedures and administrative controls to ensure the valves are normally sealed closed and that the purge valves have motive power to the valve operators removed.

19.9.19 Procedures for Combustion Turbine Generator to Supply Power to Condensate and Condensate Booster Pumps

The COL applicant will implement procedures for manual transfer of Combustion Turbine Generator (CTG) power to the condensate pumps. Condensate pump support systems (lube oil, cooling water) are also supplied power from the CTG.

19.9.20 Actions to Assure Reliability of the Supporting RCW and Service Water Systems

To assure the reliability of the RCW and Service Water Systems, the COL applicant will take the following action. At least each month, the standby pumps and heat exchangers are started and the previously running RCW and service water equipment is placed in a standby mode.

19.9.21 Housing of ACIWA Equipment

If AC-independent water addition (ACIWA) equipment is housed in a separate building, that building must be capable of withstanding site specific seismic events, flooding, and other site-specific external events such as high winds (e.g., hurricanes). The capability of the building housing the ACIWA equipment must be included in the plant-specific PRA.

19.9.22 Procedures to Assure SRV Operability During Station Blackout

To assure the operability of the SRVs during station blackout, the COL applicant will develop procedures for the use of the stored nitrogen bottles as discussed in Subsection 19E.2.1.2.2.2 (b).

19.9.23 Procedures for Ensuring Integrity of Freeze Seals

The COL applicant will provide administrative procedures to ensure the integrity of the temporary boundary when freeze seals are used. Mitigative measures will be identified in advance, and appropriate back-up systems will be made available to minimize the effects of a loss of coolant inventory (See Subsection 19Q.8).

19.9.24 Procedures for Controlling Combustibles During Shutdown

The COL applicant shall provide administrative procedures for controlling the combustibles and ignition sources during shutdown operations. (See Subsection 19Q.6 under “Fires During Maintenance”).

19.9.25 Outage Planning and Control

The COL applicant shall provide an outage planning and control program to ensure that the safety principle is clearly defined and documented (See Subsection 19Q.10).

19.9.26 Reactor Service Water Systems Definition

Service water systems modeled in the ABWR PRA are described and fault trees presented in Subsection 19D.6.4.2. These include the Reactor Building Cooling Water (RCW) System, Reactor Service Water (RSW) System, and the Ultimate Heat Sink (UHS). Those portions of the RSW System that are outside of the Control Building and the entire UHS are not in the scope of the ABWR Standard Plant. The COL applicant shall review RSW and UHS design configurations and performance capabilities against those assumed and modeled in Subsection 19D.6.4.2 and assess the impact of any differences on the ABWR PRA results.

19.9.27 Capability of Vacuum Breakers

The vacuum breaker seating material will be demonstrated to withstand the temperature profiles associated with the equipment survivability requirements specified in Subsection 19E.2.1.2.3.

19.9.28 Capability of the Containment Atmospheric Monitoring System

The COL applicant will demonstrate that the portion of the CAMS System which can be exposed to containment pressure can withstand the loading associated with the equipment survivability requirements specified in Subsection 19E.2.1.2.3.

19.9.29 Plant Specific Safety-Related Issues and Vendors Operating Guidance

The COL applicant shall address and incorporate plant-specific safety-related issues and the vendor's operating guidance on safe operations during shutdown (See Subsection 19Q.10 under "Shutdown Safety Issues").

19.9.30 PRA Update

A COL applicant referencing the ABWR certified design will review and, if necessary, update the design PRA to ensure that it bounds the site specific design (e.g. the ultimate heat sink) and that interface requirements of the standard design are satisfied. In addition, site characteristics such as river flooding, wind loadings, etc., will be compared to those assumed in the design PRA to ensure it is bounding. If the existing PRA is not bounding for site characteristics, then a risk based evaluation should be performed.