December 14, 1977

Docket No. 50-305

DISTRIBUTION
Docket
NRC PDR
Local PDR
VStello
KRGoller
ASchwencer
SMSheppard
DNeighbors
OELD
OI&E(5)
BJones(4)
BScharf(15)
JMcGough
BHarless
DEisenhut
ACRS(16)
OPA(CMiles)
DRoss

Wisconsin Public Service Corporation
ATTN: Mr. E. W. James
Senior Vice President
Post Office Box 1200
Green Bay, Wisconsin 54305

Gentlemen:

The Commission has issued the enclosed Amendment No. 17 to Facility License No. DPR-43 for the Kewaunee Nuclear Power Plant. This amendment consists of changes to the Technical Specifications in response to your request dated July 8, 1977.

The amendment revises the Technical Specifications to modify ~~moderate~~ heatup and cooldown pressure-temperature limitations.

Copies of the Safety Evaluation and Notice of Issuance are also enclosed.

Sincerely,

Original signed by

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

Enclosures:
1. Amendment No. 17 to DPR-43
2. Safety Evaluation
3. Notice of Issuance

cc w/enclosures:
See next page

Const. 1

60

OFFICE	ORB#1	OELD	ORB#1			
SURNAME	DNeighbors	JLawrence *	ASchwencer			
DATE	11/8/77	11/9/77	11/14/77			

x27433:tsb

NRC FORM 318 (9-76) NRCM 0240

☆ U.S. GOVERNMENT PRINTING OFFICE: 1976—626-624

* See attached memo

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

December 14, 1977

Docket No. 50-305

Wisconsin Public Service Corporation
ATTN: Mr. E. W. James
Senior Vice President
Post Office Box 1200
Green Bay, Wisconsin 54305

Gentlemen:

The Commission has issued the enclosed Amendment No. 17 to Facility License No. DPR-43 for the Kewaunee Nuclear Power Plant. This amendment consists of changes to the Technical Specifications in response to your request dated July 8, 1977.

The amendment revises the Technical Specifications to modify heatup and cooldown pressure-temperature limitations.

Copies of the Safety Evaluation and Notice of Issuance are also enclosed.

Sincerely,

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

Enclosures:
1. Amendment No. 17 to DPR-43
2. Safety Evaluation
3. Notice of Issuance

cc w/enclosures:
See next page

cc: Steven E. Keane, Esquire
Foley, Sammond & Lardner
777 East Wisconsin Avenue
Milwaukee, Wisconsin 53202

Bruce W. Churchill, Esquire
Shaw, Pittman, Potts & Trowbridge
1800 M Street, NW
Washington, D. C. 20036

Kewaunee Public Library
314 Milwaukee Street
Kewaunee, Wisconsin 54216

Mr. Donald L. Quistorff
Chairman Kewaunee County Board
Kewaunee County Courthouse
Kewaunee, Wisconsin 54216

Mr. Lester Huber
Chairman, Town of Carlton
Route 1
Kewaunee, Wisconsin 54216

Mr. Norman M. Clapp, Chairman
Public Service Commission of
Wisconsin
Hill Farms State Office Building
Madison, Wisconsin 53702

Chief, Energy Systems
Analyses Branch (AW-459)
Office of Radiation Programs
U. S. Environmental Protection Agency
Room 645, East Tower
401 M Street, S. W.
Washington, D.C. 20460

U. S. Environmental Protection Agency
Federal Activities Branch
Region V Office
ATTN: EIS COORDINATOR
230 South Dearborn Street
Chicago, Illinois 60604

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

WISCONSIN PUBLIC SERVICE CORPORATION

WISCONSIN POWER AND LIGHT COMPANY

MADISON GAS AND ELECTRIC COMPANY

DOCKET NO. 50-305

KEWAUNEE NUCLEAR POWER PLANT

AMENDMENT TO FACILITY OPERATING LICENSE

Amendment No. 17
License No. DPR-43

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

   A. The application for amendment by Wisconsin Public Service Corporation, Wisconsin Power and Light Company and Madison Gas and Electric Company (the licensee) dated July 8, 1977, 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.

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-43 is hereby amended to read as follows:

   (2) Technical Specifications

   The Technical Specifications contained in Appendices A and B, as revised through Amendment No. 17, are hereby incorporated in the license. The licensee shall operate the facility in accordance with the Technical Specifications.

3. This license amendment will be effective January 1, 1978.

FOR THE NUCLEAR REGULATORY COMMISSION

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

Attachment:
Changes to the Technical
Specifications

Date of Issuance: December 14, 1977

ATTACHMENT TO LICENSE AMENDMENT NO. 17

FACILITY OPERATING LICENSE NO. DPR-43

DOCKET NO. 50-305

Revise Appendix A as follows:

Remove the following pages and replace with identically numbered pages:

TS 3.1-3	Figure TS 3.1-1
TS 3.1-4	Figure TS 3.1-2
TS 3.1-5	
TS 3.1-6	
TS 3.1-7	

b. HEATUP AND COOLDOWN LIMIT CURVES FOR NORMAL OPERATION

Specification

1. The reactor coolant temperature and pressure and system heatup and cooldown rates (with the exception of the pressurizer) shall be limited in accordance with Figures TS 3.1-1 and TS 3.1-2 for the service period up to 6.6 equivalent fullpower years.

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

   b. Figures TS 3.1-1 and TS 3.1-2 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.

2. The secondary side of the steam generator must not be pressurized above 200 psig if the temperature of the steam generator is below 70°F.

3. The pressurizer heatup and cooldown rates shall 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.

Basis

Fracture Toughness Properties

The fracture toughness properties of the ferritic material in the reactor coolant pressure boundary are determined in accordance with the ASME Boiler and Pressure Vessel Code [1], and the calculation methods of reference [2]. The post-irradiation fracture toughness properties of the reactor vessel belt line material were obtained directly from the Kewaunee Reactor Vessel Material Surveillance Program.

Allowable pressure-temperature relationships for various heatup and cooldown rates are calculated using methods derived from Nonmandatory Appendix G in Section III of the ASME Boiler and Pressure Vessel Code, and are discussed in detail in Reference (3).

The method specifies 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 for the metal temperature at that time. Furthermore, the approach applies explicit safety factors of 2.0 and 1.25 (The 1.25 safety factor K_{It} represents additional conservatism above Code requirements.) on stress intensity factors induced by pressure and thermal gradients, respectively. Thus, the governing equation for the heatup-cooldown analysis is:

$$2\,K_{Im} + 1.25\,K_{It} \leqslant K_{IR} \qquad (3.1B\text{-}1)$$

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.

From equation (3.1B-1) the variables that effect the heatup and cooldown analysis can be readily identified. K_{IM} is the stress intensity factor due to membrane (pressure) stress. K_{It} is the thermal (bending) stress intensity factor and accounts for the linearly varying stress in the vessel wall due to thermal gradients. During heatup K_{It} is negative on the inside and positive on the outer surface of the vessel wall. The signs are reversed for cooldown and, therefore, an ID or an OD one quarter thickness surface flaw is postulated in whichever location is more limiting. K_{IR} is dependent on irradiation and temperature and, therefore, the fluence profile through the reactor vessel wall and the rates of heatup and cooldown are important. Details of the procedure used to account for these variables is explained in the following text.

Following the generation of pressure-temperature curves for both the steady-state (zero rate of change of temperature) 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 composite curve is then adjusted to allow for possible errors in the pressure and temperature sensing instruments.

The use of the composite curve is 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 OD to the ID location. 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 the ID. The thermal gradients

induced during cooldown tend to produce tensile stresses at the ID location and compressive stresses at the OD 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. Again adjustments are made to account for pressure and temperature instrumentation error.

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, of course, is not true for the steady-state situation. It follows that the ΔT induced during cooldown results in a calculated higher K_{IR} for finite cooldown rates than for steady-state under certain conditions.

Limit curves for normal heatup and cooldown of the primary reactor coolant system have been calculated using the methods discussed above. The derivation of the limit curves is consistent with NRC Regulatory Standard Review Plan Directorate of Licensing, Section 5.3.2 "Pressure-Temperature Limits" 1974 in Reference (1).

Transition temperature shifts occurring in the pressure vessel materials due to radiation exposure have been obtained directly from the reactor pressure vessel surveillance program. Weld metal Charpy test specimens from Capsule V indicate that the core region weld metal exhibits the largest shift in RT_{NDT} (195°F). The capsule experienced an equivalent dose of 6.6 effective fullpower years presented in WCAP 8908.

The results of the first Irradiation Capsule analysis are presented in WCAP 8908. Heatup and cooldown limit curves for normal operation of the reactor vessel are presented in Figures TS 3.1-1 and TS 3.1-2 and represent an operational time period of 6.6 effective fullpower years.

Pressure 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 compatibility of operation with the fatigue analysis performed in accordance with Code requirements.

REFERENCES

1. ASME Boiler and Pressure Vessel Code, "Nuclear Power Plant Components" Section III, Summer 1972 Addenda, Non-Mandatory Appendix G - "Protection Against Non-ductile Failure."

2. Standard Method for Measuring Thermal Neutron Flux by Radioactivation Techniques, ASTM designation E262-70, 1975 Book of ASTM Standards, Part 45, pp. 756-763.

3. W. S. Hazelton, S. L. Anderson, and S. E. Yanichko, "Basis for Heatup and Cooldown Limit Curves," WCAP 7924, July 1972.

4. S. E. Yanichko, S. L. Anderson, and K. V. Scott, "Analysis of Capsule V from the Wisconsin Public Service Corporation Kewaunee Nuclear Plant Reactor Vessel Radiation Surveillance Program," WCAP 8908, January 1977.

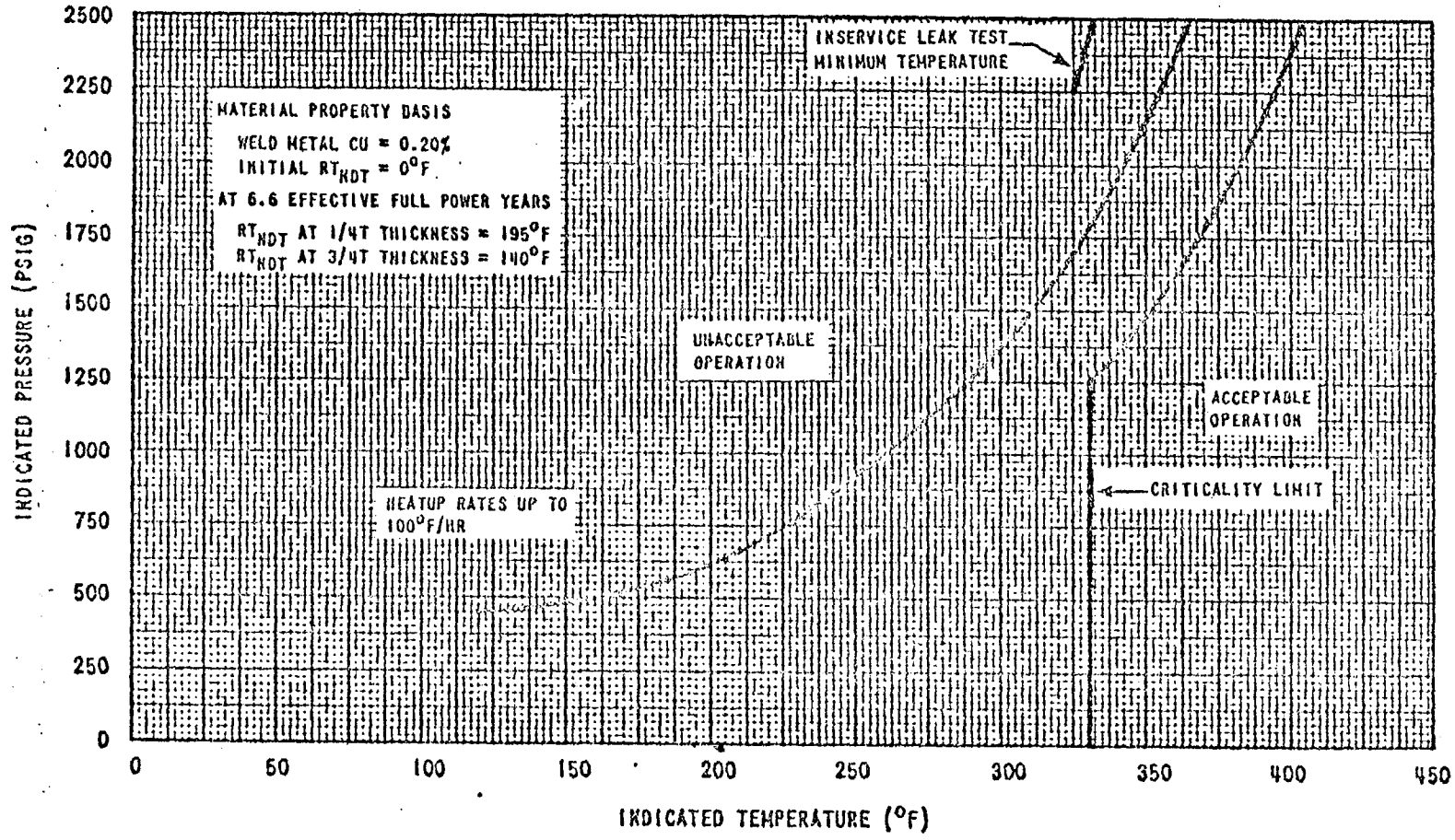

Figure TS 3.1-1

Figure TS 3.1-1 Kewaunee Reactor Coolant System Heatup Limitations Applicable for Periods up to 6.6 Effective Full Power Years. Margins of 60 PSIG and 10°F are Included for Possible Instrument Error

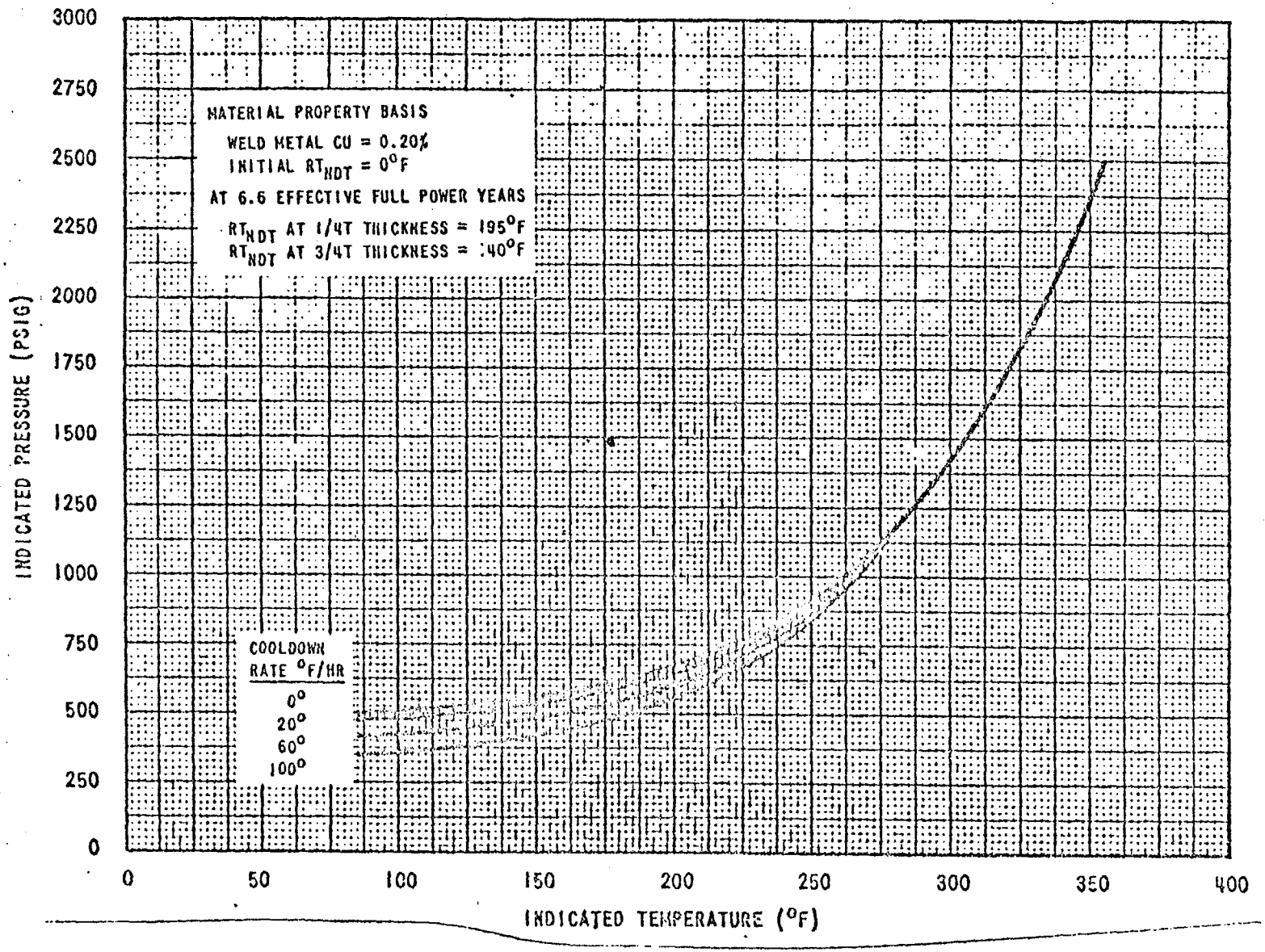

Figure TS 3.1-2 Kewaunee Reactor Coolant System Cooldown Limiations Applicable for Periods up to 6.6 Effective Full Power Years. Margins of 60 PSIG and 10°F are Included for Possible Instrument Error

Figure TS 3.1-2

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

SAFETY EVALUATION BY THE OFFICE OF NUCLEAR REACTOR REGULATION

SUPPORTING AMENDMENT NO. 17 TO FACILITY LICENSE NO. DPR-43

WISCONSIN PUBLIC SERVICE CORPORATION

WISCONSIN POWER AND LIGHT COMPANY

MADISON GAS AND ELECTRIC COMPANY

KEWAUNEE NUCLEAR POWER PLANT

DOCKET NO. 50-305

Introduction

By letter dated July 8, 1977, Wisconsin Public Service Corporation (the licensee), requested revisions to the Kewaunee Nuclear Power Plant Technical Specifications which would incorporate changes to the heatup and cooldown pressure-temperature limits for Kewaunee.

Discussion

The heatup and cooldown pressure-temperature Technical Specification changes are based on testing and postirradiation data obtained from the material surveillance capsule (Capsule V) removed from the Kewaunee reactor vessel. To account for revised estimates of radiation damage, the proposed curves reflect a shift in the pressure-temperature curve to higher temperatures. Also, the schedule for subsequent surveillance capsule withdrawal and analysis has been modified to permit continued verification of adequate conservatism in the pressure-temperature limit curve.

Evaluation

The Kewaunee Nuclear Power Plant pressure-temperature operating limit curves, Figures TS 3.1-1 and TS 3.1-2 of the Technical Specifications were derived using the test results obtained from surveillance Capsule V. The test results were reported and analyzed in Westinghouse report WCAP-8908. The pressure-temperature operating limits were derived in accordance with Appendix G, ASME Code Section III and WCAP-7924, and are valid for operation through 6.6 EFPY.

We have reviewed the proposed pressure-temperature operating limits for Kewaunee and conclude that they are in conformance with Appendix G, 10 CFR 50 through 6.6 EFPY; such conformance, in establishing these limits will ensure adequate safety margins during operation, testing, maintenance and postulated accident conditions and constitutes an acceptable basis for satisfying the requirements of General Design Criteria 31, Appendix A, 10 CFR 50. We conclude these changes to the Technical Specifications are acceptable.

We have also reviewed the proposed withdrawal schedule for subsequent surveillance capsules and conclude that it meets the requirements of Appendix H, 10 CFR 50, and is acceptable.

Environmental Consideration

We have determined that this amendment does not authorize a change in effluent types or total amounts nor an increase in power level and will not result in any significant environmental impact. Having made this determination, we have further concluded that this amendment involves an action which is insignificant from the standpoint of environmental impact and pursuant to 10 CFR §51.5(d)(4) that an environmental impact statement, negative declaration, or environmental impact appraisal need not be prepared in connection with the issuance of this amendment.

Conclusion

We have concluded, based on the considerations discussed above, that: (1) because the amendment does not involve a significant increase in the probability or consequences of accidents previously considered and does not involve a significant decrease in a safety margin, the amendment does not involve a significant hazards consideration, (2) there is reasonable assurance that the health and safety of the public will not be endangered by operation in the proposed manner, and (3) such activities will be conducted in compliance with the Commission's regulations and the issuance of these amendments will not be inimical to the common defense and security or to the health and safety of the public.

Date: December 14, 1977

UNITED STATES NUCLEAR REGULATORY COMMISSION

DOCKET NO. 50-305

WISCONSIN PUBLIC SERVICE CORPORATION

WISCONSIN POWER AND LIGHT COMPANY

MADISON GAS AND ELECTRIC COMPANY

NOTICE OF ISSUANCE OF AMENDMENT TO FACILITY OPERATING LICENSE

The U. S. Nuclear Regulatory Commission (the Commission) has issued Amendment No. 17 to Facility Operating License No. DPR-43 issued to Wisconsin Public Service Corporation, Wisconsin Power and Light Company, and Madison Gas and Electric Company which revised Technical Specifications for operation of the Kewaunee Nuclear Power Plant located in Kewaunee, Wisconsin. The amendment will become effective as of January 1, 1978.

The amendment revises the Technical Specifications to modify heatup and cooldown pressure-temperature limitations.

The application for the amendment complies with the standards and requirements of the Atomic Energy Act of 1954, as amended (the Act), and the Commission's rules and regulations. The Commission has made appropriate findings as required by the Act and the Commission's rules and regulations in 10 CFR Chapter I, which are set forth in the license amendment. Prior public notice of this amendment was not required since the amendment does not involve a significant hazards consideration.

The Commission has determined that the issuance of this amendment will not result in any significant environmental impact and that pursuant to 10 CFR §51.5(d)(4) an environmental impact statement or negative declaration and environmental impact appraisal need not be prepared in connection with the issuance of this amendment.

For further details with respect to this action, see (1) the application for amendment dated July 8, 1977, (2) Amendment No. 17 to Facility Operating License No. DPR-43, and (3) the Commission's related Safety Evaluation. All of these items are available for public inspection at the Commission's Public Document Room, 1717 H Street, N. W., Washington, D. C. 20555, and at the Kewaunee Public Library, 314 Milwaukee Street, Kewaunee, Wisconsin 54216. A copy of items (2) and (3) may be obtained upon request addressed to the U. S. Nuclear Regulatory Commission, Washington, D. C. 20555, Attention: Director, Division of Operating Reactors.

Dated at Bethesda, Maryland, this 14th day of December 1977.

FOR THE NUCLEAR REGULATORY COMMISSION

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