March 2, 1995

Mr. Kurt M. Haas
Plant Safety and Licensing Director
Palisades Plant
27780 Blue Star Memorial Highway
Covert, MI 49043

SUBJECT: PALISADES PLANT - ISSUANCE OF AMENDMENT RE: PRESSURE-TEMPERATURE LIMITS (TAC NO. M90650)

Dear Mr. Haas:

The Commission has issued the enclosed Amendment No. 163 to Facility Operating License No. DPR-20 for the Palisades Plant. The amendment consists of changes to the Technical Specifications (TS) in response to your application dated October 5, 1994, as supplemented February 10, 20, and 22, 1995.

The amendment revises primary coolant system (PCS) pressure-temperature limits, power-operated relief valve setting limits, and primary coolant pump starting limits to accommodate reactor vessel fluence for an additional 4 effective full power years. The amendment also revises the emergency core cooling system TS to render two high-pressure safety injection pumps incapable of injecting into the PCS when the PCS is below 300°F rather than rendering both inoperable below 260°F. In addition, it revises the pressurizer heatup to achieve consistency between design assumptions and TS limits.

A copy of our Safety Evaluation is also enclosed. The notice of issuance will be included in the Commission's biweekly Federal Register notice.

Sincerely,

ORIGINAL SIGNED BY

Marsha K. Gamberoni, Project Manager
Project Directorate III-1
Division of Reactor Projects - III/IV
Office of Nuclear Reactor Regulation

Docket No. 50-255

Enclosures: 1. Amendment No. 163to DPR-20
2. Safety Evaluation

cc w/encls: See next page

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Mr. Kurt M. Haas
Consumers Power Company

Palisades Plant

cc:

Mr. Thomas J. Palmisano
Plant General Manager
Palisades Plant
27780 Blue Star Memorial Highway
Covert, Michigan 49043

Mr. Robert A. Fenech
Vice President, Nuclear Operations
Palisades Plant
27780 Blue Star Memorial Highway
Covert, Michigan 49043

M. I. Miller, Esquire
Sidley & Austin
54th Floor
One First National Plaza
Chicago, Illinois 60603

Mr. Thomas A. McNish, Secretary
Consumers Power Company
212 West Michigan Avenue
Jackson, Michigan 49201

Judd L. Bacon, Esquire
Consumers Power Company
212 West Michigan Avenue
Jackson, Michigan 49201

Regional Administrator, Region III
U.S. Nuclear Regulatory Commission
801 Warrenville Road
Lisle, Illinois 60532-4351

Jerry Sarno
Township Supervisor
Covert Township
36197 M-140 Highway
Covert, Michigan 49043

Office of the Governor
Room 1 - Capitol Building
Lansing, Michigan 48913

U.S. Nuclear Regulatory Commission
Resident Inspector Office
Palisades Plant
27782 Blue Star Memorial Highway
Covert, Michigan 49043

Nuclear Facilities and Environmental
Monitoring Section Office
Division of Radiological Health
Department of Public Health
3423 N. Logan Street
P. O. Box 30195
Lansing, Michigan 48909

Gerald Charnoff, Esquire
Shaw, Pittman, Potts and Trowbridge
2300 N Street, N. W.
Washington DC 20037

Michigan Department of Attorney
General
Special Litigation Division
630 Law Building
P.O. Box 30212
Lansing, Michigan 48909

February 1995

DATED: March 2, 1995

AMENDMENT NO. 163 TO FACILITY OPERATING LICENSE NO. DPR-20-PALISADES

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E. Adensam
J. Hannon
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MGamberoni
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B. Elliot
C. Liang
ACRS (4)
OPA
OC/LFDCB
W. Kropp, RIII
SEDB

cc: Plant Service list

UNITED STATES
NUCLEAR REGULATORY COMMISSION
WASHINGTON, D.C. 20555-0001

CONSUMERS POWER COMPANY

DOCKET NO. 50-255

PALISADES PLANT

AMENDMENT TO FACILITY OPERATING LICENSE

Amendment No. 163
License No. DPR-20

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

   A. The application for amendment by Consumers Power Company (the licensee) dated October 5, 1994, as supplemented February 10, 20, and 22, 1995 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;

   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.

2. Accordingly, the license is amended by changes to the Technical Specifications as indicated in the attachment to the license amendment and Paragraph 2.C.(2) of Facility Operating License No. DPR-20 is hereby amended to read as follows:

Technical Specifications

The Technical Specifications contained in Appendix A, as revised through Amendment No. 163 , and the Environmental Protection Plan contained in Appendix B are hereby incorporated in the license. The licensee shall operate the facility in accordance with the Technical Specifications and the Environmental Protection Plan.

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

FOR THE NUCLEAR REGULATORY COMMISSION

Cynthia A Carpenter for

John N. Hannon, Director
Project Directorate III-1
Division of Reactor Projects - III/IV
Office of Nuclear Reactor Regulation

Attachment: Changes to the Technical Specifications

Date of Issuance: **March 2, 1995**

ATTACHMENT TO LICENSE AMENDMENT NO. 163

FACILITY OPERATING LICENSE NO. DPR-20

DOCKET NO. 50-255

Revise Appendix A Technical Specifications by removing the pages identified below and inserting the attached pages. The revised pages are identified by amendment number and contain vertical lines indicating the areas of change.

REMOVE	INSERT
i	i
3-1d	3-1d
3-4	3-4
3-5	3-5
3-6	3-6
3-7	3-7
3-8	3-8
3-9	3-9
3-10	3-10
3-11	--
3-12	3-12
3-13	3-13
3-25c	3-25c
3-25e	3-25e
3-25f	3-25f
3-25g	3-25g
3-30	3-30
3-33	3-33
4-6	4-6

PALISADES PLANT TECHNICAL SPECIFICATIONS
TABLE OF CONTENTS

3.1.1 Operable Components (continued)

h. Forced circulation (starting the first primary coolant pump) shall not be initiated unless one of the following conditions is met:

(1) PCS cold leg temperature (T_c) is > 430°F.

(2) S/G secondary temperature is ≤ T_c.

(3) S/G secondary temperature is < 100°F above T_c, and shutdown cooling is isolated from the PCS, and PCS heatup/cooldown rate is ≤ 10°F/hour.

(4) S/G secondary temperature is < 100°F above T_c, and shutdown cooling is isolated from the PCS, and pressurizer level is ≤ 57%.

i. When the PCS cold leg temperature is < 300°F, primary coolant pumps P-50A and P-50B shall not be operated simultaneously.

j. The PCS shall not be heated or maintained above 300°F unless a minimum of 375 kW of pressurizer heater capacity is available from both buses 1D and 1E. Should heater capacity from either bus 1D or 1E fall below 375 kW, either restore the inoperable heaters to provide at least 375 kW of heater capacity from both buses 1D and 1E within 72 hours or be in HOT SHUTDOWN within the next 12 hours.

Basis

When primary coolant boron concentration is being changed, the process must be uniform throughout the primary coolant system volume to prevent stratification of primary coolant at lower boron concentration which could result in a reactivity insertion. Sufficient mixing of the primary coolant is assured if one shutdown cooling or one primary coolant pump is in operation.[1] The shutdown cooling pump will circulate the primary system volume in less than 60 minutes when operated at rated capacity. By imposing a minimum shutdown cooling pump flow rate of 2810 gpm, sufficient time is provided for the operator to terminate the boron dilution under asymmetric flow conditions.[5] The pressurizer volume is relatively inactive, therefore will tend to have a boron concentration higher than rest of the primary coolant system during a dilution operation. Administrative procedures will provide for use of pressurizer sprays to maintain a nominal spread between the boron concentration in the pressurizer and the primary system during the addition of boron.[2]

The 57% pressurizer level, in section 3.1.1h(4), is not an analytical result, but simply a decision point between having and not having a bubble. It was chosen to agree with the maximum programmed level during power operation.

The limitation, in section 3.1.1i, on operating P-50A and P-50B together with T_c below 300°F allows the Pressure Temperature limits of Figures 3-1 and 3-2 to be higher than they would be without this limit.

3.1 PRIMARY COOLANT SYSTEM

Specification

3.1.2 PCS pressure, PCS temperature, and PCS heatup and cooldown rates shall be maintained within the following limits:

a. The primary coolant system (PCS) pressure shall be maintained within the limits of Figures 3-1 and 3-2.

b. The pressurizer heatup and cooldown rates be maintained ≤ 100°F/hour **.

c. The primary coolant system (PCS) heatup and cooldown rates be maintained within the following limits:

Reactor Vessel Inlet Temperature (T)	Heatup Rate Limit	Cooldown Rate Limit
T ≤ 170°F	20°F/hour	40°F/hour
250 ≥ T > 170°F	40°F/hour	40°F/hour
350 > T > 250°F	60°F/hour **	60°F/hour
T ≥ 350°F	100°F/hour	100°F/hour

** When shutdown cooling isolation valves MO-3015 and MO-3016 are open, PCS heatup rate shall be maintained ≤ 40°F/hour and the pressurizer heatup rate shall be maintained ≤ 60°F/hour.

Applicability

Specification 3.1.2 applies at all times.

Action

a. If the limits of Specification 3.1.2 are exceeded:

1. Return to within limits within 30 minutes, and

2. Determine that the PCS condition is acceptable for continued operation within 72 hours.

b. If any action required by 3.1.2a is not met and the associated completion time has expired:

1. The reactor shall be placed in HOT SHUTDOWN within 12 hours, and

2. The reactor shall be placed in a COLD SHUTDOWN with PCS pressure less than 270 psia, within 48 hours.

Amendment No. ~~27~~, ~~41~~, ~~55~~, ~~89~~, ~~97~~, ~~117~~, ~~131~~, 163

Figure 3-1
Pressure-Temperature Limits for Heatup

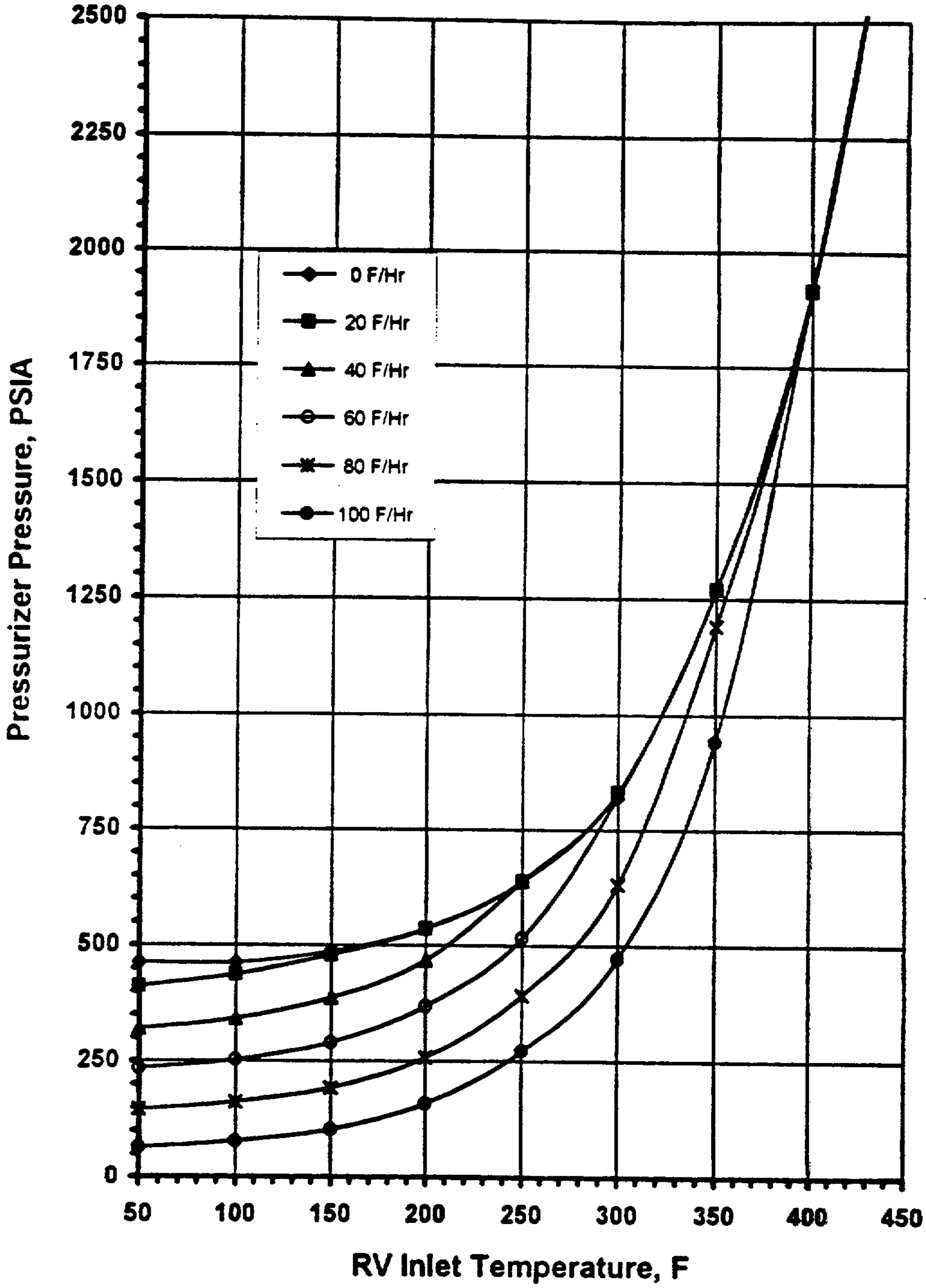
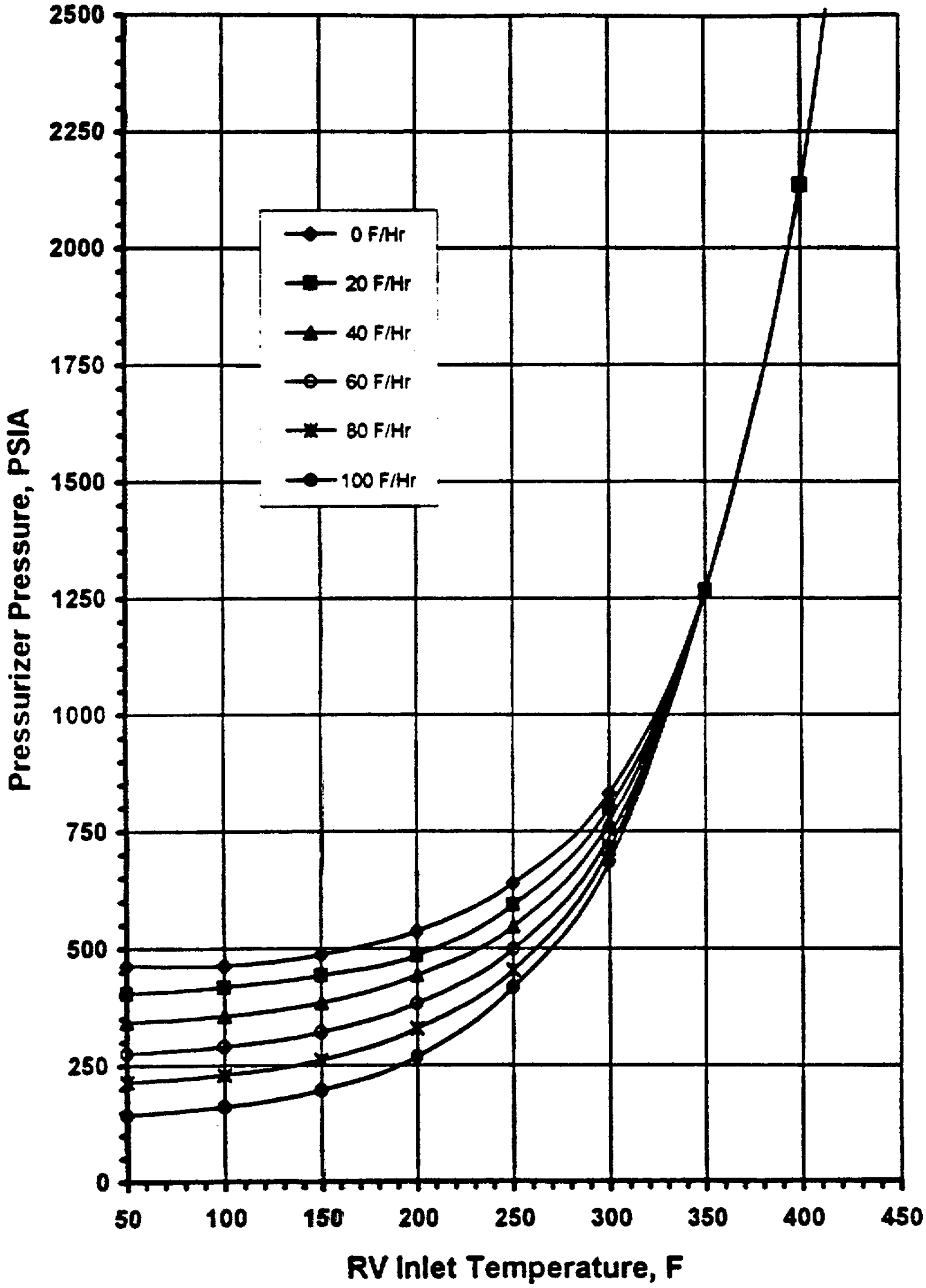


Figure 3-2
Pressure-Temperature Limits for Cooldown



Amendment No. ~~27~~, ~~41~~, ~~55~~, ~~89~~, ~~97~~, ~~117~~, ~~131~~, 163

3.1 PRIMARY COOLANT SYSTEM

Basis - Pressure Temperature Limits:

The Primary Coolant System Pressure-Temperature limits are calculated for a reactor vessel wall fluence of 2.192 x 10^{19}nvt. Before the radiation exposure of the reactor vessel exceeds that fluence, Figures 3-1 and 3-2 shall be updated in accordance with the following criteria and procedure:

1. US Nuclear Regulatory Commission Regulatory Guide 1.99 Revision 2 has been used to predict the increase in transition temperature based on integrated fast neutron flux and surveillance test data. If measurements on the irradiated specimens show increase above this curve, a new curve shall be constructed such that it is above and to the left of all applicable data points.

2. Before the end of the integrated power period for which Figures 3-1 and 3-2 apply, the limit lines on the figures shall be updated for a new integrated power period. The total integrated reactor thermal power from start-up to the end of the new power period shall be converted to an equivalent integrated fast neutron exposure (E ≥ 1 MeV). Such a conversion shall be made consistent with the dosimetry evaluation of capsule W-290[12].

3. The limit lines in Figures 3-1 and 3-2 are based on the requirements of Reference 9, Paragraphs IV.A.2 and IV.A.3.

All components in the primary coolant system are designed to withstand the effects of cyclic loads due to primary system temperature and pressure changes.[1] These cyclic loads are introduced by normal unit load transients, reactor trips and start-up and shutdown operation. During unit start-up and shutdown, the rates of temperature and pressure changes are limited. A maximum plant heatup and cooldown limit of 100°F per hour is consistent with the design number of cycles and satisfies stress limits for cyclic operation.[2]

The reactor vessel plate and material opposite the core has been purchased to a specified Charpy V-Notch test result of 30 ft-lb or greater at an NDTT of + 10°F or less. The vessel circumferential weld has the highest RT_{NDT} of plate, weld and HAZ materials at the fluence to which the Figures 3-1 and 3-2 apply.[10] The unirradiated RT_{NDT} has been determined to be -56°F.[11] An RT_{NDT} of -56°F is used as an unirradiated value to which irradiation effects are added. In addition, the plate has been 100% volumetrically inspected by ultrasonic test using both longitudinal and shear wave methods. The remaining material in the reactor vessel, and other primary coolant system components, meets the appropriate design code requirements and specific component function and has a maximum NDTT of +40°F.[5]

As a result of fast neutron irradiation in the beltline region of the core, there will be an increase in the RT_{NDT} with operation. The integrated fast neutron (E >1 MeV) fluxes of the reactor vessel are contained in Reference 13.

Basis - Pressure Temperature Limits: (continued)

Since the neutron spectra and the flux measured at the samples and reactor vessel inside radius should be nearly identical, the measured transition shift from a sample can be applied to the adjacent section of the reactor vessel for later stages in plant life equivalent to the difference in calculated flux magnitude. The maximum exposure of the reactor vessel will be obtained from the measured sample exposure by application of the calculated azimuthal neutron flux variation. The predicted RT_{NDT} shift for the base metal has been predicted based upon surveillance data and the US NRC Regulatory Guide.[10] To compensate for any increase in the RT_{NDT} caused by irradiation, limits on the pressure-temperature relationship are periodically changed to stay within the stress limits during heatup and cooldown.

Reference 7 provides a procedure for obtaining the allowable loadings for ferritic pressure-retaining materials in Class 1 components. This procedure is based on the principles of linear elastic fracture mechanics and involves a stress intensity factor prediction which is a lower bound of static, dynamic and crack arrest critical values. The stress intensity factor computed[7] is a function of RT_{NDT}, operating temperature, and vessel wall temperature gradients.

Pressure-temperature limit calculational procedures for the reactor coolant pressure boundary are defined in Reference 8 based upon Reference 7. The limit lines of Figures 3-1 and 3-2 include an allowance to account for the fact that pressure is measured in the pressurizer rather than at the vessel beltline and to account for PCP discharge pressure. In addition, for calculational purposes, 5°F and 30 psi was taken as measurement error allowances for calculation of criticality temperature. By Reference 7, reactor vessel wall locations at 1/4 and 3/4 thickness are limiting. It is at these locations that the crack propagation associated with the hypothetical flaw must be arrested. At these locations, fluence attenuation and thermal gradients have been evaluated. During cooldown, the 1/4 thickness location is always more limiting in that the RT_{NDT} is higher than that at the 3/4 thickness location and thermal gradient stresses are tensile there. During heatup, either the 1/4 thickness or 3/4 thickness location may be limiting depending upon heatup rate.

Figures 3-1 and 3-2 define stress limitations only from a fracture mechanics point of view.

Other considerations may be more restrictive with respect to pressure-temperature limits. For normal operation, other inherent plant characteristics may limit the heatup and cooldown rates which can be achieved. Pump parameters and pressurizer heating capacity tends to restrict both normal heatup and cooldown rates to less than 60°F per hour.

Basis - Pressure Temperature Limits: (continued)

The revised pressure-temperature limits are applicable to reactor vessel inner wall fluences of up to 2.192 x 10^{19}nvt. The application of appropriate fluence attenuation factors (Reference 10) at the 1/4 and 3/4 thickness locations results in RT_{NDT} shifts of 255°F and 191°F, respectively, for the limiting weld material.

The criticality condition which defines a temperature below which the core cannot be made critical (strictly based upon fracture mechanics' considerations) is 385°F. The most limiting wall location is at 1/4 thickness. The minimum criticality temperature, 385°F is the minimum permissible temperature for the inservice system hydrostatic pressure test. That temperature is calculated based upon 2310 psig inservice hydrostatic test pressure.

The restriction of average heatup and cooldown rates to 100°F/hour when all PCS cold legs are ≥ 350°F and the maintenance of a pressure-temperature relationship under Figures 3-1 and 3-2 ensures that the requirements of References 7, 8 and 9 are met. Calculation of average hourly cooldown rate must consider changes in reactor vessel inlet temperature caused by initiating shutdown cooling, by starting primary coolant pumps with a temperature difference between the steam generator and PCS, or by stopping primary coolant pumps with shutdown cooling in service.

The heatup and cooldown rate restrictions are consistent with the analyses performed for low temperature overpressure protection (LTOP) (Reference 14). Below 430°F, the Power Operated Relief Valves (PORVs) provide overpressure protection; at 430°F or above, the PCS safety valves provide overpressure protection.

Basis - Pressure Temperature Limits: (continued)

References

(1) FSAR, Section 4.2.2.

(2) ASME Boiler and Pressure Vessel Code,Section III, A-2000.

(3) Battelle Columbus Laboratories Report, "Palisades Pressure Vessel Irradiation Capsule Program: Unirradiated Mechanical Properties," August 25, 1977.

(4) Battelle Columbus Laboratories Report, "Palisades Nuclear Plant Reactor Vessel Surveillance Program: Capsule A-240," March 13, 1979, submitted to the NRC by Consumers Power Company letter dated July 2, 1979.

(5) FSAR, Section 4.2.4.

(6) (Deleted)

(7) ASME Boiler and Pressure Vessel Code, Section III, Appendix G, "Protection Against Non-Ductile Failure," 1974 Edition.

(8) US Atomic Energy Commission Standard Review Plan, Directorate of Licensing, Section 5.3.2, "Pressure-Temperature Limits."

(9) 10 CFR Part 50, Appendix G, "Fracture Toughness Requirements," May 31, 1983 as amended November 6, 1986.

(10) US Nuclear Regulatory Commission, Regulatory Guide 1.99, Revision 2, May, 1988.

(11) Combustion Engineering Report CEN-189, December, 1981.

(12) "Analysis of Capsules T-330 and W-290 from the Consumers Power Company Palisades Reactor Vessel Radiation Surveillance Program," WCAP-10637, September, 1984.

(13) Consumers Power Company letter to NRC, June 10, 1993; 10CFR50.61 Pressurized Thermal Shock - Reactor Vessel Neutron Fluence - Additional Information.

(14) Consumers Power Company Engineering Analysis EA-A-PAL-92095-01, Rev 0; "Pressure Temperature Curves and LTOP Limit Curve for Maximum Reactor Vessel Fluence of 2.192×10^{19} Neutron/cm^2"

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3.1.3 Minimum Conditions for Criticality

a) Except during low-power physics test, the reactor shall not be made critical if the primary coolant temperature is below 525°F.

b) In no case shall the reactor be made critical if the primary coolant temperature is below 385°F.

c) When the primary coolant temperature is below the minimum temperature specified in "a" above, the reactor shall be subcritical by an amount equal to or greater than the potential reactivity insertion due to depressurization.

d) No more than one control rod at a time shall be exercised or withdrawn until after a steam bubble and normal water level are established in the pressurizer.

e) Primary coolant boron concentration shall not be reduced until after a steam bubble and normal water level are established in the pressurizer.

Basis

At the beginning of life of the initial fuel cycle, the moderator temperature coefficient is expected to be slightly negative at operating temperatures with all control rods withdrawn.[1] However, the uncertainty of the calculation is such that it is possible that a slightly positive coefficient could exist.

The moderator coefficient at lower temperatures will be less negative or more positive than at operating temperature.[1,2] It is, therefore, 3.1.3 Minimum Conditions for Criticality (Cont'd)

Basis (Cont'd)

prudent to restrict the operation of the reactor when primary coolant temperatures are less than normal operating temperature (≥525°F). Assuming the most pessimistic rods out moderator coefficient, the maximum potential reactivity insertion that could result from depressurizing the coolant from 2100 psia to saturation pressure at 525°F is 0.1% $\Delta\rho$.

During physics tests, special operating precautions will be taken. In addition, the strong negative Doppler coefficient[3] and the small integrated $\Delta\rho$ would limit the magnitude of a power excursion resulting from a reduction of moderator density. The requirement that the reactor is not to be made critical below 385°F provides increased assurance that the proper relationship between primary coolant pressure and temperature will be maintained relative to the RT_{NDT} of the primary coolant system pressure boundary material. Heatup to this temperature will be accomplished by operating the primary coolant pumps.

If the shutdown margin required by Specification 3.10.1 is maintained, there is no possibility of an accidental criticality as a result of an increase of moderator temperature or a decrease of coolant pressure.

Normal water level is established in the pressurizer prior to the withdrawal of control rods or the dilution of boron so as to preclude the possible overpressurization of a solid primary coolant system.

References

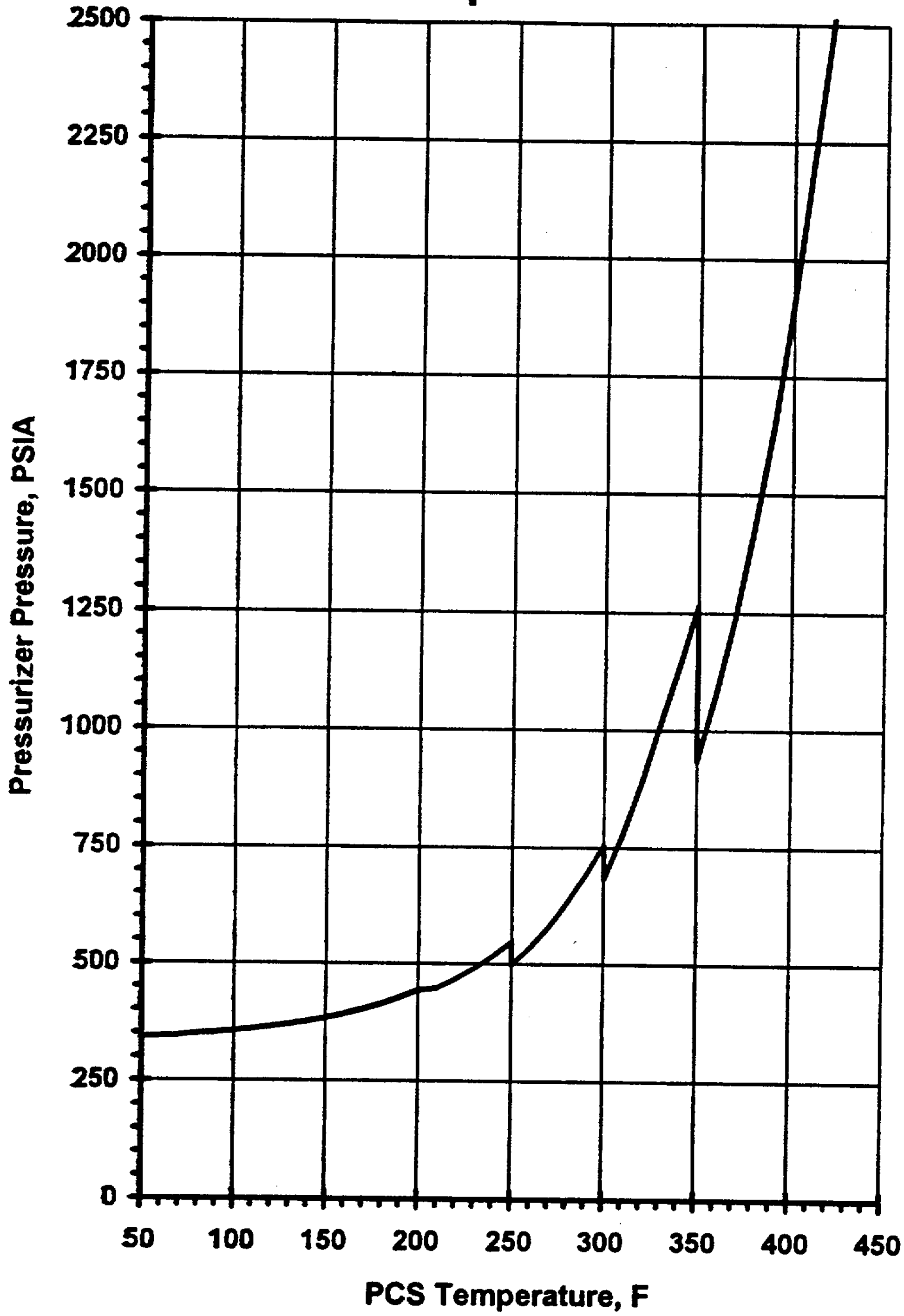
(1) FSAR, Table 3-2

(2) FSAR, Table 3-6

(3) FSAR, Table 3-3

(Next page is 3-17)

Figure 3-4
LTOP Setpoint LIMIT



3.1.8 OVER PRESSURE PROTECTION SYSTEMS

Basis 3.1.8.1 (continued)

Normally, during operation at HOT STANDBY and above, the PORV controls are in the CLOSE position, and the block valves are closed. The PORVs, block valves, and the associated manual controls must be operable. If either valve in a PORV flow path is inoperable, the other valve in the flow path must provide PCS integrity assurance. When a PORV is inoperable, the block valve must be closed; when a block valve is inoperable, the PORV must have its control in the "CLOSE" position.

If the inoperable valves cannot be restored to OPERABLE status within the specified completion time, the plant must be placed in HOT SHUTDOWN. The completion times allow the required action to be accomplished without undue haste, yet allow less time when more equipment is inoperable.

Basis 3.1.8.2

When PCS is below 430°F with the reactor vessel head installed, two PORVs are required to be operable to avoid pressures which might lead to failure of the reactor vessel. Pressure increases could be caused by sudden additions (or imbalances) of either mass or energy.

The allowable pressure limits are determined in accordance with 10 CFR 50, Appendix G, and are referred to as "Low Temperature Overpressure Protection" (LTOP) limits. The variable setpoint of the LTOP system is programmed and calibrated to ensure opening of the pressurizer PORVs when the PCS pressure is above the limit in Figure 3-4. The pressure limit for each temperature is developed from the heating or cooling limits for the PCS.

The limit in Figure 3-4 includes an allowance for pressure overshoot during the interval between the time pressurizer pressure reaches the limit, and the time a PORV opens enough to terminate the pressure rise.

LTOP is provided by two independent channels each consisting of measurement, control, actuation, and valves. Either channel is capable of providing full protection. The actual setpoint of PORV actuation for LTOP will be below the limit in Figure 3-4 to allow for potential instrument inaccuracies, and drift. This will ensure that at no time between calibration intervals will the PCS pressure exceed the limit of Figure 3-4 without PORV actuation.

Mass additions could come from the starting of pumps or from opening a Safety Injection Tank isolation valve. Only the charging pumps or high pressure safety injection pumps could cause the PCS pressure to exceed its limits. Neither the shutoff head of the low pressure safety injection pumps nor the operating pressure of the safety injection tanks is above the cold PCS pressure limit. Specification 3.3.5 places limits on HPSI pump operability when the PCS is below 300°F to assure inadvertent starting does not cause overpressurization of the PCS.

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Basis 3.1.8.2 (continued)

Energy additions could come from either the steam generators or from the reactor core. Small energy addition could come from operation of the pressurizer heaters. Energy addition from the steam generators could occur if a primary coolant pump was started when the steam generator secondary temperature was significantly above the PCS temperature. Specification 3.1.1.h places limits on the starting of primary coolant pumps to avoid undesired energy additions from the steam generators. Energy addition from the reactor core could occur due to an inadvertent criticality or to an imbalance in decay heat removal. Specification 3.10.1 places limits on shutdown margin to avoid a rod withdrawal event causing a criticality and to provide sufficient time for operator action to terminate a dilution event prior to criticality.

The potential causes of a sudden PCS pressure increase which the LTOP system must be able to mitigate are imbalance in charging and letdown flow, starting of the HPSI pumps when above 300°F, and in an imbalance in decay heat (and pressurizer heat) addition and removal. A Safety Injection Signal (SIS) could both initiate flow from two HPSI pumps (when above 300°F) and three charging pumps, and isolate letdown. The PCS heatup from a loss of shutdown cooling event occurring 24 hours after shutdown from a continuous full power run would generate less additional coolant volume than the starting of three charging pumps (Reference 5). The limiting event for the LTOP system would be an inadvertent SIS occurring during an established PCS heatup.

Analysis (Reference 1) has concluded that an SIS occurring, during a PCS and pressurizer heatup at the maximum allowable rates, either between 300°F and 430°F with the HPSI pumps, or below 300°F without the HPSI pumps, would not cause PCS pressure to exceed the Appendix G limit if either PORV opens when the set pressure is reached. With the PCS above 430°F, the pressurizer safety valves, required by Specification 3.1.7, provide adequate overpressure protection. Both PORVs are required to be operable to allow for a single failure.

If a PORV becomes inoperable when it is required for LTOP, it must be restored to operable status, or the plant must be cooled down, depressurized, and vented through a vent path with sufficient capacity to provide the necessary protection. Since the pressure response to a transient is greater if the pressurizer steam space is small or if PCS is solid, the allowed outage time for a PORV flow path out of service is shorter. The maximum pressurizer level at which credit can be taken for having a bubble (57%, which provides about 700 cubic feet of steam space) is based on judgement rather than on analyses. This level provides the same steam volume to dampen pressure transients as would be available at full power. This steam volume provides time for operator action, if the PORVs failed to operate, between an inadvertent SIS and PCS pressure reaching the 10 CFR 50 Appendix G pressure limit. The time available for action would depend upon the existing pressure and temperature when the inadvertent SIS occurred.

3.1.8 OVER PRESSURE PROTECTION SYSTEMS

Basis 3.1.8.2 (continued)

Reference 1 has determined that any vent path capable of relieving 167 gpm at a PCS pressure of 315 psia is acceptable. The 167 gpm flow rate is based on an assumed charging imbalance due to interruption of letdown flow with three charging pumps operating, a 40°F per hour PCS heatup rate, a 60°F per hour pressurizer heatup rate, and an initially depressurized and vented PCS. The PCS heatup rate is limited to 40°F per hour by Specification 3.1.2c; the pressurizer heatup rate is limited to 60°F per hour by Specification 3.1.2b. Neither HPSI pump nor PCP starts need to be assumed with the PCS initially depressurized, because Specification 3.3.5 requires both HPSI pumps to be incapable of injection into the PCS and operating procedures prohibit PCP operation.

The pressure relieving ability of a vent path depends not only upon the area of the vent opening, but also upon the configuration of the piping connecting the vent opening to the PCS. A long, or restrictive piping connection may prevent a larger vent opening from providing adequate flow, while a smaller opening immediately adjacent to the PCS would be adequate. The areas of multiple vent paths cannot simply be added to determine the necessary vent area.

The following vent path examples are acceptable:

1. Removal of the reactor vessel head,
2. Removal of a steam generator primary manway,
3. Removal of the pressurizer manway,
4. Removal of a PORV or pressurizer safety valve,
5. Both PORVs and associated block valves open,
6. Opening of both PCS vent valves PC-514 and PC-515.

Reference 2 determined that venting the PCS through PC-514 and PC-515 provided adequate flow area. The other listed examples provide greater flow areas with less piping restriction and are therefore acceptable. Other vent paths shown to provide adequate capacity could also be used.

One open PORV provides sufficient flow area to prevent excessive PCS pressure. However, if the PORVs are elected as the vent path, both valves must be used to meet the single failure criterion, since the PORVs are held open against spring pressure by energizing the operating solenoid.

When the shutdown cooling system is in service with MO-3015 and MO-3016 open, additional overpressure protection is provided by the relief valves on the shutdown cooling system. References 3 and 4 show that this relief capacity will prevent the PCS pressure from exceeding its pressure limits during any of the above mentioned events.

References

1. Consumers Power Company Engineering Analysis, EA-A-PAL-92095-01
2. Consumers Power Company Engineering Analysis, EA-TCD-91-01-01.
3. Consumers Power Company Engineering Analysis, EA-PAL-89-040-1
4. Consumers Power Company Corrective Action Document, A-PAL-91-011
5. Consumers Power Company Engineering Analysis, EA-AG-93-02

3.3.3 Prior to returning to the Power Operation Condition after every time the plant has been placed in the Refueling Shutdown Condition, or the Cold Shutdown Condition for more than 72 hours and testing of Specification 4.3.h has not been accomplished in the previous 9 months, or prior to returning the check valves in Table 4.3.1 to service after maintenance, repair or replacement, the following conditions shall be met:

a. All pressure isolation valves listed in Table 4.3.1 shall be functional as a pressure isolation device, except as specified in b. Valve leakage shall not exceed the amounts indicated.

b. In the event that integrity of any pressure isolation valve specified in Table 4.3.1 cannot be demonstrated, at least two valves in each high pressure line having a non-functional valve must be in and remain in, the mode corresponding to the isolated condition.(1)

1 Motor-operated valves shall be placed in the closed position and power supplies deenergized.

3.3.4 Two HPSI pumps shall be operable when the PCS temperature is >325°F.

a) One HPSI pump may be inoperable provided the requirements of Section 3.3.2.c are met.

3.3.5 Two HPSI pumps shall be rendered incapable of injection into the PCS when PCS temperature is <300°F, if the reactor vessel head is installed.

Note: Specification 3.3.5 does not prohibit use of the HPSI pumps for emergency addition of makeup to the PCS.

Basis (continued)

demonstrate that the maximum fuel clad temperatures that could occur over the break size spectrum are well below the melting temperature of zirconium (3300°F).

Malfunction of the Low Pressure Safety Injection Flow control valve could defeat the Low Pressure Injection feature of the ECCS; therefore, it is disabled in the 'open' mode (by isolating the air supply) during plant operation. This action assures that it will not block flow during Safety Injection.

The inadvertent closing of any one of the Safety Injection bottle isolation valves in conjunction with a LOCA has not been analyzed. To provide assurance that this will not occur, these valves are electrically locked open by a key switch in the control room. In addition, prior to critical the valves are checked open, and then the 480 volt breakers are opened. Thus, a failure of a breaker and a switch are required for any of the valves to close.

Insuring both HPSI pumps are incapable of injecting into the PCS when the PCS temperature is <300°F eliminates PCS mass additions due to inadvertent HPSI pump starts. Both HPSI pumps starting in conjunction with a charging/letdown imbalance may cause 10CFR50 Appendix G limits to be exceeded when the PCS temperature is <300°F. A note is provided to assure that this specification does not cause hesitation in the use of a HPSI pump for PCS makeup if it is needed due to a loss of shutdown cooling of a loss of PCS inventory.

Rendering the HPSI pumps "incapable of injection" means to assure that a single event cannot cause overpressurization of the PCS due to operation of the HPSI pump. Typical methods of accomplishing this are the pulling of the HPSI pump breaker control power fuses, racking out the HPSI pump circuit breaker, or closing the manual discharge valve.

The requirement to have both HPSI trains operable above 325°F provides added assurance that the effects of a LOCA occurring under LTOP conditions would be mitigated. If a LOCA occurs when the primary system temperature is less than or equal to 325°F, the pressure would drop to the level where low pressure safety injection can prevent core damage. When the PCS temperature is ≥300°F and ≤325°F operation of the HPSI system would not cause the 10CFR50 Appendix G limits to be exceeded nor is HPSI system operation necessary for core cooling.

References

(1) FSAR, Section 9.10.3;
(2) FSAR, Section 6.1,
(3) FSAR, Section 14.17
(4) Letter, H.G.Shaw (ANF) to R.J.Gerling (CPCo), "Standard Review Plan Chapter 15 Disposition of Events Review for Changes to Technical Specifications Limits for Palisades Safety Injection Tank Liquid Levels", April 11, 1990.

4.1 OVERPRESSURE PROTECTION SYSTEM TESTS

Surveillance Requirements

In addition to the requirements of Specification 4.0.5, each PORV flow path shall be demonstrated OPERABLE by:

1. Testing the PORVs in accordance with the inservice inspection requirements for ASME Boiler and Pressure Vessel Code, Section XI, Section IWV, Category B valves.

2. Performance of a CHANNEL CALIBRATION on the PORV actuation channel at least once per 18 months.

3. When the PORV flow path is required to be OPERABLE by Specification 3.1.8.1:

   (a) Performing a complete cycle of the PORV with the plant above COLD SHUTDOWN at least once per 18 months.

   (b) Performing a complete cycle of the block valve prior to heatup from COLD SHUTDOWN, if not cycled within 92 days.

4. When the PORV flow path is required to be OPERABLE by Specification 3.1.8.2:

   (a) Performance of a CHANNEL FUNCTIONAL TEST on the PORV actuation channel, but excluding valve operation, at least once per 31 days.

   (b) Verifying the associated block valve is open at least once per 72 hours.

5. Both High Pressure Safety Injection pumps shall be verified incapable of injection into the PCS at least once per 12 hours, unless the reactor head is removed, when either PCS cold leg temperature is <300°F, or when both shutdown cooling suction valves, MO-3015 and MO-3016, are open.

Basis

With the reactor vessel head installed when the PCS cold leg temperature is less than 300°F, or if the shutdown cooling system isolation valves MO-3015 and MO-3016 are open, the start of one HPSI pump could cause the Appendix G or the shutdown cooling system pressure limits to be exceeded; therefore, both pumps are rendered inoperable.

UNITED STATES
NUCLEAR REGULATORY COMMISSION
WASHINGTON, D.C. 20555-0001

SAFETY EVALUATION BY THE OFFICE OF NUCLEAR REACTOR REGULATION

RELATED TO AMENDMENT NO. 163 TO FACILITY OPERATING LICENSE NO. DPR-20

CONSUMERS POWER COMPANY

PALISADES PLANT

DOCKET NO. 50-255

1.0 INTRODUCTION

By letter dated October 5, 1994, as supplemented February 10, 20 and 22, 1995, the Consumers Power Company (CPCo or the licensee) requested an amendment to the Technical Specifications (TS) appended to Facility Operating License No. DPR-20 for the Palisades Plant. The proposed amendment would revise primary coolant system (PCS) pressure-temperature (P-T) limits, power-operated relief valve (PORV) setting limits, and primary coolant pump (PCP) starting limits to accommodate reactor vessel fluence for an additional 4 effective full power years (EFPY). The amendment would also revise the emergency core cooling system TS to render two high-pressure safety injection (HPSI) pumps incapable of injecting into the PCS when the PCS is below 300°F rather than rendering both inoperable below 260°F. In addition, it would revise the pressurizer heatup to achieve consistency between design assumptions and TS limits.

The licensee's P-T limits were prepared from embrittlement estimates that were based on the data that was available prior to October 5, 1994. Subsequent to that date, the licensee gathered additional data that affected its embrittlement estimates. The additional data was provided to the staff at a meeting in NRC headquarters on November 21, 1994. These data were provided to the staff as part of the licensee's recent pressurized thermal shock (PTS) evaluation. Since the additional data affect the embrittlement estimates for the Palisades reactor vessel, the staff has included the data from the PTS evaluation in its assessment of the proposed Palisades P-T limits. The February 10, 20, and 22, 1995, submittals provided clarifying information and a revised figure 3-4 that was more restrictive. Therefore, these submittals provided information that was within the scope of the initial application and did not affect the staff's initial proposed no significant hazards consideration findings.

2.0 EVALUATION

2.1 P-T Limits

The staff evaluates the P-T limits based on the following NRC regulations and guidance: Appendix G to 10 CFR Part 50; Generic Letters (GL) 88-11 and 92-01; Regulatory Guide (RG) 1.99, Rev. 2; and Standard Review Plan (SRP) Section 5.3.2. Appendix G to 10 CFR Part 50 requires that P-T limits for the reactor vessel must be at least as conservative as those obtained by Appendix G to Section III of the American Society of Mechanical Engineers (ASME) Code. GL 88-11 requires that licensees use the methods in RG 1.99, Rev. 2, to predict the effect of neutron irradiation by calculating the adjusted reference temperature (ART) of reactor vessel materials. The ART is defined as the sum of initial reference temperature (RT_{NDT}) of the material, the mean value for the adjustment in RT_{NDT} caused by neutron irradiation, and a margin to account for uncertainties in the initial RT_{NDT}, percent nickel, copper, neutron fluence and calculational procedures. The mean value for the adjustment in RT_{NDT} is calculated from the product of a chemistry factor and a fluence factor. The chemistry factor is dependent upon the amount of copper and nickel in the vessel material. GL 92-01 requires licensees to submit reactor vessel materials data, which the staff will use in the review of the P-T limits. SRP 5.3.2 provides guidance on calculation of the P-T limits using the linear elastic fracture mechanics methodology specified in Appendix G to Section III of the ASME Code. The linear elastic fracture mechanics methodology specified in Appendix G to Section III of the ASME Code requires that the analysis be performed using postulated sharp surface defects that are normal to the direction of maximum stress and have a depth of one-fourth of the section thickness (1/4T) and a length of 1 1/2 the section thickness. The critical locations in the vessel for this methodology is the 1/4T and 3/4T locations, which correspond to the maximum depth of the postulated inside surface and outside surface defects, respectively.

The licensee's P-T limit evaluation determined the adjusted reference temperature caused by radiation in accordance with the methodology in RG 1.99, Revision 2. In this methodology, the adjustment in reference temperature is dependent upon the neutron fluence and the amounts of copper and nickel in the material. The adjustment in reference temperature was determined using the best-estimate amounts of copper for the Palisades reactor vessel materials that were available on October 5, 1994. The licensee's evaluation did not include the chemical composition data provided subsequent to that date. These additional data affected the projected amount of embrittlement for welds fabricated using heat numbers 34B009 and W-5214 weld wire.

The effect of radiation on the Palisades reactor vessel was evaluated during the staff's assessment of the licensee's PTS evaluation. The staff's PTS assessment indicates that the Palisades reactor vessel was fabricated by Combustion Engineering and that the limiting material with respect to PTS in the Palisades reactor vessel beltline is the axial weld fabricated using weld wire heat number W-5214. The Palisades reactor vessel beltline also contains axial welds fabricated using weld wire heat number 34B009 and a circumferential weld fabricated using weld wire heat number 27204.

As part of its PTS evaluation, the licensee determined the best-estimate value of the percent copper and nickel from surrogate weld data that were fabricated using the same weld wire heat number as the Palisades beltline welds. These data indicate that the best-estimate for the percent copper and nickel are: (a) 0.212% copper and 1.02% nickel for weld wire heat number W-5214, (b) 0.19% copper and 0.99% nickel for weld wire heat number 34B009, and (c) 0.208% copper and 1.00% nickel for weld wire heat number 27204. These values of copper and nickel result in chemistry factors of: (a) 232°F for weld wire heat number W-5214, (b) 219°F for weld wire heat number 34B009, and (c) 228°F for weld wire heat number 27204.

The surrogate weld chemistry data for heat number W-5214 weld wire indicated a large variability in the percent copper and percent nickel. After considering the large variability in percent copper and nickel, the limiting weld is the weld fabricated using weld wire heat number 27204, since it has the highest ART of 255°F and 191°F at the 1/4T and 3/4T locations, respectively. This weld is not limiting for PTS because it is a circumferentially oriented weld and is further from the screening criteria in the PTS rule than the heat number W-5214 weld.

Substituting the limiting ARTs into equations in SRP 5.3.2, the staff verified that the proposed P-T limits satisfy the requirements in paragraphs IV.A.2 and IV.A.3 of Appendix G of 10 CFR Part 50.

In addition to beltline materials, Appendix G of 10 CFR Part 50 also imposes a minimum temperature at the closure head flange based on the reference temperature for the flange material. Section IV.A.2 of Appendix G states that when the pressure exceeds 20% of the preservice system hydrostatic test pressure, the temperature of the closure flange regions highly stressed by the bolt preload must exceed the reference temperature of the material in those regions by at least 120°F for normal operation and by 90°F for hydrostatic pressure tests and leak tests. Based on the flange RT_{NDT} of 40°F, the staff has determined that the proposed P-T limits have satisfied the requirement for the closure flange region during normal operation, hydrostatic pressure test and leak test.

The licensee's P-T limit evaluation determined the adjusted reference temperature caused by radiation in accordance with the methodology in RG 1.99, Revision 2, and the data available prior to October 5, 1994. The staff reviewed this data and questioned what effect the additional data would have on the evaluation. In response, the licensee stated that the new data would not affect the results. The licensee will resubmit its technical assessment of the P-T limits based on the data submitted as part of its PTS evaluation before May 1, 1995, to confirm the conclusions stated in the February 22, 1995, letter.

The staff has performed an independent analysis to verify the licensee's proposed P-T limits, and reviewed the chemical composition data from PTS discussions during the November 21, 1994, meeting. The staff concludes that the proposed P-T limits for heatup and cooldown are valid for a neutron fluence at the limiting weld of 2.192E19 n/cm^2, which corresponds to 6 EFPY from the beginning of cycle 10 because (1) the limits conform to the requirements of Appendix G of 10 CFR Part 50 and GL 88-11, and (2) the material properties and chemistry used in calculating the P-T limits are consistent with data submitted as part of the licensee's PTS evaluation and the staff's PTS assessment. Hence, the proposed P-T limits may be incorporated into the Palisades TSs.

2.2 PORV Setting Limit, PCP Starting Limit and HPSI Pump Restrictions

The PCS P-T limits during plant heatup and cooldown for Palisades Plant are specified in TS Figures 3-1 and 3-2. The existing PCS P-T limits were calculated for a reactor vessel wall fluence of 1.8×10^{19}nvt. The pressurizer PORVs are used for overpressure mitigation against an inadvertent mass addition or energy addition event during low-temperature operating conditions. The PORV setpoints are specified in TS Figure 3-4 which assures that the transient peak PCS pressure are within the P-T limits specified in Figures 3-1 and 3-2. Restrictions for starting the first PCP are specified in TS 3.1.1h. These restrictions would ensure that the PCS P-T limits are protected against an energy addition event while the secondary side temperature is more than 100°F hotter than the PCS temperature. TS 3.1.1h also ensures the closure of shutdown cooling system isolation valves prior to forced circulation to protect the shutdown cooling system from exceeding its pressure limit. Limitations for HPSI pump operability during low temperature operation conditions are specified in TS 3.3 which would eliminate the potential mass addition from the HPSI pumps during an inadvertent safety injection actuation.

CPCo proposed changes to the P-T curves in TS Figures 3-1 (for heatup) and 3-2 (for cooldown), to TS Figure 3-4 (for PORV setpoints), to TS 3.1.1h (for starting first PCP), and to TS 3.3 (for HPSI pump operability). The licensee states that the existing PCS P-T limits were based on a reactor vessel wall fluence of 1.8×10^{19}nvt. The changes in TS 3.1.1h and TS Figure 3-4 are intended to protect against P-T limits specified in the revised TS Figures 3-1 and 3-2. The revised TS 3.3 would allow the HPSI pumps to remain operable during low temperature operating conditions so that these pumps could be manually actuated for PCS makeup in case the shutdown cooling capability is lost. However, when the PCS temperatuare is less than 300°F, the HPSI pumps would be rendered incapable of injection into the PCS by manually interrupting the power supplies to HPSI pumps or by isolating the flow path.

In the current TS, when the temperature of the PCS cold leg is less than or equal to 430°F with the reactor vessel head unremoved, low temperature overpressurization is protected by either of the pressurizer PORVs with lift settings specified in TS Figure 3-4. These settings were developed to avoid PCS pressure from exceeding the PCS P-T limits which were developed per the requirements of 10 CFR Part 50, Appendix G. The new PORV settings were determined using the proposed PCS P-T limits and the ASME Code Case N-514 which allows the maximum allowable P-T limits to be 10% above the P-T limits specified in the revised TS Figures 3-1 and 3-2. Since the ASME Code Case N-514 has not been officially endorsed by NRC, the licensee submitted an exemption request on February 10, 1995. On March 2, 1995, the staff approved an exemption from the requirements of 10 CFR Part 50, Appendix G, so that the Palisades Plant could take this needed 10% allowance in the maximum allowable P-T limits to avoid operational difficulties at Palisades.

The most limiting mass addition transient assumed in the licensee's analysis is an inadvertent safety injection actuation with the letdown system isolated. For PCS temperature above 300°F, the mass input from two HPSI pumps and three charging pumps was assumed following a safety injection actuation. For PCS temperature below 300°F the mass input from three charging pumps was assumed. This is consistent with the revised TS 3.3 which requires that both HPSI pumps be rendered incapable of injection into the PCS. The new analysis incorporates additional conservatisms in the areas of the assumed PCS volume, charging flow and HPSI flow rate.

The most limiting energy addition transient assumed in the licensee's analysis is the start of the first idle PCP with secondary system temperature less than 100°F above the PCS cold leg temperature. The results of the analysis indicates that the transient PCS peak pressures are below their allowable P-T limits under isothermal conditions. The PCS was assumed in water solid condition prior to the transient for added conservatism in the licensee's analysis to support the proposed PORV settings.

The current TS 3.1.1h specifies the restriction of starting the first idle PCP at various PCS temperatures. The licensee proposed a revised TS 3.1.1h which would provide more generalized starting conditions for the first idle PCP. The revised PCP starting criteria are based on the licensee's calculations for protecting PCS P-T limits under a design basis energy addition transient. The proposed TS 3.1.1h(3) would permit the first idle PCP starting when the secondary system temperature is less than 100°F above PCS cold leg temperature and PCS heatup or cooldown rate is less than or equal to 10°F/hour. This proposed TS is supported by the licensee's analysis since at 10°F/hour heatup or cooldown rate, the P-T limits is very close to the isothermal curve which was assumed in the analysis. The proposed TS 3.1.1h(4) would permit starting the first PCP when the secondary system temperature is less than 100°F above PCS cold leg temperature and pressurizer level is less than or equal to 57%. The licensee stated that the 57% pressurizer level would indicate that there is a steam bubble in the pressurizer and the presence of the steam bubble in the pressurizer would provide protection against PCS P-T limits for a higher heatup and cooldown rate when the secondary system temperature is less than 100°F above PCS cold leg temperature. In response to the staff's request for a justification of the above assertion, the licensee in its letter dated February 20, 1995, submitted a revised TS Figure 3-4 which reflects lower PORV setpoints than its originally proposed settings in its October 5, 1994, letter. In addition, the licensee provided the results of its study regarding an energy addition transient due to startup of an idle PCP when the secondary system temperature is 100°F above the PCS temperature with a steam bubble in the pressurizer. The licensee stated that because the PORV stroke time is relatively short, it will reach full open before the PCS pressure exceeds 105% of its setpoint. The volume of the steam bubble is more than enough to compensate for the expansion of primary coolant due to heatup by the secondary system fluid at a temperature which is 100°F higher than the PCS temperature. The pressure rise will be stopped when the PORVs reach full open because the relief capacity of one single PORV exceeds the calculated PCS expansion rate. The licensee has concluded that the results of its calculations confirm that with the revised TS Figure 3-4, the resultant peak pressure will remain below the transient pressure limit allowed by ASME Code Case N-514. We find the licensee's assessment acceptable.

The proposed TS 3.1.1i prevents PCP P-50A and P-50B being operated simultaneously when the PCS cold leg temperature is less than 300°F. This is an added TS to minimize the potential challenge to the allowable PCS P-T limit under low temperature operating conditions.

The licensee proposed changes in TS 3.1, 3.3, Figures 3-1, 3-2 and 3-4 reflect the changes discussed above. The staff has reviewed the licensee's submittals and finds that the changes are based on applicable regulatory guidance in SRP 5.2.2 (Revision 2), are reasonably conservative and are acceptable.

3.0 STATE CONSULTATION

In accordance with the Commission's regulations, the Michigan State official was notified of the proposed issuance of the amendment. The Michigan State official had no comments.

4.0 ENVIRONMENTAL CONSIDERATION

The amendment changes a requirement with respect to the installation or use of a facility component located within the restricted area as defined in 10 CFR Part 20. The staff has determined that the amendment involves no significant increase in the amounts, and no significant change in the types, of any effluents that may be released offsite, and that there is no significant increase in individual or cumulative occupational radiation exposure. The Commission has previously issued a proposed finding that the amendment involves no significant hazards consideration and there has been no public comment on such finding (60 FR 501). Accordingly, the amendment meets the eligibility criteria for categorical exclusion set forth in 10 CFR 51.22(c)(9).

5.0 CONCLUSION

The staff has concluded, based on the considerations discussed above, that: (1) there is reasonable assurance that the health and safety of the public will not be endangered by operation in the proposed manner, (2) such activities will be conducted in compliance with the Commission's regulations, and (3) the issuance of the amendment will not be inimical to the common defense and security or to the health and safety of the public.

Principal Contributors: B. Elliot
C. Liang

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