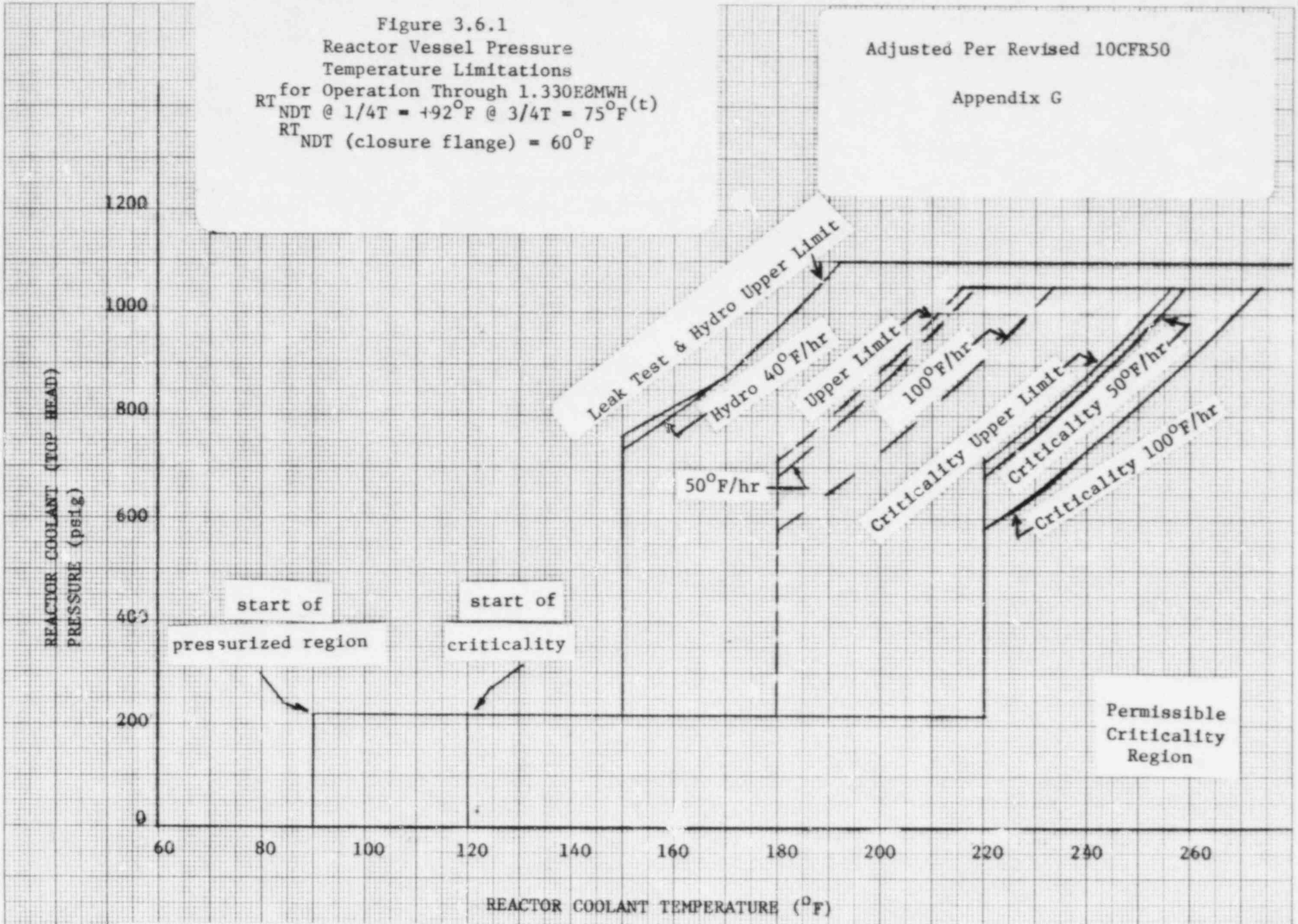


Figure 3.6.1
Reactor Vessel Pressure
Temperature Limitations
for Operation Through 1.330E8MWH(t)
RTNDT @ 1/4T = +92°F @ 3/4T = 75°F
RTNDT (closure flange) = 60°F
Adjusted Per Revised 10CFR50
Appendix G
Leak Test & Hydro Upper Limit
Hydro 40°F/hr
Upper Limit
100°F/hr
50°F/hr
Criticality Upper Limit
Criticality 50°F/hr
Criticality 100°F/hr
start of
pressurized region
start of
criticality
Permissible
Criticality
Region
REACTOR COOLANT (TOP HEAD)
PRESSURE (psig)
0
200
400
600
800
1000
1200
60
80
100
120
140
160
180
200
220
240
260
REACTOR COOLANT TEMPERATURE (°F)

BASES

3.6 & 4.6 REACTOR COOLANT SYSTEM

Pressure and Temperature Limitations

All components in the Reactor Coolant System are designed to withstand the effects of cyclic loads due to system temperature and pressure changes. These cyclic loads are introduced by normal load transients, reactor trips, and startup and shutdown operations. The various categories of load cycles used for design purposes are provided in Section 4.2 of the FSAR. During startup and shutdown, the rates of temperature and pressure changes are limited so that the maximum specified heatup and cooldown rates are consistent with the design assumptions and satisfy the stress limits for cyclic operation.

During heatup, the thermal gradients in the reactor vessel wall produce thermal stresses which vary from compressive at the inner wall to tensile at the outer wall. These thermal-induced compressive stresses tend to alleviate the tensile stresses induced by the internal pressure. Therefore, a pressure-temperature curve based on steady-state conditions (i.e., no thermal stresses) represents a lower bound of all similar curves for finite heatup rates when the inner wall of the vessel is treated as the governing location.

The heatup analysis also covers the determination of pressure-temperature limitations for the case in which the outer wall of the vessel becomes the controlling location. The thermal gradients established during heatup produce tensile stresses at the outer wall of the vessel. These stresses are additive to the pressure-induced tensile stresses which are already present. The thermal-induced stresses at the outer wall of the vessel are tensile and are dependent on both the rate of heatup and the time along the heatup ramp; therefore, a lower bound curve similar to that described for the heatup of the inner wall cannot be defined. Subsequently, for the cases in which the outer wall of the vessel becomes the stress controlling location, each heatup rate of interest must be analyzed on an individual basis.

In order to prevent undue stress on the vessel nozzles and bottom head region, the recirculation loop temperatures should be within 50°F of each other prior to startup of an idle loop.

The reactor vessel materials have been tested to determine their initial nil-ductility transition temperature (NDTT) of 40°F maximum. An additional margin of 20°F has been added in order to estimate reference temperature, RT_{NDT}. Reactor operation and resultant fast neutron (E greater than 1 Mev) irradiation will cause an increase in the RT_{NDT}. Therefore, an adjusted reference temperature can be predicted using current industry practices (GE SIL No. 14, Supplement No. 1) based on recent GE surveillance data. The reference

temperature for closure flange material is defined by SRP Section 5.3.2, and Branch Technical Position MTEB 5-2, "Fracture Toughness Requirements for Older Plants". The closure flange is located in a low neutron fluence area and therefore no measurable RT_{NDT} shift is expected over the life of the plant. The pressure/temperature limit curve Figure 3.6.1 includes predicted adjustments for this shift in RT_{NDT} for operation through 1.330×10^8 MWH(t), as well as adjustments for possible errors in the pressure and temperature sensing instruments.

The actual shift in NDTT of the vessel material will be established periodically during operation by removing and evaluating, in accordance with ASTM E185-73, reactor vessel material irradiation surveillance specimens installed near the inside wall of the reactor vessel in the core area. Since the neutron spectra at the irradiation samples and vessel inside radius are essentially identical, the measured transition shift for a sample can be applied with confidence to the adjacent section of the reactor vessel. In order to estimate the material properties at the 1/4 and 3/4 positions in the vessel plate, the shift in NDTT is assumed to be 62% and 22%, respectively of the irradiation samples properties. The heatup and cooldown curves must be recalculated when the RT_{NDT} determined from the surveillance capsule is different from the calculated RT_{NDT} for the equivalent capsule radiation exposure.

The pressure-temperature limit lines shown on Figure 3.6.1 for reactor criticality and for inservice leak and hydrostatic testing have been provided to assure compliance with the minimum temperature requirements of Appendix G to 10CFR50 for reactor criticality and for inservice leak and hydrostatic testing.

The number of reactor vessel irradiation surveillance specimens and the frequencies for removing and testing these specimens are provided to assure compliance with the requirements of Appendix H to 10CFR Part 50.

Coolant Chemistry

A steady-state radioiodine concentration limit of 1.1 Ci of I-131 dose equivalent per gram of water in the reactor coolant system can be reached if the gross radioactivity in the gaseous effluents are near the limit as set forth in Specification 3.8.C.1.a or there is a failure or prolonged shutdown of the cleanup demineralizer. In the event of a steam line rupture outside the drywell, the NRC staff calculations show the resultant radiological dose at the site boundary to be less than 30 rem to the thyroid.

VERMONT YANKEE NUCLEAR POWER CORPORATION

RD 5, Box 169, Ferry Road, Brattleboro, VT 05301

REPLY TO
ENGINEERING OFFICE
1671 WORCESTER ROAD
FRAMINGHAM, MASSACHUSETTS 01701
TELEPHONE 617-872-8100

Proposed Change No. 118

February 7, 1984
FVY 84-9

United States Nuclear Regulatory Commission
Washington, D. C. 20555

Attention: Office of Nuclear Reactor Regulation
Mr. D. G. Eisenhut, Director
Division of Licensing

References:
(a) License No. DPR-28 (Docket No. 50-271)
(b) Letter, VYNPC to USNRC, FVY 83-45, Proposed Change No. 107, dated May 26, 1983
(c) Final Rule [48FR24008], Fracture Toughness Requirements for Light Water Reactors, dated May 27, 1983

Subject: Reactor Vessel Pressure Temperature Curves

Dear Sir:

Pursuant to Section 50.59 of the Commission's Rules and Regulations, Vermont Yankee Nuclear Power Corporation hereby proposes the following change to Appendix A of the Operating License.

Proposed Change

Replace Pages 111, 117, and 118 of the Vermont Yankee Technical Specifications with the enclosed revised Pages 111, 117, and 118. These pages are intended to supersede the replacement pages previously submitted to you via Reference (b).

Figure 3.6.1, "Reactor Vessel Pressure Temperature Limits for Operation Through 1.15E8 MWh(t)" has been updated to reflect allowable heatup curves for reactor operation through a power output of 1.330E8 MWh(t). The revised figure also reflects the promulgation of a revision to 10CFR Part 50, Appendix G [Reference (c)]. Pages 117 and 118 have been revised to reflect a change to the bases section of the Technical Specifications.

DUPE

Reason for Change

This proposed change will revise our Technical Specifications to accommodate shifts in transition temperature for the reactor vessel materials that were induced by radiation effects. These shifts are accounted for by revision of our pressure-temperature limits for heating up and cooling down the reactor. Periodic review and adjustment, if necessary, of the curves to account for the effects of increased neutron exposure is required by 10CFR Part 50, Appendices G and H.

This change adjusts the curves of Figure 3.6.1 to compensate for the effects of increased neutron exposure to permit operation to a power level of 1.330E8 MWh(t). This adjustment is necessary because the existing curves are limited to a power output of 1.15E8 MWh(t), a value which is expected to be reached during March 1984.

Basis for Change

The basis for this change is discussed in detail in Reference (b). In addition, the recent promulgation of a rule change to 10CFR Part 50, Appendix G [Reference (c)] allows for:

1. Removal (for BWRs) of the hydrostatic pressure test temperature limit for criticality. The new temperature limit for criticality is the RT_{NDT} of the closure flange plus 60°F. For Vermont Yankee, this will be 120°F (the former temperature was 173.5°F). This value is applicable at pressures <220 psig. At pressures $\geq$ 220, the criticality curves are a continuation of the previous curves based on 10CFR50, Appendix G, which requires that vessel temperature always be 40°F above the ASME Code, Section III, Appendix G, calculated curves during criticality.

2. Limiting normal operation and hydrotest to pressures below 220 psig until vessel closure flange temperature is well above RT_{NDT} of closure flange region. Specifically, when pressure exceeds 220 psig, the new hydrotest temperature is RT_{NDT} of the closure flange plus 90°F. This temperature is 150°F. In addition, when pressure exceeds 220 psig, the new normal operation temperature is $[RT_{NDT}]_{CF}$ plus 120°F = 180°F.

Vermont Yankee's vessel closure flange is ASME SA 508, Cl 2 material. Because no fracture toughness test data for this material is available, its reference temperature (RT_{NDT}) is defined by "Standard Review Plan", Section 5.3.2, Pressure Temperature Limits, and Branch Technical Position MTEB 5-2, "Fracture Toughness Requirements for Older Plants". That temperature is 60°F.

The closure flange is located in a low neutron fluence area, i.e., out of the "vessel beltline", and therefore no measurable RT_{NDT} shift is expected over plant life.

These changes are reflected on the enclosed Pages 111 (Figure 3.6.1), 117, and 118.

Safety Considerations

The safety considerations are discussed in detail in Reference (b). This change has been reviewed by the Nuclear Safety Audit and Review Committee.

Significant Hazards Consideration

The NRC has provided guidance concerning the application of standards for conclusions regarding "Significant Hazards Consideration" [48FR14870]. The examples of actions involving no significant hazards consideration include: "A change to make a license conform to changes in the regulations, where the license change results in very minor changes to facility operations clearly in keeping with the regulations."

This change to the pressure-temperature limits is similar to the example cited above because 10CFR Part 50, Appendices G and H require the updating of pressure-temperature limits based on the surveillance program. This proposed change will result in a minor change to facility operations clearly in keeping with the regulations.

Based on the above, we have determined that this change does not constitute a significant hazards consideration, as defined in 10CFR50.92(c).

Fee Determination

This proposed change requires an approval that involves a single safety issue and is not deemed to involve an unreviewed safety question. For these reasons, Vermont Yankee Nuclear Power Corporation proposes this change as a Class III Amendment. A payment of $4,000.00 is enclosed.

Schedule of Change

For reasons discussed above, we request that you expedite your review and approval of this proposed change. This change will be implemented as soon as practicable following receipt of your approval.

We trust that this information is acceptable; however, should you require additional information, please contact us.

Very truly yours,

VERMONT YANKEE NUCLEAR POWER CORPORATION

L. H. Heider
Vice President

JBS/bal

cc: Vermont Department of Public Services
120 State Street
Montpelier, Vermont 05602
Attention: Mr. Richard Saudek, Chairman

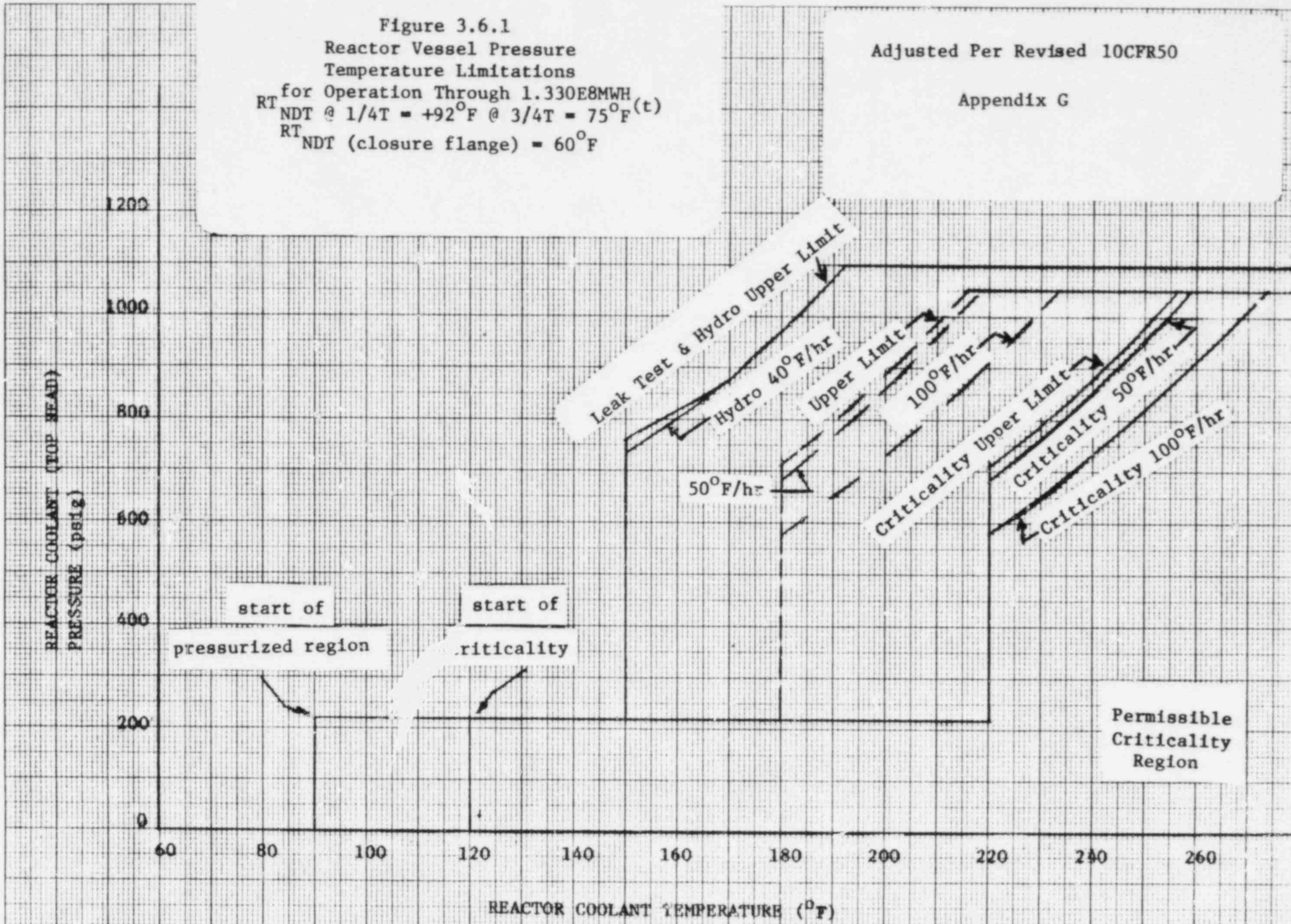
Enclosure

COMMONWEALTH OF MASSACHUSETTS)
)ss
MIDDLESEX COUNTY)

Then personally appeared before me, L. H. Heider, who, being duly sworn, did state that he is a Vice President of Vermont Yankee Nuclear Power Corporation, that he is duly authorized to execute and file the foregoing request in the name and on the behalf of Vermont Yankee Nuclear Power Corporation and that the statements therein are true to the best of his knowledge and belief.

J. B. Sinclair — Notary Public
My Commission Expires — June 1, 1984

JAMES B. SINCLAIR NOTARY PUBLIC
COMMONWEALTH OF MASSACHUSETTS
U.S.A.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Upper Limit
100°F/hr
50°F/hr
Criticality Upper Limit
Criticality 50°F/hr
Criticality 100°F/hr
start of
pressurized region
start of
riticality
Permissible
Criticality
Region
REACTOR COOLANT (TOP HEAD)
PRESSURE (psig)
1200
1000
800
600
400
200
0
60
80
100
120
140
160
180
200
220
240
260
REACTOR COOLANT TEMPERATURE (°F)

BASES

3.6 & 4.6 REACTOR COOLANT SYSTEM

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