REQUEST FOR ADDITIONAL INFORMATION 808-5921 REVISION 3

8/22/2011

US-APWR Design Certification

Mitsubishi Heavy Industries

Docket No. 52-021

SRP Section: 15.06.03 - Radiological Consequences of Steam Generator Tube Failure (PWR) 07/1981
Application Section: 15.6.3

QUESTIONS for Reactor System, Nuclear Performance and Code Review (SRSB)

15.06.03-3

1. The design basis analysis of the steam generator tube rupture (SGTR) event, described in DCD Section 15.6.3, assumed a series of operator actions as a part of mitigating and recovery procedures to stabilize the plant in a timely manner to terminate the primary-to-secondary break flow, and minimize contamination of the secondary system and the release of radioactivity to the atmosphere. It is also stated that the operator actions for SGTR recovery are proceduralized in the emergency operating procedures (EOP). However, the plant-specific EOPs are not yet available as they will be developed based on the emergency response guidelines (ERG). The staff will review the ERGs to assure that the design basis operator action assumptions in the safety analysis are consistent with the ERG-specified steps and bound the operator response times.
   (a) Provide the US-APWR ERG for the SGTR event.
   (b) Provide an evaluation of the operator actions and completion times credited in the SGTR analysis. The evaluation should consider each operator action for consistency with the corresponding steps in the ERG, the alarms and indications of event symptoms, quality and adequacy of diagnostic instrumentation, and training which would enable the operators to properly interpret the symptoms to take proper action within the assumed operator response time. The operator actions assumed in the SGTR analysis for the radiological dose evaluation case include:
      · Manual reactor trip and main feedwater (MFW) isolation at 15 minutes
      · Identification and isolation (main steam isolation valve closure) of the ruptured SG at 20 minutes
      · Opening of intact SG main steam depressurization valves (MSDV) at 25 minutes
      · Opening of pressurizer safety depressurization valve (SDV) at ~45.3 minutes
      · Closure of SDV at ~47.5 minutes
      · Manual termination of ECCS at 48 minutes

15.06.03-4

2. In the analyses of the SGTR for both the radiological dose evaluation and margin to overfill cases, the limiting single failure is assumed to be the loss of one emergency feedwater system (EFWS) train.
   Provide an evaluation, which shows the loss of one EFWS train being the limiting single failure. The evaluation should be done for both cases, and determine whether

other single failures can give worse results, e.g., failure of an intact SG MSRV to open, failure of EFW control valve to the ruptured SG to close, failure of MFW control valve to the ruptured SG to close, failure of the MSIV to the ruptured SG to close, failure of the pressurizer SDV to open on manual demand, or failure of high pressure safety injection (HPSI) pump switches when SI is to be terminated.

15.06.03-5

3. Regarding the input assumptions in the analysis of the SGTR event,
   (a) Explain why the initial reactor coolant temperature is assumed to be 4°F above the nominal value for the radiological dose evaluation case, and 4°F below the nominal value for the overfill margin case.
   (b) Explain why the MFW control system is not credited in the SG overfill margin case, but is assumed in the radiological dose evaluation case.

15.06.03-6

4. Clarify the discussion in Section 15.6.3.4.3 regarding the results of the radiological dose evaluation case.

(a) It indicates that the EFW flow is not provided for the ruptured SG since the MSIV closed before the EFW initiation. However, though the EFWS is designed with the capability to automatically terminate EFW flow to prevent overfilling of the SGs, the EFW isolation is not based on an MSIV closure. According to the US-APWR technical specifications, the EFW isolation can be initiated by high SG water level, coincident with reactor trip and no low main steam line pressure.
Clarify whether the MSIV closure or other engineered safety actuation function prevents the EFW flow to the ruptured SG.

(b) Figure 15.6.3-5 indicates the SG pressure increasing and exceeding the MSSV setpoint at about 900 seconds.
Explain why the sequence of event in Table 15.6.3-1 does not indicate the MSSV opening.

15.06.03-7

5. One of key parameters affecting the results of the SG margin to overfill (MTO) analysis during an SGTR event is the initial SG water level. Section 15.6.3.4.2 states that the initial water level is assumed at its expected nominal programmed level with positive uncertainty applied.
   (a) What is the value of the expected nominal programmed SG water level? Provide the basis to determine that bounding initial water level has been used in the MTO analysis.
   (b) What is the value of uncertainty applied to the MTO analysis? Describe the analysis which determines the uncertainty value. The information should also include a discussion of the effect of potential turbine runback on the SG level assumed in the MTO analysis.

15.06.03-8

6. List systems, components and instruments that are credited in the SGTR analysis. Discuss whether each system and component is safety grade. For non-safety grade systems and components, discuss whether safety grade backups are available which can be expected to function, or justify that non-safety grade systems and components can be used for the SGTR analysis.