Nuclear Operating Company
South Texas Project Electric Generating Station P.O. Box 289 Wadsworth, Texas 77483

ABWR

February 25, 2010
U7-C-STP-NRC-100052

U. S. Nuclear Regulatory Commission
Attention: Document Control Desk
One White Flint North
11555 Rockville Pike
Rockville, MD 20852-2738

South Texas Project
Units 3 and 4
Docket No. 52-001
Response to Request for Additional Information

Reference: Letter, Mark McBurnett to Document Control Desk, "Application to Amend the Design Certification Rule for the U.S. Advanced Boiling Water Reactor (ABWR)," dated June 30, 2009, U7-C-STP-NRC-090070 (ML092040048).

This letter provides responses to Request for Additional Information (RAI) Letter Numbers 5, 8, and 9 related to the application to amend the ABWR DCD Part 2, Tier 2, Sections 3.8, 9.2 and 19 provided in Attachment 1 to the referenced letter. This submittal completes the responses to these RAI letters.

The attachment to this letter provides the following RAI question responses:

03.08.04-2	09.02.04-1	19.11
03.08.04-4	09.02.04-2	
	09.02.04-3	
	09.02.04-4	

Changes will be incorporated into the next update of the ABWR DCD Amendment application after review by the NRC Staff.

There are no commitments in this letter.

If you have any questions, please contact me at (361) 972-7136, or Bill Mookhoek at (361) 972-7274.

D091
NRO

STI 32621432

I declare under penalty of perjury that the foregoing is true and correct.

Executed on 2/25/10

Scott Head
Manager, Regulatory Affairs
South Texas Project Units 3 & 4

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Attachment:

1. Question 03.08.04-2
2. Question 03.08.04-4
3. Question 09.02.04-1
4. Question 09.02.04-2
5. Question 09.02.04-3
6. Question 09.02.04-4
7. Question 19.11

cc: w/o attachments and enclosure except*
(paper copy)

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RAI 03.08.04-2

QUESTION:

Section 9.5.14.1, "System Description," of the ABWR DCR amendment application states that, "The injection is provided through the non-safety-related portion of the CUW tie-in lines to the feedwater system. The tie-in is in the R/B portion of the Steam Tunnel. A single AFI system may be used with the injection configured to support more than one unit of a multiple unit site." Please confirm if any piping seismic response analysis of the modified CUW tie-in lines to the feedwater system, modeled in conjunction with the AFI line, was performed to ensure that the effects of the AFI line addition are accounted for within the seismic design basis of the original feedwater piping and supports. Clarify if the design basis of the feedwater system will be adversely affected by the addition of the AFI line. Also, summarize the results of these analyses, if any.

RESPONSE:

The piping seismic response analysis of the modified reactor water cleanup system (CUW) tie-in lines to the feedwater system has not yet been performed. This analysis must be performed by the COL holder following completion of detailed design after determination of such details as pipe routing, location of pipe supports and restraints, final line sizes, etc. The final piping seismic analysis of the feedwater system will account for the effects of attached non-safety piping systems, including the CUW water system and the AFI piping. This piping seismic analysis is performed according to the requirements identified in the ABWR DCD, Tier 1, Section 3.3, the associated ITAAC provided in Table 3.3, and the seismic analysis methods identified in Tier 2, Section 3.7.3. Because the tie-in of the AFI line is to the nonsafety-related portion of the CUW lines, and consequently does not tie-in directly to a safety-related line, it is expected that the design basis of the original feedwater piping and supports will not be adversely affected by this added AFI tie-in line.

There is no DCD amendment application change required as a result of this RAI.

RAI 03.08.04-4

QUESTION:

Several sections of Attachment 1 to the STPNOC's letter dated June 30, 2009 list replacements of nonrated, 3-h fire resistant or a non-fire rated doors with 5-psid door or two 3-hour rated fire doors (refer to Sections 9A.4.1.3.7, 9A.4.1.4.3, 9A.4.1.4.8, 9A.4.1.5.1, 9A.4.1.5.5, 9A.4.1.6.1, 9A.4.1.6.43 and 9A4.1.7.2). Please discuss and confirm that the above noted changes and additions of doors as well as their resulting structural configuration changes were evaluated (including wall structural integrity analyses, as needed) to ensure that the changes are bounded within their original structural design basis, and the affected walls will continue to maintain their structural integrity and perform their intended safety functions.

RESPONSE:

The overall structural characteristics of the reactor building are unchanged by replacement of these doors. Calculations for room pressurization already account for the existence of the doors; thus, the change to two doors or a pressure rated door represents a very small change to the analysis. Consequently, replacement of the doors is expected to have a minimal effect on the overall structural performance of the reactor building. The detailed structural analysis must be performed by the COL holder following completion of detailed design, which will include such details as reactor building internal wall location, wall dimensions, wall materials, the replacement of the 3-hour fire resistant or non-rated fire doors with 5-psid or two 3-hour rated fire doors, and any other changes resulting from the final fire hazards analyses. The interior wall structural analysis will be performed as part of the complete reactor building design in accordance with ABWR DCD, Tier 1, Section 2.15.10, the associated ITAAC provided in Table 2.15.10, and Tier 2, Appendix 3H.1.

There is no DCD amendment application change required as a result of this response.

RAI 09.02.04-1

QUESTION:

In section 9.5.14.1 of the application to amend the design certification rule for the US ABWR (U7-CSTP-NRC-0900070) dated June 30, 2009, it is stated that the Alternate Feedwater Injection (AFI) system piping is routed underground or otherwise protected from physical impact. It also states that injection is provided through the non-safety-related portion of the CUW tie-in lines to the feedwater system, which are in the R/B portion of the Steam Tunnel. The tie-in provides an interface between the non radioactive AFI system with the CUW system which contains radioactive fluids, reverse flow and leakage thru the check valves could result in the fluid in the injection piping becoming contaminated.

General Design Criteria (GDC) 60 "Control of releases of radioactive materials to the environment" requires that a means be provided to control the release of radioactive materials in liquid effluents. Means must also be provided for monitoring effluent discharge paths and plant environs for radioactivity that may be released in accordance with GDC 64 "Monitoring radioactivity releases" requirements. Also 10CFR52.47(a)(6) and 10CFR20.1406 requires applicants for standard plant design certifications to describe how facilities design and procedures for operation will minimize contamination of the facility and environment.

Provide a discussion that describes how the AFI system complies with GDC 60, GDC 64, and 10CFR20.1406. Include discussion on relevant design features, operation and maintenance, monitoring of the AFI systems for radiation, and detection of leaks from the AFI system to the environment.

RESPONSE:

As shown in the AFI description in Figure 9.5-6 of the DCD amendment application, the AFI contains two check valves located in the Reactor Building main steam tunnel and three normally-closed motor-operated valves (MOVs). These will act as a barrier against release of radioactive fluid from the CUW lines during normal reactor operation. In the event that fluid from the CUW system should leak past the two check valves and the first MOV, a leakoff line is included in the AFI design as shown in Figure 9.5-6 which directs any leakage back to the Reactor Building low conductivity sump. Consequently, any leakage of radioactive fluid into the AFI system is ultimately contained within the Reactor Building. The existing leak detection and radiation monitoring that exists for the Reactor Building low conductivity sump can then be used to monitor this leakage. Based on these design features, the AFI system is compliant with General Design Criteria (GDC) 60, GDC 64, 10CFR52.47(a)(6) and 10CFR20.1406.

There are no DCD amendment application changes as a result of this response.

RAI 09.02.04-2

QUESTION:

In section 9.5.14.1 of the application to amend the design certification rule for the US ABWR (U7-CSTP- NRC-0900070) dated June 30, 2009, it is stated that there is a minimum of 300,000 gallons of usable water at the AFI pump suction line while the AFI is in standby. The application indicates there will be an existing source near the AFI pump house. Figure 9.5-6 provides a schematic of the AFI system. In order to inject water into the RPV the AFI is required to operate at a high pressure. The proposed AFI system is non-seismic and non-tornado protected.

GDC 2 requires in part that "structures, systems, and components important to safety shall be designed to withstand the effects of natural phenomena such as ... floods ... without loss of capability to perform their safety functions." Meeting the requirements of GDC 2 includes evaluating the effects of flooding from full circumferential failures of non-seismic, moderate-energy piping.

Provide a discussion on provisions for terminating flow following a AFI line break, and discuss how the AFI line break is addressed in the appropriate flood analysis for the affected areas. Also discuss the impact that a failure of the 300,000 gallon water source would have on safety-related equipment. Provide a summary of the results and describe the impact on risk assessment for internal flooding.

RESPONSE:

As noted in DCD, Tier 2, Section 3.6.2.1.3, pipe breaks are not required to be postulated for portions of piping systems that are isolated from the source of the high-energy fluid during normal plant conditions. The AFI is an isolated piping system because it contains two check valves and three normally closed motor operated valves that separate the AFI from the primary system (Reference DCD Tier 2, Figure 9.5-6). Therefore, pipe breaks in the AFI system are not required to be postulated.

As noted above, the likelihood of an AFI line break is minimal; the AFI system is powered off and unpressurized for all normal and design basis accident conditions. Initiation of the AFI system is performed manually, requiring intentional operator action involving: (a) entering the AFI Pump House, (b) activating the breakers to power the system, (c) turning on the AFI pump, and (d) opening the normally closed motor-operated injection valves. Therefore, it is unlikely that the AFI will be actuated during any plant MODE. The AFI system is only actuated in the beyond design basis event when all normal makeup and ECC systems are rendered unavailable as a result of an aircraft impact. The impact of an AFI pipe break on safety systems during AFI operation is irrelevant because those safety systems are already assumed to have failed. Because the AFI system is normally powered off and only required after an aircraft impact, after all normal and emergency cooling systems are rendered unavailable, which is already a beyond design basis event, then postulation of an additional break in the AFI line is not required.

Regarding flooding, an AFI line break in the Main Steam Tunnel area is bounded by the feedwater high energy line break which is analyzed in DCD Tier 2, Subsection 3.4.1.1.2. As noted in that section, a break in the MSL tunnel area will be contained in the Seismic Category I structure of the MSL tunnel and will not flood any safety-related equipment in the Reactor Building. The flooded area will be allowed to drain through floor drains in the tunnel area, which are routed to the HCW sumps in the Reactor Building for collection and discharge. It should be noted, however, that based on the discussion in the paragraph above, analysis of flooding due to AFI line breaks during AFI operation is not required.

The water source for the AFI system is required to be located at least 300 feet from the reactor building and control building. This ensures that fire associated with an aircraft impact that would disable the SSC's in those buildings will not disable the AFI system function. This separation will minimize the possibility that flooding associated with a failure of the 300,000-gallon water source will also fail SSC's located in those buildings. As noted in ABWR DCD Subsection 3.4.1.1.1, the flood protection measures in the ABWR design guard against flooding from onsite storage tanks that may rupture. This includes the condensate storage tank, which has a capacity of twice the volume of water as the AFI water source (Reference DCD Tier 2, Table 1C-2). Consequently, any flooding from the AFI water source is already bounded by existing flood analysis.

In summary, an AFI pipe break is not required to be postulated. Flooding from AFI pipe breaks during AFI operation, as well as from the AFI water source, is bounded by existing analyses in the DCD. The impact on risk assessment for internal flooding is minimal because the AFI system is only required to operate for beyond design basis events after all safety systems have already assumed to have failed.

There is no DCD amendment application change required as a result of this response.

RAI 09.02.04-3

QUESTION:

The flow of the AFI is through the AFI system piping and components, through check valves to the CUW tie in and then to the main feedwater lines. When the system is operated, the potential for water hammer may exist due to pump starts and stops, control or isolation valve operation, check valve closure, etc. The occurrence of water hammer can result in damage to the feedwater system. 10 CFR 50, Appendix A, GDC-4, "Environmental and Dynamic Effects Design Bases," requires safety-related portions of the condensate and feedwater systems to be protected against hydraulic instabilities such as water-hammer events. Provide a discussion of specific design features and system operation consideration used to minimize or preclude water hammer events due to operation of the AFI system.

RESPONSE:

As shown in Figure 9.5-6 of the DCD amendment application, the AFI design includes a "keep-full" line to maintain the system full of water to preclude water hammer upon system initiation. In addition, existing vent valves in the feedwater pipes and the CUW system return pipe can be used to fill and vent the AFI system to ensure that the piping is maintained full of water.

ABWR DCD Section 13.5 lists those systems for which operating procedures will need to be written. As shown in the markup below to the DCD amendment application, the AFI system is being added to this list. The procedures for operation of the AFI system will include provisions to throttle the flow at the start of the AFI pump, which will also minimize the effects of water hammer. This is also reflected in the markup to the DCD amendment application as shown below. All changes are shown with gray shading.

9.5.14 Alternate Feedwater Injection System

9.5.14.1 System Description

The system can be operated from the AFI Pump House. This will ensure that the injection can be initiated within 30 minutes after the loss of normal makeup systems to provide sufficient core cooling. In addition, the operator is provided with the capability to control flow from the AFI Pump House by throttling a motor- operated valve located in the Pump House. The procedures for operation of the AFI system will include provisions to throttle the flow at the start of the AFI pump, which will minimize the effects of water hammer.

13.5.3.4 Procedures Included In Scope Of Plan

The following procedures shall be included in the scope of the Plant Operating Procedures Development Plan described above:

System Procedures

Procedures as delineated in Section A3 of ANSI/ANS-3.2 shall be prepared, as appropriate, for the following BWR systems:

- Hydrogen Recombiners
- Alternate Feedwater Injection System

RAI 09.02.02-4

QUESTION:

The flow of the AFI is through the AFI system piping and components, through check valves to the CUW tie in and then to the main feedwater lines. In order to inject water into the RPV the AFI is required to operate at a high pressure. The proposed AFI system is non-seismic and non-tornado protected. GDC-4, "Environmental and Dynamic Effects Design Bases," requires that safety-related systems and equipment be capable of withstanding the effects of external and internally generated missiles, pipe whip and jet impingement forces associated with pipe breaks.

Provide a discussion on what effect that failure of the non-safety related AFI line will have on safety related equipment in the RB and MST. Include the impact that the failure of the line will have taking into consideration dynamic effects such as pipe whip, jet impingement, the generation of missiles as a result of system failure. Where applicable, discuss protective measures used to protect against AFI line breaks from affecting other systems.

RESPONSE:

As noted in DCD, Tier 2, Subsection 3.6.2.1.3, pipe breaks are not required to be postulated for portions of piping systems that are isolated from the source of the high-energy fluid during normal plant conditions. The AFI is an isolated piping system because it contains two check valves and three normally closed motor operated valves that separate the AFI from the primary system (Reference DCD Tier 2, Figure 9.5-6). Therefore, pipe breaks in the AFI system are not required to be postulated. However, should such a break occur, the dynamic effects of the break on plant safety systems are bounded by the Main Steam or Feedwater High Energy Line Breaks (HELB) that are already evaluated in DCD Tier 2, Section 3.6. This is because the AFI lines are at much lower temperature and pressure and have a smaller line size than the Feedwater or Main Steam lines, which experience full system pressure during normal operating conditions.

Regarding the impact of a postulated AFI system break on safety systems, it should be noted that the AFI system is only required for beyond design basis events for which all other safety systems including the ECC system are not available. Consequently, the safety systems are already assumed to have failed at the time that the AFI system is required. Therefore, an evaluation of the impact of an AFI pipe break on safety systems is not required.

In addition, the likelihood of an AFI line break is minimal; the AFI system is powered off and unpressurized for all normal and design basis accident conditions. The AFI system is only actuated in the beyond design basis event when all normal makeup and ECC systems are rendered unavailable as a result of an aircraft impact. Initiation of the AFI system is performed manually, requiring intentional operator action involving: (a) entering the AFI Pump House, (b) activating the breakers to power the system, (c) turning on the AFI pump, and (d) opening the normally closed motor-operated injection valves. Therefore, it is unlikely that the AFI will be inadvertently actuated during any plant MODE.

There is no DCD amendment application change required as a result of this response.

RAI 19-11

QUESTION:

In DCD Section 19S4.2(5), the applicant states, "*the physical separation of the Class 1E emergency diesel generators and an independent power supply as described in Tier 2 Section 9.5.14 is a key design feature that prevents the loss of all electrical power to core cooling systems.*" The applicant is requested to provide the following:

1. clarify if this physical separation is between the Class 1E diesels and the AFI power supply or between the multiple Class 1E emergency diesels or other;

2. provide a more detail description of the physical separation to include the extent of the separation such as distance, barriers, standards referenced, etc.;

3. based on this physical separation, provide addition details to confirm that for the impact scenarios where an electrical source for the AFI system is required, at least one of these electrical sources will survive those scenarios;

4. confirm if the AFI pump and MOVs can be powered via the emergency power supply.

RESPONSE:

1. The physical separation being discussed in Section 19S4.2(5) is between the Class 1E power supply and the independent AFI power supply. The Class 1E power supplies would be required in support of existing core cooling systems; the independent AFI power supply is provided for the AFI system.

2. An ITAAC is being submitted as shown in the Tier 1 markup included in the response to RAI 14.02-1. This ITAAC addresses the physical separation of the AFI power supply and associated controls from the impact area that would disable the safety systems.

3. The ITAAC reference in Item 2 satisfies the physical separation requirement for the AFI power supply to assure that, for the impact scenarios where an electrical source for the AFI system is required, at least one of these electrical sources will survive those scenarios.

4. The AFI pump and MOVs are not powered by the emergency power supply. The AFI pump and MOVs are only powered by the independent AFI power supply.

A markup of Part 2 Tier 2 of the DCD amendment application is included with the response to RAI 19-6 which specifies the separation criterion for the AFI power supply consistent with the ITAAC described in Items 2 and 3 above.