LIMITING CONDITION FOR OPERATION	SURVEILLANCE REQUIREMENT
3.6 PRIMARY SYSTEM BOUNDARY	4.6 PRIMARY SYSTEM BOUNDARY
Applicability:	Applicability:
Applies to the operating status of the reactor coolant system.	Applies to the periodic examination and testing requirements for the reactor cooling system.
Objective:	Objective:
To assure the integrity and safe operation of the reactor coolant system.	To determine the condition of the reactor coolant system and the operation of the safety devices related to it.
Specification:	Specification:
A. Thermal and Pressurization Limitations	A. Thermal and Pressurization Limitations
1. The average rate of reactor coolant temperature change during normal heatup or cooldown shall not exceed 100°F/hr when averaged over a one-hour period.	1. During heatups and cooldowns, the following temperatures shall be logged at least every 15 minutes until 3 consecutive readings at each given location are within 5°F. a. Reactor vessel shell adjacent to shell flange. b. Reactor vessel bottom drain. c. Recirculation loops A and B. d. Reactor vessel bottom head temperature.
2. The reactor vessel shall be vented and power operation shall not be conducted unless the reactor vessel temperature is equal to or greater than that shown in Curve C or Figure 3.6-1. Operation for hydrostatic or leakage tests, during heatup or cooldown, and with the core critical shall be conducted only when vessel temperature is equal to or above that shown in the appropriate curve of Figure 3.6-1. Figure 3.6-1 is effective through 16 effective full power years. At least six months prior to 16 effective full power years new curves will be submitted.	2. Reactor vessel metal temperature at the outside surface of the bottom head in the vicinity of the control rod drive housing and reactor vessel shell adjacent to shall flange shall be recorded at least every 15 minutes during inservice hydrostatic or leak testing when the vessel pressure is >312 psig.

LIMITING CONDITION FOR OPERATION	SURVEILLANCE REQUIREMENT
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 74°F.	Test specimens of the reactor vessel base, weld and heat affected zone metal subjected to the highest fluence of greater than 1 MeV neutrons were installed in the reactor vessel adjacent to the vessel wall at the core midplane level at the start of operation. The specimens and sample program shall conform to ASTM E 185-66 to the degree discussed in the FSAR.
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.	Samples from surveillance capsule 1 at 288° were withdrawn at 6 effective full power years and tested in accordance with 10CFR50, Appendix H. Neutron flux wires installed in the surveillance capsule were tested to experimentally determine the flux and fluence at one-fourth of the beltline shell thickness, used to determine the NDTT shift. The next surveillance capsule shall be withdrawn at 15 effective full power years.
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.	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.

550°F range. The differential is due to the sluggish temperature response to the flange metal and its value decreases for any lower heating rate or the same rate applied over a narrower range.

The coolant in the bottom of the vessel is at a lower temperature than that in the upper regions of the vessel when there is no recirculation flow. This colder water is forced up when recirculation pumps are started. This will not result in stresses which exceed ASME Boiler and Pressure Vessel Code, Section III limits when the temperature differential is not greater than 145°F.

The reactor coolant system is a primary barrier against the release of fission products to the environs. In order to provide assurance that this barrier is maintained at a high degree of integrity, restrictions have been placed on the operating conditions to which it can be subjected.

The operating limits in Figure 3.6-1 are derived in accordance with 10CFR50 Appendix G, May, 1983 and Appendix G of the ASME Code. Conditions in three regions influence the curves: the closure flange region, the non-beltline region which includes most nozzles and discontinuities, and the beltline region which is irradiated with fluence above 10^{17} n/cm^2 during the vessel operating life. Irradiation has caused an increase in the nil-ductility temperature (RT_{NDT}) of the beltline materials, to the point where the beltline region impacts the pressure-temperature limits for the vessel. For Figure 3.6-1, effective to 16 EFPY, the beltline which has an RT_{NDT} of 40°F is limiting at higher pressures. The non-beltline regions which generally experience higher stresses at nozzles and discontinuities are limiting at lower pressures. The limiting RT_{NDT} of 58°F for the Standby Liquid Control Nozzle (N10) is the highest RT_{NDT} of any component in the non-beltline region.

The closure flange region, with RT_{NDT} = 14°F, has a bolt preload and minimum operating temperature of 74°F. This exceeds original requirements of the ASME Code (Winter 1967 Addendum) and provides extra margin relative to current ASME Code requirements.

Neutron flux wires and samples of vessel material are installed in the reactor vessel adjacent to the vessel wall at the core midplane level. The first capsule was removed after fuel cycle 7, at 6 effective full power years. The neutron flux wires tested were used to determine the end-of-life fluence at the 1/4 T depth in the vessel wall of 3.6×10^{18} n/cm^2. Irradiated and unirradiated Charpy specimens were tested. Since the test showed that the limiting beltline material initial RT_{NDT} and the RT_{NDT} shift are the same as those previously predicted, there was no need to change the curves of Figure 3.6-1 based on Surveillance Materials Testing. However, an adjusted reference temperature, based on the fluence, nickel content and copper content of the material in question, can be predicted using the recommendations of Regulatory Guide 1.99, Revision 2, "Radiation Embrittlement of Reactor Vessel Materials." The pressure-temperature curves of Figure 3.6-1, includes predicted adjustments for this shift in RT_{NDT} at the end of 16 EFPY.

As described in paragraph 4.2.5 of the Safety Analysis report, detailed stress analyses have been made on the reactor vessel for both steady state and transient conditions with respect to material fatigue. The results of these transients are compared to allowable stress limits. Requiring the coolant temperature in an idle recirculation loop to be within 50°F of the operating loop temperature before a recirculation pump is started assures that the changes in coolant temperature at the reactor vessel nozzles and bottom head region are acceptable.

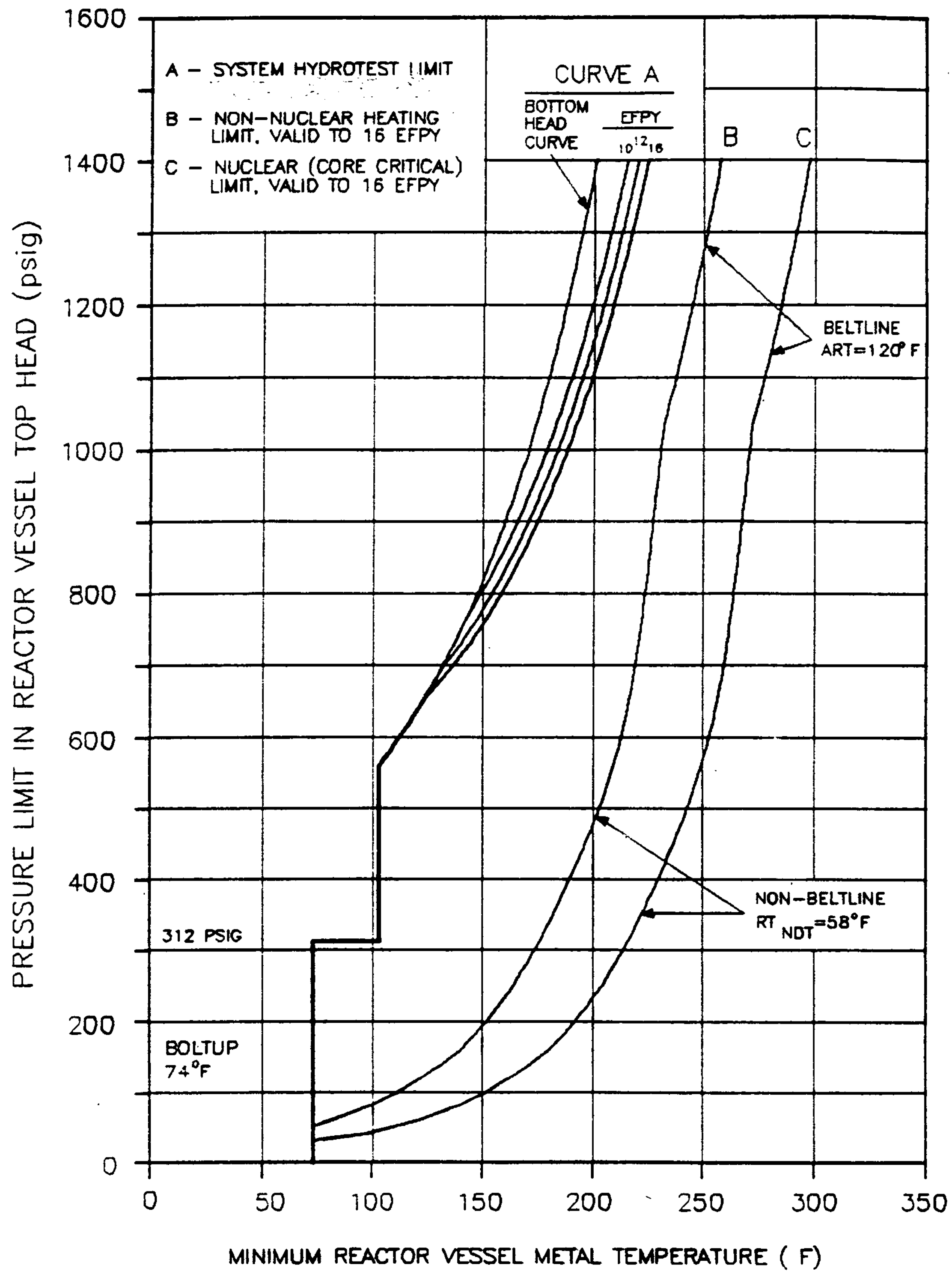

Figure 3.6-1. Pressure versus Minimum Temperature Valid to Sixteen Full Power Years, per Appendix G of 10CFR50