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SUBJECT:
FORWARDING TABLE SUMMARIZING THE EXISTING RHR RELIEF VALVE AND THE PROPOSED OVERPRESSURE PROTECTION RELIEF VALVE AND AN EVALUATION OF THE OVERPRESSURE PROTECTION RELIEF VALVE SIZING... W/ATT SUPPORTING INFO.

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REGULATORY DOCKET FILE

January 30, 1978

FEB 2 1978
U.S. NUCLEAR REGULATORY COMMISSION
Mail Section

Office of Nuclear Reactor Regulation
U. S. Nuclear Regulatory Commission
Washington, D. C. 20555

Attention Mr. A. Schwencer, Chief
Operating Reactors Branch #1

Dear Sir:

Docket 50-305
Operating License DPR-43
Overpressurization

Enclosed please find (1) a table summarizing the existing RHR relief valve and the proposed overpressure protection relief valve and (2) an evaluation of the overpressure protection relief valve sizing. Enclosure (2) is intended to demonstrate the adequacy of the relief valve we have selected to provide overpressure protection for the Kewaunee Nuclear Power Plant. Both enclosures are being submitted in response to requests made by members of your staff.

Very truly yours,

Carl W. Giesler
for

E. W. James
Senior Vice President
Power Supply & Engineering

sa

Enc.

780330050

A010/S
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Enclosure (1)

Kewaunee Nuclear Power Plant
Overpressure Protection System Relief
Valve Specific Information

	Existing Relief Valve	Overpressure Protection Valve
Manufacturer	Crosby	Crosby
Inlet Size	2 inches	4 inches
Outlet size	3 inches	6 inches
Orifice Type	J	P
Set Pressure	500 psig	525 psig
Accumulation	10%	10%
Capacity (Fluid)	400 gpm (Design)	2438 gpm

Evaluation of Overpressure Protection Relief Valve Sizing - 4 inch inlet, "P" Orifice

Reference: Pressure Mitigating Systems Transient Analysis Results, Westinghouse Electric Corporation, July 1977.

A. Calculation of rate of pressure rise for a given mass input rate:

From Figure M15 for SI pump startup:

Pressure (psia)	Time (Sec.)
200	1.6
650	4.85

Δ pressure = 450 psia, Δ time = 3.25 sec.

rate of pressure rise = $\frac{450}{3.25}$ = 138 psia/sec

Average SI pump output over pressure range 200-650 psia is obtained from Figure 2.3.2, curve C: (pump characteristic cure is linear over this range)

Pressure (psia)	Flow rate (gpm)
200	810
650	990
	Average=900 gpm

Therefore, at a delivery rate of 900 gpm the rate of pressure rise for a 6000 cubic foot plant is 138 psi/sec.

B. Calculation of equivalent mass input rate for a heat input transient, initial RCS temperature 250°F, ΔT=100°F:

From Figure H12 the maximum rate of pressure rise for each case given is determined graphically by a tangent of maximum slope to each curve:

Initial RCS Temp. (°F)	Time at 600 psia (sec.)	Time at 2600 psia (sec.)	Max. Rate of Pressure Rise (psi/sec)
100	11.5	33.5	90.9
140	9.0	23.7	136.1
180	8.0	19.0	181.8

Example: @ 100°F initial RCS Temp.:

$$\frac{2000 \text{ psi}}{(33.5-11.5)\text{sec.}} = 90.9 \frac{\text{psi}}{\text{sec}}$$

The attached figure plots the above data, indicating a linear relationship. Extending the line to 250°F initial RCS temperature results in a rate of pressure rise of 262 psi/sec.

Now, using the correlation between mass input rate and rate of pressure rise from part A, the equivalent mass input rate for the rate of pressure rise due to this heat input transient can be calculated as follows:

$$\dot{V} = \frac{(900 \text{ gpm})\ (262 \text{ psi/sec})}{138 \text{ psi}/\text{sec}} = 1710 \text{ gpm}$$

C. Evaluation of Relief Valve Sizing

The valve manufacturer, Crosby, has supplied the following data based on a 4-inch valve with a "P" orifice, set pressure 550 psig, and temperature 350°F.

Accumulation	Capacity per fluid formula	Capacity with flashing
10%	2438 gpm	954 gpm
25%	4069 gpm	1591 gpm

From part B the maximum mass input rate for 250°F initial RCS temperature is 1710 gpm. Based on the valve data for 350°F, it is apparent that the valve would exceed 1710 gpm capacity at an accumulation of less than 30%. This capacity would be reached at a much lower accumulation for the actual case of 250°F RCS temperature since the penalty associated with two phase flow will be significantly less than the 350°F penalty assumed.

From the pressure-temperature limitations curve, Figure TS 3.1-2 Kewaunee Technical Specifications, a pressure of 1060 psig can be permitted for an RCS temperature of 250°F (the instrument error conservatism has been removed). A 30% accumulation is equivalent to 683 psig based on a 525 psig valve setpoint; therefore, the plant pressure limitation would not be exceeded. In fact, more than 300 psi margin is provided with this conservative analysis method.

The relief valve as specified is fully capable of mitigating any potential overpressure condition of the Kewaunee Plant.

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