UNITED STATES
NUCLEAR REGULATORY COMMISSION
WASHINGTON, D. C. 20555

COMMONWEALTH EDISON COMPANY

DOCKET NO. 50-295

ZION STATION UNIT NO. 1

AMENDMENT TO FACILITY OPERATING LICENSE

Amendment No. 50
License No. DPR-39

1. The Nuclear Regulatory Commission (the Commission) has found that:

   A. The application for amendment by Commonwealth Edison Company (the licensee) dated February 26, 1979, as supplemented May 11, 1979, complies with the standards and requirements of the Atomic Energy Act of 1954, as amended (the Act), and the Commission's rules and regulations set forth in 10 CFR Chapter I;

   B. The facility will operate in conformity with the application, the provisions of the Act, and the rules and regulations of the Commission;

   C. There is reasonable assurance (i) that the activities authorized by this amendment can be conducted without endangering the health and safety of the public, and (ii) that such activities will be conducted in compliance with the Commission's regulations;

   D. The issuance of this amendment will not be inimical to the common defense and security or to the health and safety of the public; and

   E. The issuance of this amendment is in accordance with 10 CFR Part 51 of the Commission's regulations and all applicable requirements have been satisfied.

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2. Accordingly, the license is amended by changes to the Technical Specifications as indicated in the attachment to this license amendment and paragraph 2.C.(2) of Facility License No. DPR-39 is hereby amended to read as follows:

   (2) Technical Specifications

   The Technical Specifications contained in Appendices A and B, as revised through Amendment No. 50, are hereby incorporated in the license. The licensee shall operate the facility in accordance with the Technical Specifications.

3. This license amendment is effective as of the date of its issuance.

FOR THE NUCLEAR REGULATORY COMMISSION

A. Schwencer

A. Schwencer, Chief
Operating Reactors Branch #1
Division of Operating Reactors

Attachment:
Changes to the Technical Specifications

Date of Issuance: June 18, 1979

UNITED STATES
NUCLEAR REGULATORY COMMISSION
WASHINGTON, D. C. 20555

COMMONWEALTH EDISON COMPANY

DOCKET NO. 50-304

ZION STATION UNIT NO. 2

AMENDMENT TO FACILITY OPERATING LICENSE

Amendment No. 47
License No. DPR-48

1. The Nuclear Regulatory Commission (the Commission) has found that:

   A. The application for amendment by Commonwealth Edison Company (the licensee) dated February 26, 1979, as supplemented May 11, 1979, complies with the standards and requirements of the Atomic Energy Act of 1954, as amended (the Act), and the Commission's rules and regulations set forth in 10 CFR Chapter I;

   B. The facility will operate in conformity with the application, the provisions of the Act, and the rules and regulations of the Commission;

   C. There is reasonable assurance (i) that the activities authorized by this amendment can be conducted without endangering the health and safety of the public, and (ii) that such activities will be conducted in compliance with the Commission's regulations;

   D. The issuance of this amendment will not be inimical to the common defense and security or to the health and safety of the public; and

   E. The issuance of this amendment is in accordance with 10 CFR Part 51 of the Commission's regulations and all applicable requirements have been satisfied.

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2. Accordingly, the license is amended by changes to the Technical Specifications as indicated in the attachment to this license amendment and paragraph 2.C.(2) of Facility License No. DPR-48 is hereby amended to read as follows:

   (2) Technical Specifications

   The Technical Specifications contained in Appendices A and B, as revised through Amendment No. 47, are hereby incorporated in the license. The licensee shall operate the facility in accordance with the Technical Specifications.

3. This license amendment is effective as of the date of its issuance.

FOR THE NUCLEAR REGULATORY COMMISSION

A. Schwencer

A. Schwencer, Chief
Operating Reactors Branch #1
Division of Operating Reactors

Attachment:
Changes to the Technical
Specifications

Date of Issuance: June 18, 1979

ATTACHMENT TO LICENSE AMENDMENTS

AMENDMENT NO. 50 TO FACILITY OPERATING LICENSE NO. DPR-39

AMENDMENT NO. 47 TO FACILITY OPERATING LICENSE NO. DPR-48

DOCKET NOS. 50-295 AND 50-304

Revise Appendix A as follows:

Remove Pages	Insert Pages
vii	vii
79	79
80	80
81	81
82	82 (Intentionally Blank)
83	83 (Intentionally Blank)
84	84
85	85
86	86
87	87
90	90
91	91
92	92
93	93
94	94 (Intentionally Blank)

LIST OF FIGURES (Continued)

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LIMITING CONDITION FOR OPERATION	SURVEILLANCE REQUIREMENT
3.3 2. Pressurization and System Integrity	4.3 2. Pressurization and System Integrity
A. Heatup and Cooldown	A. Not Applicable

The Reactor Coolant System temperature and pressure (with the exception of the pressurizer) shall be limited in accordance with the limit lines shown in Figures 3.3.2-1 and 3.3.2-2 during heatup, cooldown and inservice leak and hydrostatic testing.

1. Allowable combinations of pressure and temperature for specified temperature change rates are below and of the right of the limit lines shown. Limit lines for cooldown rates between those presented may be obtained by interpolation.

2. Figures 3.3.2-1 and 3.3.2-2 define limits to assure prevention of non-ductile failure only. For normal operation other inherent plant characteristics, e.g., pump heat addition and pressurizer heater capacity may limit the heatup and cooldown rates that can be achieved over certain pressure-temperature ranges.

3. The Reactor Coolant System shall be limited to a maximum temperature change of 10^{o}F/hr during inservice

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LIMITING CONDITION FOR OPERATION	SURVEILLANCE REQUIREMENT

3.3.2. A3. (Continued)

leak and hydrostatic testing operations above the heatup and cooldown limit curves.

B. The limit lines shown in Figures 3.3.2-1 and 3.3.2-2 shall be recalculated periodically as required based on results from the material surveillance program.

C. The secondary side of the steam generator must be pressurized above 200 psig if the temperature of the vessel is below 70°F.

D. The pressurizer heatup rate shall not exceed 100°F/hr and the pressurizer cooldown rate not exceed 200°F/hr. The spray shall not be used if the temperature difference between the pressurizer and the spray fluid is greater than 320°F.

E. Hydrostatic Testing

1. System inservice leak and hydrotests shall be performed in accordance with the requirements of ASME Boiler and Pressure Vessel Code, Section XI, 1974 Edition, up to and including Summer 1975 Addendum.

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LIMITING CONDITION FOR OPERATION	SURVEILLANCE REQUIREMENT

3.3.2. A3. (Continued)

leak and hydrostatic testing operations above the heatup and cooldown limit curves.

B. The limit lines shown in Figures 3.3.2-1 and 3.3.2-2 shall be recalculated periodically as required, based on results from the material surveillance program.

C. The secondary side of the steam generator must be pressurized above 200 psig if the temperature of the vessel is below $70^{\circ}F$.

D. The pressurizer heatup rate shall not exceed $100^{\circ}F/hr$ and the pressurizer cooldown rate not exceed $200^{\circ}F/hr$. The spray shall not be used if the temperature difference between the pressurizer and the spray fluid is greater than $320^{\circ}F$.

E. Hydrostatic Testing

1. System inservice leak and hydrotests shall be performed in accordance with the requirements of ASME Boiler and Pressure Vessel Code, Section XI, 1974 Edition, up to and including Summer 1975 Addendum.

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LIMITING CONDITION FOR OPERATION	SURVEILLANCE REQUIREMENT

3.3.2

F. Safety Injection Actuation

1. If safety injection should occur when a reactor is in the hot shutdown condition or above, the reactor shall remain in the hot shutdown condition until the status of the reactor coolant system integrity is determined.

2. If the inspection and review (Sec. 6.1.G.2.a(7) and Sec. 6.3) of the reactor coolant system integrity determines that:

   a. The injection did not affect reactor coolant system integrity the plant may proceed to power operation.

   b. The injection did affect reactor coolant system integrity, the reactor shall be placed in the cold shutdown condition within 24 hours.

3. The NRC shall be notified within 24 hours and an analysis of the incident shall be submitted to the NRC within 90 days.

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4.3.2

F. Not Applicable

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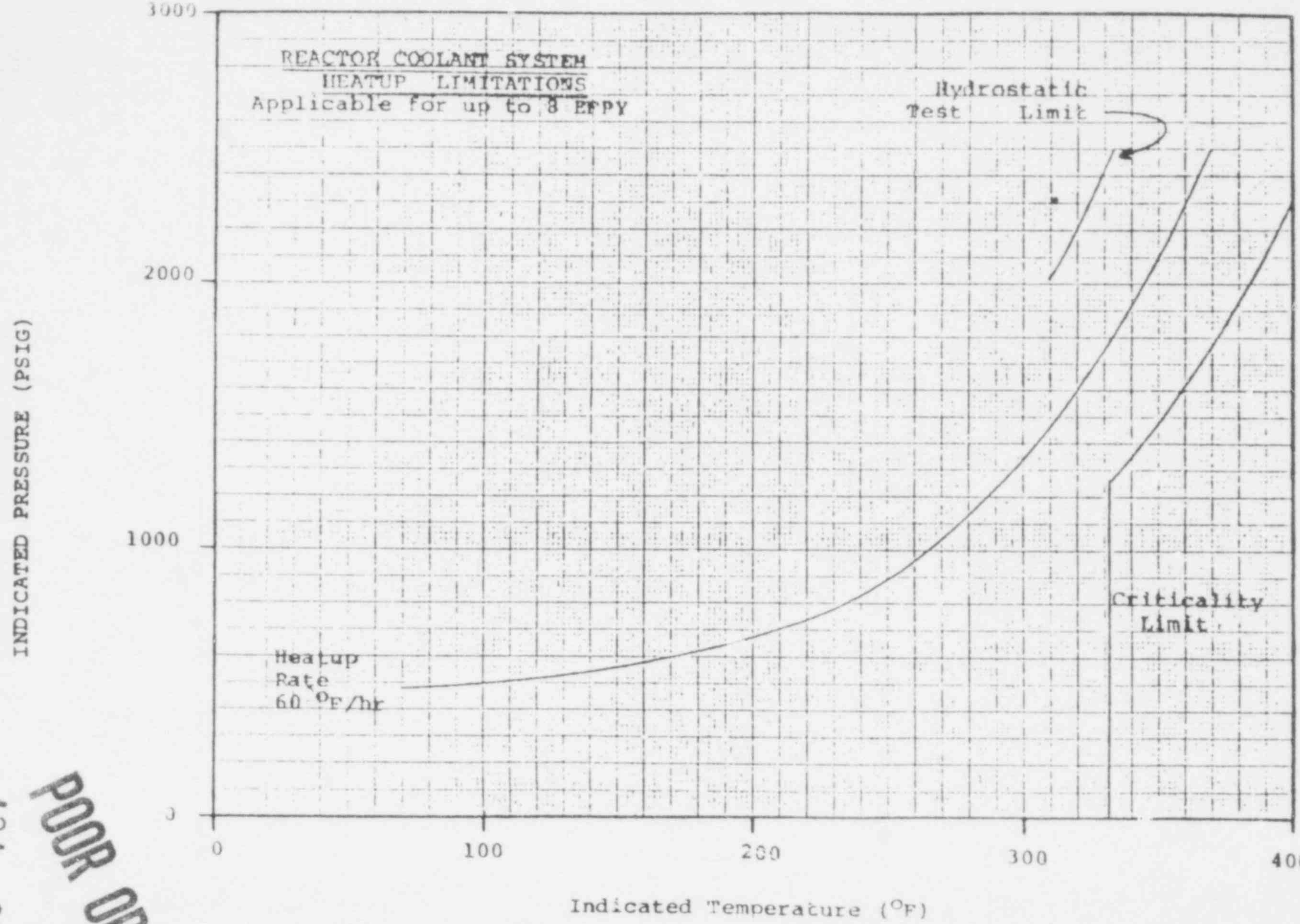
REACTOR COOLANT SYSTEM
HEATUP LIMITATIONS
Applicable for up to 8 EFPY
Hydrostatic
Test Limit
Criticality
Limit
Heatup
Rate
60 °F/hr
3000
2000
1000
0
0
100
200
300
400
INDICATED PRESSURE (PSIG)
Indicated Temperature (°F)

Figure 3.3.2-1

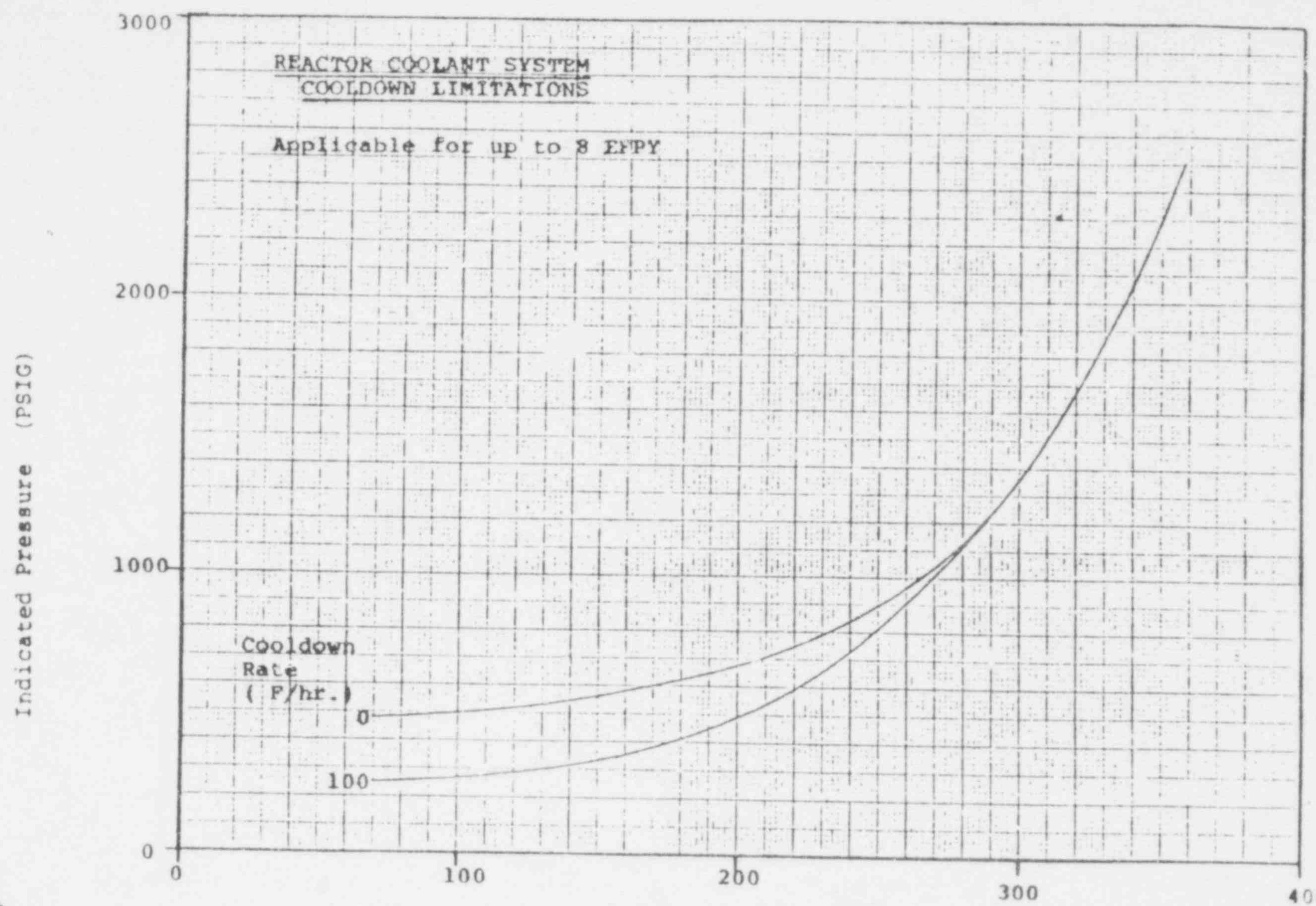

Figure 3.3.2-2

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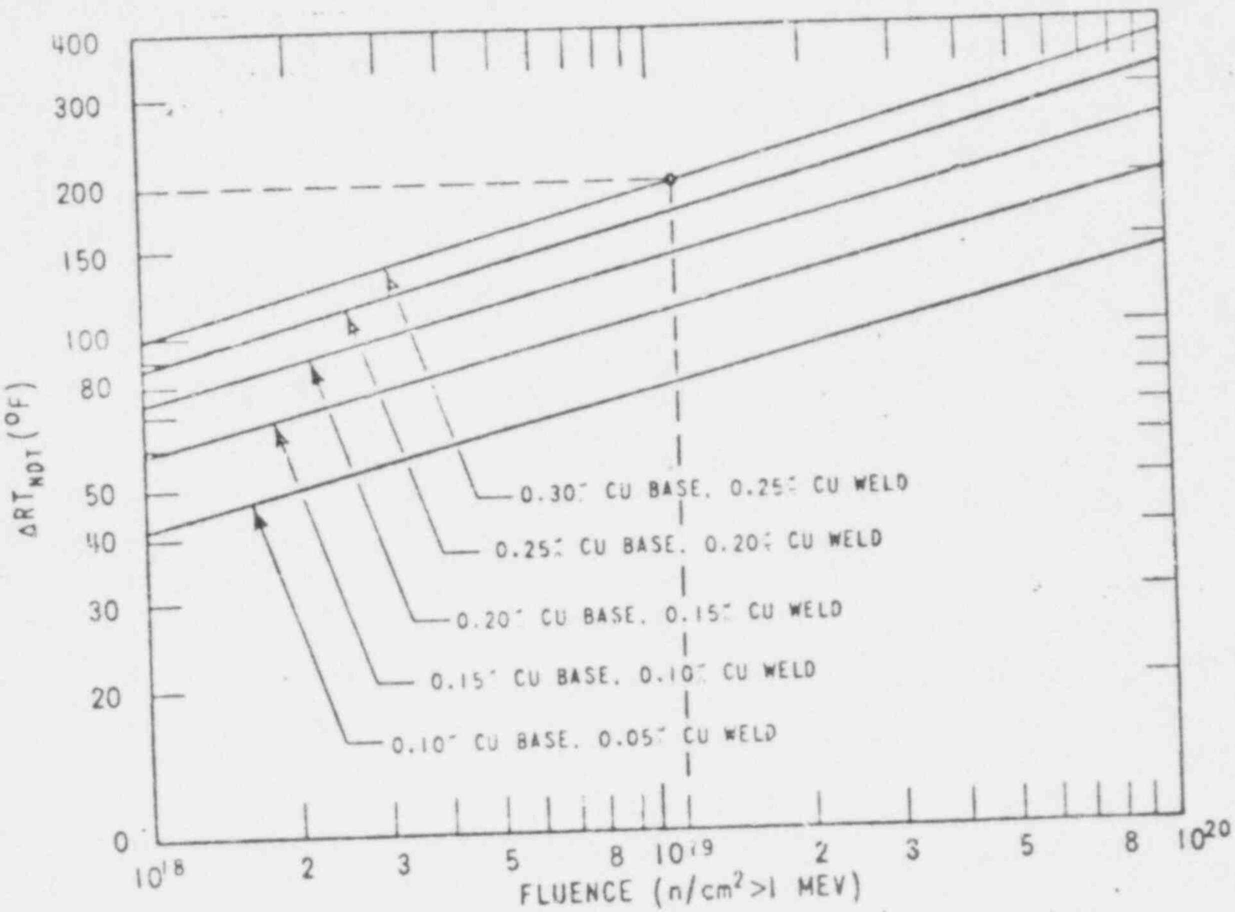

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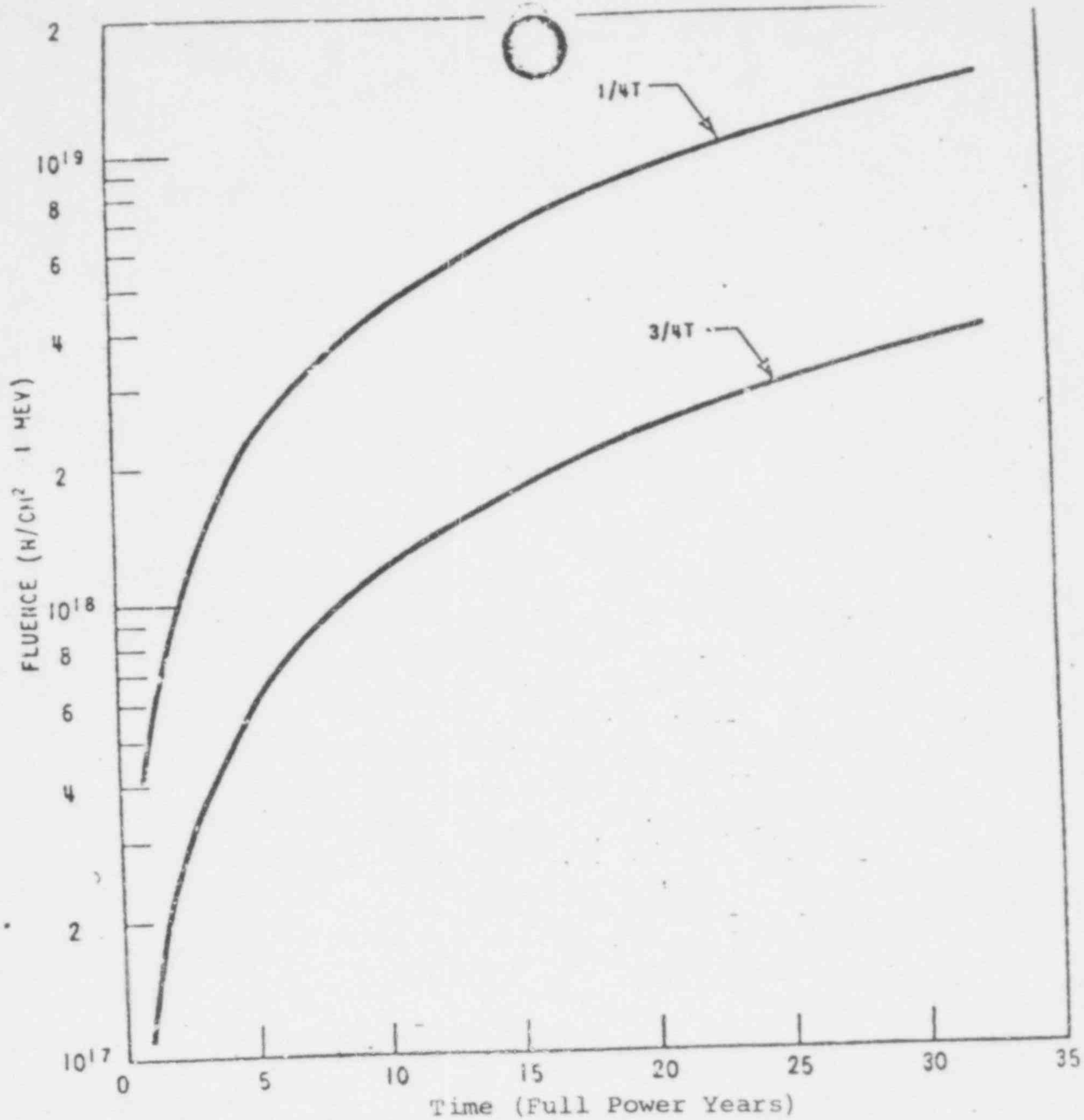
Effect of Fluence and Copper Content on Shift of RT_{NDT} for Reactor Vessel Steels Exposed to 550°F Temperature

FIGURE 3.3.2-3



Fluence at 1/4T and 3/4T as a Function of Full Power Service Years

FIGURE 3.3.2-4

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Bases

3.3.2 & 3.3.4 Fracture Toughness Properties

The fracture toughness properties of the ferritic materials in a reactor coolant pressure boundary are determined in accordance with Section III of the ASME Boiler and Pressure Vessel Code, 1974 Edition. (1). Heatup and cooldown limit curves are calculated using the most limiting value of RT_{NDT}, determined as follows:

1. Determine the highest RT_{NDT} of the material in the core region of a reactor vessel using original values from Table 3.3.2-1 and estimating the radiation induced ΔRT_{NDT} using Figure 3.3.2-3 (Reference 6 & 7). Fast neutron (E > 1 Mev) fluence at the 1/4 T and 3/4 T vessel locations are given as a function of full power service life in Figure 3.3.2-4.

2. Examine the data for all other ferritic materials in a reactor coolant pressure boundary to assure that no other component will be limiting.

3. Initially, the effect of radiation on the RT_{NDT} of a reactor vessel core region material is estimated using the curves shown in Figure 3.3.2-3. The ΔRT_{NDT} shown for the first eight effective full power years is factored into the heatup and cooldown curves provided. Values of ΔRT_{NDT} determined in this manner may be used until the results from the material surveillance program, when evaluated according to ASTM E185, indicate that they are inappropriate. At this time, the heatup and cooldown curves must be recalculated.

The length of the first full power service period has been chosen such that the limiting RT_{NDT} at the 1/4 T vessel location includes a radiation induced ΔRT_{NDT} on the order of 100-150°F. The assumption of a radiation induced shift of this magnitude assures that all other components in the primary pressure boundary will be operated conservatively, in accordance with code recommendation.

Heatup and Cooldown Limit Curves

Allowable pressure-temperature relationships for various heatup and cooldown rates are calculated using methods derived from Non Mandatory Appendix G2000 in Section III of the ASME Boiler and Pressure Vessel Code; and discussed in detail in Reference (2). The approach specified that the allowable total stress intensity factor (K_I) at any time during heatup or cooldown cannot be greater than that shown on the K_{IR} curve (Reference 1) for the metal temperature at that time. Furthermore the approach applies explicit safety factors of 2.0 and 1.25* on stress intensity factors induced by pressure and thermal gradients, respectively. Thus, the governing equation for the heatup-cooldown analysis is:

*The 1.25 safety factor on K_{It} represents additional conservatism above Code requirements

$$2.0\ K_{Im} + 1.25\ K_{It} < K_{IR} \qquad (1)$$

where:

K_{Im} is the stress intensity factor caused by membrane (pressure) stress

K_{It} is the stress intensity factor caused by the thermal gradients

K_{IR} is provided by the code as a function of temperature relative to the RT_{NDT} of the material.

During the heatup analysis, Equation (1) is evaluated for two distant situations.

First, allowable pressure-temperature relationships are developed for steady state (i.e., zero rate of change of temperature) conditions assuming the presence of the code reference 1/4 T deep flaw at the ID of the pressure vessel. Due to the fact that, during heatup, the thermal gradients in the vessel wall tend to produce compressive stresses at the 1/4 T location, the tensile stresses induced by internal pressure are somewhat alleviated. Thus, 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 1/4 T location is treated as the governing factor.

The second portion of the heatup analysis concerns the calculation of pressure temperature limitations for the case in which the 3/4 T location becomes the controlling factor.

Unlike the situation at the 1/4 T location, at the 3/4 T location (i.e., the tip of the 1/4 T deep O.D. flaw) the thermal gradients established during heatup produce stresses which are tensile in nature; and, thus, tend to reinforce the pressure stresses present. These thermal stresses are, of course, dependent on both the rate of heatup and the time (or water temperature) along the heatup ramp. Furthermore, since the thermal stresses at 3/4 T are tensile and increase with increasing heatup rate, a lower bound curve similar to that described in the preceding paragraph cannot be defined. Rather, each heatup rate of interest must be analyzed on an individual basis.

Following the generation of pressure-temperature curves for both the steady state and finite heatup rate situations, the final limit curves are produced in the following fashion. First, a composite curve is constructed based on a point by point comparison of the steady state and finite heatup rate data. At any given temperature, the allowable pressure is taken to be the lesser of the two values taken from the curves under consideration.

The use of the composite curve becomes mandatory in setting heatup limitations because it is possible for conditions to exist such that over the course of the heatup ramp the controlling analysis switches from the O.D. to the I.D. location; and the pressure limit must, at all times, be based on the most conservative case.

The cooldown analysis proceeds in the same fashion as that for heatup, with the exception that the controlling location is always at 1/4T. The thermal gradients induced during cooldown tend to produce tensile stresses at the 1/4T location and compressive stresses at the 3/4T position. Thus, the ID flaw is clearly the worst case.

As in the case of heatup, allowable pressure temperature relations are generated for both steady state and finite cooldown rate situations. Composite limit curves are then constructed for each cooldown rate of interest.

The use of the composite curve in the cooldown analysis is necessary because system control is based on a measurement of reactor coolant temperature, whereas the limiting pressure is calculated using the material temperature at the tip of the assumed reference flaw. During cooldown, the 1/4T vessel location is at a higher temperature than the fluid adjacent to the vessel ID. This condition is, of course, not true for the steady-state situation. If follows that the ΔT induced during cooldown results in a calculated higher allowable K_{IR} for finite cooldown rates than for steady state under certain conditions.

Details of these calculations are provided in Reference (2).

Heatup and cooldown limit curves shown are the results of the above analysis. The most limiting material properties for both reactor vessels were used in a single analysis, therefore, the curves apply conservatively to both units.

Pressurizer Limits

Although the pressurizer operates at temperature ranges above those for which there is reason for concern about brittle fracture, operating limits are provided to assure compatability of operation with the fatigue analysis performed in accordance with Code requirements.

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Hydrostatic Testing Limit Curve

Allowable pressure-temperature relationships for leak and hydrostatic testing are also calculated using methods derived from Non-Mandatory Appendix G2000 in Section III of the ASME Boiler and Pressure Vessel Code. The approach specified is the same as described for heatup and cooldown limits except that the safety factor on KI_m is reduced to 1.5 and there are no significant thermal transients or gradients. Thus the governing equation for the leak and hydrostatic testing analysis is:

$$1.5\ KI_m < K_{IR}$$

Inadvertent Safety Injection

In the event of an inadvertent safety injection actuation the affected reactor will trip immediately, placing the reactor in the hot shutdown condition. After 90 seconds safety injection may be reset and injection terminated as required. An inspection of the primary system while at hot shutdown will prevent possible degradations in the primary system for undergoing further immediate thermal shock imposed during a cooldown. If degradations in the primary system are discovered an orderly controlled cooldown will be planned to minimize the effects of thermal shock on these degradations on the affected unit.

References:

1. ASME Boiler and Pressure Vessel Code, Section III
2. WCAP - 7924, "Basis for heatup and Cooldown Limit Curves", July 1972
3. ASME Boiler and Pressure Vessel Code, Section III, N-331
4. ASME Boiler and Pressure Vessel Code Section III, N-415
5. FSAR, Chapter 4.3
6. WCAP - 87[illegible], "ASME III, Appendix G Analysis of the Commonwealth Edison Company Zion Unit 1 Reactor Vessel"
7. WCAP-8727, "ASME III, Appendix G Analysis of the Commonwealth Edison Company Zion Unit 2 Reactor Vessel".

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