1/15/02

AP1000 DESIGN CERTIFICATION REVIEW

Response to Request For Additional Information

RAI Number: 220.007

Question:

AP1000 DCD Subsection 3.8.3.3.1, "Passive Core Cooling System Loads," describes the pressure and thermal transients associated with operation of the passive core cooling system which are used to evaluate structures inside containment. Some of the water temperature transients have changed from the AP600 design and it is not clear how these have affected the analysis and design of the structural modules. Therefore, please address the following issues:

A. The transient temperature was revised from 240°F reached in 5.5 hours (AP600) to 250°F reached in 3.5 hours (AP1000). Provide a discussion to explain the change and how this change was considered in the analysis and design of the AP1000 modules?

B. The extreme transient starting temperature used for the structural design was revised from 50°F (AP600) to 70°F (AP1000). This would seem to be less extreme than the 50°F case in the AP600 design. Provide the basis for this change and explain how this change was considered in the analysis and design of the AP1000 modules?

Westinghouse Response:

The thermal transients associated with operation of the passive core cooling system have been revised. The extreme transient starting temperature used for the structural design has been revised to 50°F and is now the same as was used for the AP600.

The AP1000 containment model was used to determine the IRWST water temperature as a function of time. Decay heat is added to the IRWST using a heater component to represent the PRHR heat exchanger. The following assumptions are used in this model:

- ANSI-79 decay heat with 2σ uncertainty
- IRWST water volume = 75,300 ft^3
- IRWST initial temperature = 50°F
- Complete mixing in the IRWST (no stratification)
- No heatup of IRWST walls or other structures (all decay heat deposited in IRWST)
- Full reactor power of 3400 MWt prior to simultaneous scram and PRHR actuation.
- Containment pressure conditions as calculated by WGOTHIC.

The IRWST temperature transient is shown in the attached Figure 3.8.3-7, which will be added in the DCD. The IRWST begins steaming approximately 5 hours after the event is initiated, and reaches a maximum temperature of 259°F in approximately 11 hours. The containment atmosphere heats up once the IRWST steams. This transient will be used to determine the thermal loads on the IRWST walls. There are no changes in the analysis or design criteria for the structural modules for thermal effects. The design of the structural modules for the AP1000 IRWST transient will be available for review during the NRC audit of critical sections.

Design Control Document (DCD) Revision:

Revise second bullet in subsection 3.8.3.3.1:

- ADS_2 – This automatic depressurization system transient considers heatup of the water in the in-containment refueling water storage tank. This may be due to prolonged operation of the passive residual heat removal heat exchanger or due to an automatic depressurization system discharge. **For structural design an extreme transient is defined starting at 50°F since this maximizes the temperature gradient across the concrete filled structural module walls.** Prolonged operation of the passive residual heat removal heat exchanger raises the water temperature from an ambient temperature of ~~120~~**50**°F to saturation in about ~~2~~-**5** hours, increasing to about 2~~5~~**60**°F within about **11**~~3.5~~ hours. Steaming to the containment atmosphere initiates once the water reaches its saturation temperature. The temperature transient is shown in Figure ~~19.E.4.10-4~~**3.8.3-7.** Blowdown of the primary system through the spargers may occur during this transient and occurs prior to 24 hours after the initiation of the event. Since the flow through the sparger cannot fully condense in the saturated conditions, the pressure increases in the in-containment refueling water storage tank and steam is vented through the in-containment refueling water storage tank roof. The in-containment refueling water storage tank is designed for an equivalent static internal pressure of 5 psi in addition to the hydrostatic pressure occurring at any time up to 24 hours after the initiation of the event.

PRA Revision:

None

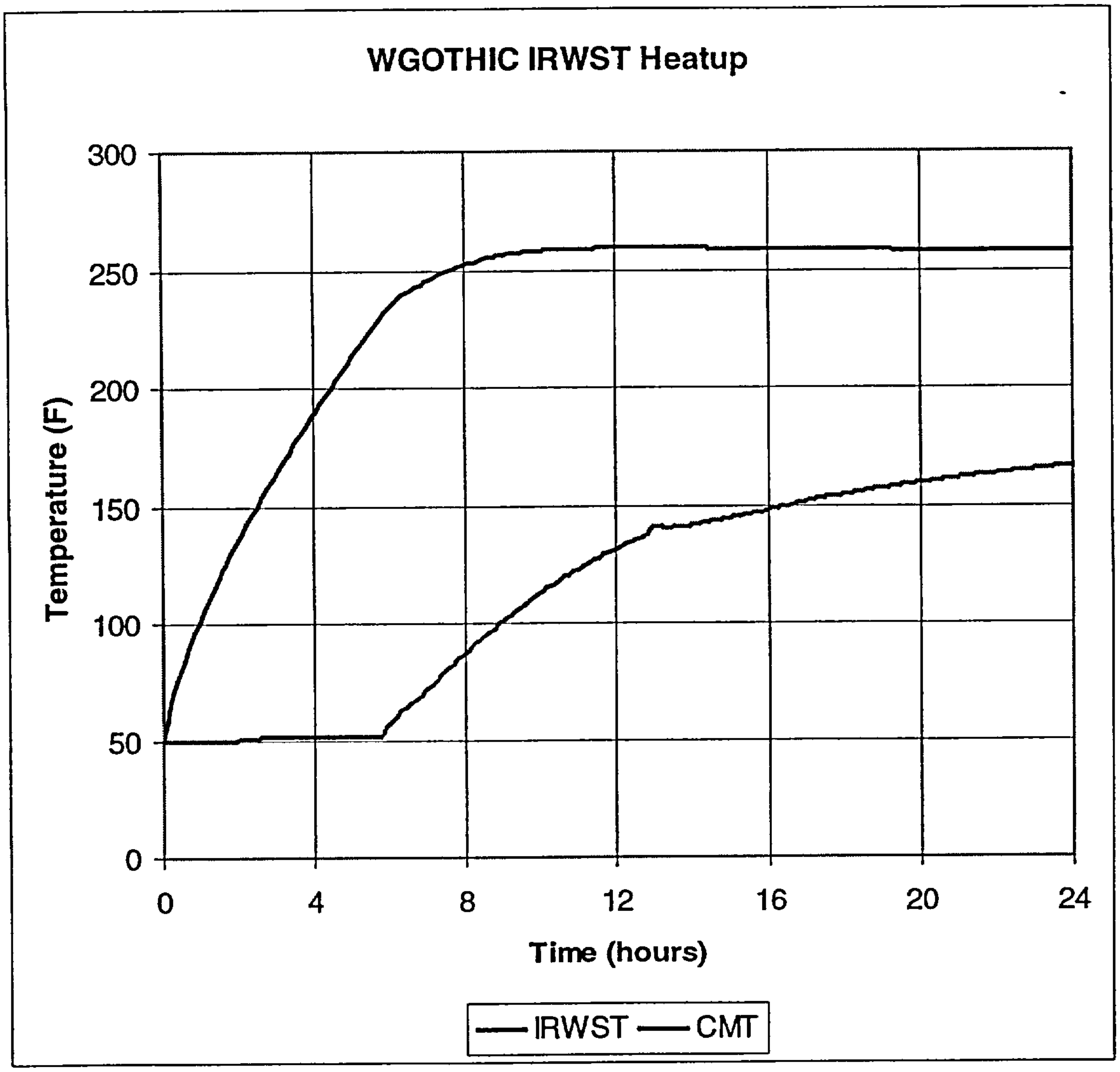

Figure 3.8.3-7
IRWST Temperature Transient