LIMITING CONDITION FOR OPERATION

3.6 PRIMARY SYSTEM BOUNDARY (Cont)

A. Thermal and Pressurization Limitations (Cont)

In the event this requirement is not met, achieve stable reactor conditions with reactor vessel temperature above that defined by the appropriate curve and obtain an engineering evaluation to determine the appropriate course of action to take.

3. The reactor vessel head bolting studs shall not be under tension unless the temperature of the vessel head flange and the head is greater than 55°F.

4. The pump in an idle recirculation loop shall not be started unless the temperatures of the coolant within the idle and operating recirculation loops are within 50°F of each other.

5. The reactor recirculation pumps shall not be started unless the coolant temperatures between the dome and the bottom head drain are within 145°F.

6. Thermal-Hydraulic Stability

   Core thermal power shall not exceed 25% of rated thermal power without forced recirculation.

SURVEILLANCE REQUIREMENTS

4.6 PRIMARY SYSTEM BOUNDARY (Cont)

A. Thermal and Pressurization Limitations (Cont)

3. When the reactor vessel head bolting studs are tensioned and the reactor is in a Cold Condition, the reactor vessel shell temperature immediately below the head flange shall be permanently recorded.

4. Prior to and during startup of an idle recirculation loop, the temperature of the reactor coolant in the operating and idle loops shall be permanently logged.

5. Prior to starting a recirculation pump, the reactor coolant temperatures in the dome and in the bottom head drain shall be compared and permanently logged.

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BASES:

3/4.6 PRIMARY SYSTEM BOUNDARY (Cont)

A. Thermal and Pressurization Limitations (Cont)

The bottom head, defined as the spherical portion of the reactor vessel located below the lower circumferential weld, was also evaluated. Reference transition temperatures (RT_{ndt}) were developed for the bottom head and the resulting pressure vs. temperature curves plotted on Figures 3.6-1 and 3.6-2. It has been determined that the bottom head temperatures are allowed to lag the vessel shell temperatures (Reference: Structural Integrity Associates (SIA) Report SIR-00-108, dated September 11, 2000). The referenced analysis utilizes the stress results established in the Combustion Engineering Inc., Pilgrim Reactor Vessel Design Report, No. CENC 1139, dated 1971, and combines the stress analysis results, specific to the bottom head, with the pressurization temperatures necessary to maintain fracture toughness requirements in accordance with the ASME Boiler and Pressure Vessel Code, Section III, the criteria of 10CFR50, Appendix G, and the supplementary guidelines of Reg. Guide 1.99, Rev. 2.

For Pilgrim pressure-temperature restrictions, two locations in the reactor vessel are limiting. The closure region controls at lower pressures and the beltline controls at higher pressures.

The nil-ductility transition (NDT) temperature is defined as the temperature below which ferritic steel breaks in a brittle rather than ductile manner. Radiation exposure from fast neutrons (>1 Mev) above about 10^{17} nvt may shift the NDT temperature of the vessel metal above the initial value. Impact tests from the first material surveillance capsule removed at 4.17 EFPY indicated a maximum RT_{ndt} shift of 55 degrees F for the weld specimens.

The RT_{ndt} of the closure region is +10 degrees F. The initial RT_{ndt} for the beltline weld and base metal are –48 degrees F and 0 degrees F, respectively. These RT_{ndt} temperatures are based upon unirradiated test data, adjusted for specimen orientation in accordance with USNRC Branch Technical Position MTEB 5-2.

The closure and bottom head regions are not exposed to neutron fluence (> 1 Mev) over the vessel life sufficient to cause a shift in RT_{ndt}. The pressure-temperature limitations (Figures 3.6-1, 3.6-2, and 3.6-3) of the closure and bottom head regions will therefore remain constant throughout vessel life. Only the beltline region of the reactor vessel will experience a shift in RT_{ndt} with a resultant increase in pressure-temperature limits.

The curves apply to 100% bolt preload condition but are conservative for lesser bolt preload condition.