Consumers Power Company

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Mr James G. Keppler
Office of Inspection Enforcement
Region III
US Nuclear Regulatory Commission
799 Roosevelt Road
Glen Ellyn, IL 60137

DOCKET 50-255, LICENSE DPR-20
PALISADES PLANT, THERMAL DISCHARGE

On October 24, 1975 the temperature differential between the intake and discharge exceeded 5°F for a period of about one hour. The maximum differential temperature reached 6.3°F during this period of time. An analysis of this event showed that after subtracting the effect of the service water (which is exempt from the temperature limits) the actual discharge temperature would have been less than 5°F and, therefore, no Technical Specification limit was exceeded. This method of analysis (with respect to the 5°F Technical Specification limit) was discussed in our letter to Dr George W. Knighton dated July 11, 1975 and was also discussed with members of your staff during a meeting held on September 17, 1975.

The attached is a description of the analysis used to show the effect of the service water and is provided for your information.

David A. Bixel

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Assistant Nuclear Licensing Administrator

CC: Director of Nuclear Reactor Regulation
File

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PALISADES PLANT
EXAMPLE CALCULATION
EFFLUENT DISCHARGE TEMPERATURE

The total heat rejected to the lake is:

$$Q_T = \sum mCp\Delta T$$

$$= (m_W + m_{BD} + m_D)Cp(T_{MB}-T_I) \qquad (1)$$

Where: m = Mass Flow Lb/h

T = Temperature, °F

W = Wier

BD = Blowdown Pipe

D = Dilution Water

MB = Mixing Basin Discharge

I = Inlet

Cp = Specific Heat of Water = $\frac{1 \text{ Btu}}{\text{lb x °F}}$

The maximum allowable heat rejected to the lake permitted by the 5°F limit on the closed cycle cooling system is:

$$Q_{ccs} \leq (m_W + m_{BD} + m_D)Cp(5°F)$$

The heat rejected to the lake from the closed cycle cooling system (adjusting the total by subtracting the heat of the service water system, which is exempt from this requirement) is:

$$Q_{ccs} = Q_T - m_{sw} \text{ x } Cp \text{ x } \Delta T_{sw}$$

or

$$Q_{ccs} = (m_W + m_{BD} + m_p)Cp(T_{MB} - T_I) - M_{sw} \text{ x } Cp \text{ x } \Delta T_{sw}$$

Solving for $(T_{MB} - T_I)$ gives:

$$T_{MB} - T_I = \frac{Q_{ccs} + M_{sw} \text{ x } Cp \text{ x } \Delta T_{sw}}{(m_W = m_{BD} = m_D)Cp}$$

To determine the maximum permissible total discharge temperature which will meet the 5°F limit for the closed cycle cooling system substitute Q_{ccs} (in the limit) equal to $(m_W + m_{BD} + m_D)Cp(5°F)$ or:

$$T_{MB} - T_I = \frac{(m_W + m_{BD} + m_D)Cp(5°F) + m_{sw} \times Cp \times \Delta T_{sw}}{(m_W + m_{BD} + m_D)Cp}$$

$$T_{MB} - T_I = 5°F + \frac{m_{sw}\,\Delta T_{sw}}{m_W + m_{BD} + m_D} \qquad (2)$$

On October 24, 1975, a discharge temperature of 6.3°F was observed. The following data was measured or conservatively estimated for use in determining heat rejected to the lake.

$T_{MB} - T_I = 6.3°F$

$m_W = 5,400 \text{ gpm} = 2.70 \times 10^6 \text{ Lb/h}$

$m_{BD} = 1,800 \text{ gpm} = 9.00 \times 10^5 \text{ Lb/h}$

$m_D = 60,000 \text{ gpm} = 2.998 \times 10^7 \text{ Lb/h}$

$m_{sw} = 10,000 \text{ gpm} = 5.0 \times 10^6 \text{ Lb/h}$

$\Delta T_{sw} = 10°F$

From equation (1) the total heat rejected to the lake is:

$$Q_T = (2.64 \times 10^6 \text{ Lb/h} + 8.8 \times 10^5 \text{ Lb/h} + 2.94 \times 10^7 \text{ Lb/h}) \frac{1 \text{ Btu}}{1 \text{ LB } °F} \times 6.3°F$$

$$Q_T = 2.12 \times 10^8 \text{ Btu/h (42\% of Limit)}$$

From equation (2), the maximum permissible total discharge temperature is:

$$T_{MB} - T_I = \frac{5°F + 5.0 \times 10^6 \text{ Lb/h} \times 10°F}{3.36 \times 10^7 \text{ Lb/h}}$$

$$= 5°F + 1.49°F$$

$$T_{MB} - T_I = 6.49°F$$