UNITED STATES
NUCLEAR REGULATORY COMMISSION
REGION III
799 ROOSEVELT ROAD
GLEN ELLYN, ILLINOIS 60137

SAFETY EVALUATION BY THE OFFICE OF NUCLEAR REACTOR REGULATION

WITHDRAWAL OF SERVICE WATER TEMPERATURE LIMIT

CONSUMERS POWER COMPANY

PALISADES PLANT

DOCKET NO. 50-255

1.0 INTRODUCTION

Consumers Power Company (the licensee) submitted a Technical Specifications Change Request on December 2, 1986, entitled "Diesel Fire Pump Operability and Service Water Temperature." Supplemental information was provided in letters dated January 28, 1987, and February 25, 1987. The February 25, 1987 letter requested withdrawal of part of the subject proposed change relating to the operability of the diesel fire pumps.

Previous evaluations for the five critical service water component heat loads provided a basis for plant operation with the service water temperature at or below 53°F. The five critical components and the results of the previous evaluations described in greater detail in the letters referenced above were: (1) for the component cooling water heat exchangers, a 70.8°F maximum service water temperature limit based on service water flow to the heat exchanger of 3130 gpm; (2) for the control room cooler, a 62°F maximum service water temperature based on a differential pressure across the cooler of 8 psi; (3) for the emergency diesel generator, a maximum service water temperature of 61°F based on an inlet pressure of 15 psig; (4) for the containment air coolers, a maximum service water temperature of 75°F based on 4875 gpm service water flow; and (5) for the west engineered safeguards room, a maximum service water temperature limit of 58°F based on a service water flow of 109 gpm.

The NRC accepted withdrawal of the licensee's commitment and proposed operability limitations related to the diesel fire pumps in their letter of March 23, 1987, and indicated that further evaluations would be forthcoming to provide justifications to conclude that the service water temperature operating restriction of 53°F as proposed in the Technical Specifications Change Request is no longer applicable.

By letter dated April 13, 1987, Consumers Power Company, requested withdrawal of the December 2, 1986 change request in its entirety.

The licensee also provided revised evaluations for the critical heat loads as follows:

1. The component cooling water heat exchanger maximum service water temperature has been analyzed at 81°F for the available 3130 gpm flow. The actual heat load was determined to be significantly lower than previously assumed, and resulted in a higher allowable service water temperature.

2. The control room cooler evaluation has determined the cooler can remove required heat loads with available service water flow at 80°F.

3. The diesel generator vendor has verified that service water inlet temperature of 80°F, at less than design flow, is acceptable.

4. The containment air coolers can remove their design heat load with 80°F inlet temperature and a service water flow of 1700 gpm to each cooler (5100 gpm for three coolers).

5. The engineered safeguards room cooler can maintain the room equipment within their environmental qualification temperature with an 80°F service water inlet temperature at a flow rate of 142 gpm.

6. The evaluation of historical data on service water temperature shows that this temperature has only twice exceeded 80°F by 1°F over the past five years (a total time of three shifts).

7. The evaluation of the probability of the event of concern occurring when the service water temperature exceeds 80°F is 2.7×10^{-13} events per year.

2.0 EVALUATION

The staff has reviewed the licensee's analytical methods, assumptions, and results of the licensee's revised evaluations. In addition, Consumers Power Company has agreed to conduct a performance test of the west engineered safeguards room air cooler to validate analytical assumptions made in the analysis. Because of the need for sensitive instrumentation to perform this test, it is their intention to install the instrumentation during the scheduled 1987 maintenance outage and conduct the performance test during the refueling outage when the plant is operating on shutdown cooling. They point out that the air side of the cooler was cleaned during the past outage and the water side was inspected for evidence of fouling and none was found. Based on this, they have determined that the cooler performance meets the manufacturer's original performance characteristics.

Consumers Power Company has also agreed to review their outstanding relief requests from the pump and valve testing requirements of Section XI of the ASME Code to determine if they are still appropriate in light of experience gained during the augmented testing done during this last outage. The staff expects that this review and those reviews committed to as part of the Material Condition Task Force effort regarding surveillance testing, and post-maintenance testing, will result in a total continuing test program that will ensure that the required flows produced by the recent service water system flow balancing, will be verified at the appropriate times over the life of the plant.

2.1 Containment Air Coolers

In the April 13, 1987 submittal, the licensee stated that the three containment air coolers (CAC), VHX 1, 2, and 3, have been shown to be adequate to remove the total FSAR required heat load under accident conditions. The analysis assumed each CAC has a service water flow of 1700 gpm, a service water inlet temperature of 80°F, and an air flow of 30,000 SCFM. The results of the analysis show that for these conditions, the heat removal capacity of the CAC's exceeds the FSAR heat removal capacity for each CAC by about a 4.6% margin. Following the recent flow balancing tests, the actual service water flow was measured at an average of 1859 gpm for each CAC and the air flow was measured at an average of 35,566 SCFM. These higher flow rates provide additional margin in the heat removal capacity.

2.2 Component Cooling Water Heat Exchanger

The reduced heat removal capability of the component cooling water heat exchangers due to reduced component cooling water flow was accepted by the staff in the SER forwarded by letter dated March 29, 1987. In the April 13, 1987 submittal, the licensee evaluated the effect of this reduction in heat transfer from the containment to the service water. The revised heat load for the service water is 62.2×10^6 BTU/hr consisting of 55.5×10^6 BTU/hr for the maximum shutdown cooling heat exchanger heat load, 1.0×10^6 BTU/hr for pump heat and other heat loads and ten percent (5.7 BTU/hr) for conservatism.

With this heat load and 3130 gpm service water flow, the required service water inlet temperature is 81°F.

2.3 Diesel Generators

In the April 13, 1987 submittal, the licensee provided the results of the latest flow balancing tests and the diesel generator manufacturer's analysis of these results compared to the operating limits of the diesel generator. Under the limiting conditions, the actual service water flow to each diesel generator was 383 gpm and 389 gpm, and when the operator closes the containment service water outlet valve, the service water to the diesel generators will increase to above 600 gpm.

The manufacturer assumed a service water flow of 383 gpm with an inlet service water temperature of 80°F, and calculated the jacket water temperature (out of engine, into cooler) to be 182°F, and the lube oil temperature (into engine) to be 172°F. The manufacturer's acceptance criteria for the standard engine operating limits for continuous duty in high ambient condition allows a jacket water temperature of 190°F and a lube oil temperature of 200°F. The calculated temperatures are within the manufacturers acceptance criteria.

2.4 Control Room Cooler

In the April 13, 1987 submittal, the licensee states that the cooler capacity was reduced to 420,000 BTU/hr in 1983 by modifications to reduce Freon flow. With 80°F service water, a flow of 77 gpm is required for this capacity. The latest flow balancing test resulted in a measured flow of 89 gpm which provides reasonable margin. In addition, the licensee reports that the actual heat load on this cooler is only 105,524 BTU/hr, thus providing additional margin.

2.5 Engineered Safeguards Room Coolers

The West Engineered Safeguards Room Cooler provided the limiting heat load that established the basis of the application for the amendment dated December 2, 1986, imposing an inlet service water temperature limit. In the April 13, 1987 submittal, the licensee provided a reanalysis of the heat loads and cooler performance based on the available service water flow and air flow measured in testing performed early this year. Included with the reanalysis is a detailed listing of the differences in the analyses with justifications for these differences. Such details as piping lengths, piping temperatures, air flows in the room which were measured subsequent to the first analysis, etc., are fully described. The staff finds these differences and their justifications acceptable.

Both analyses used comparable conservative assumptions as identified in the February 25, 1987 submittal (CPCo analysis) and in the April 13, 1987 submittal (Westinghouse Updated Analysis) except for the heat sink temperatures. The CPCo analysis was a static analysis that imposed room bulk air temperature of 100°F and an air temperature of 70°F out of the coolers which directly impacts some of the hot safety injection system piping. This maximized the heat input to the room since the analysis results showed a 135°F room temperature with 59°F service water at a flow rate of 109 gpm. Therefore, the analysis did not take credit for the self regulation of a decreasing heat input as the room temperature rose to 135°F with a constant temperature heat source. The Westinghouse Updated Analysis did take credit for this by using the calculated 135°F room bulk air temperature and 88°F air temperature out of the coolers. This resulted in a reduction of about 200,000 BTU/hr heat input from piping (a 33 percent reduction). The only additional significant change is the reduction of approximately 100,000 BTU/hr (a 29 Percent reduction) in pump and fan motor heat loads into the room by deleting the auxiliary feedwater pump input since that pump is powered by the diesel

generator assumed to be failed and by recomputing the other heat inputs from the motors using acceptably conservative methods. This resulted in a total heat load into the room of 650,513 BTU/hr for the first six hours after recirculation begins and then a reducing heat load as containment sump temperatures decrease. This heat load with the measured 142 gpm service water flow and assumed service water inlet temperature of 80°F produced a maximum bulk room temperature of 135°F, which is the original FSAR design basis. When the containment service water isolation valve is closed, approximately 20 minutes after diesel generator failure, the service water flow rate would be increased to 214 gpm providing additional margin.

2.6 Technical Specifications

Regulatory Guide 1.27, "Ultimate Heat Sinks For Nuclear Power Plants," states in Position C.4 that technical specifications for the plant should include provisions for actions to be taken in the event that conditions threaten partial loss of the capability of the ultimate heat sink. Since the licensee's analysis is based on 80°F inlet service water temperature, an increase above 80°F would represent such a partial loss. Position C.2.c, defines the criteria for such events to be considered as "reasonably probable combinations of less severe natural phenomena and/or site related events." In this case the natural phenomena is the elevated lake temperature from which the service water takes suction and the site related events are loss of coolant accident (LOCA), loss of off-site power, failure of diesel generator 1-2, plant at power, and the lake water (service water inlet) exceeds 80°F.

2.6.1 Historical Service Water Temperatures

In the submittal dated April 13, 1987, the licensee provided the time history of service water temperature readings taken in the summer months since 1982. This data shows that the service water inlet temperature has only exceeded 80°F by 1°F on two occasions for a brief period of time (one or two shifts). These time periods are shorter than the time required to complete the action statement of Technical Specifications 3.0.3 which defines the actions to be taken in the event a limit defined in the Technical Specifications cannot be met.

2.6.2 Probability of the Event

The event of concern has a low probability of occurrence. In the submittal dated April 13, 1987, the licensee estimates this probability of the postulated events as follows:

1. Large Break LOCA 1.0 E-04 events per year
2. Probability of loss of off-site power 1.65 E-04
3. Probability of failure of diesel generator 1-2 5.9 E-02
4. Probability of plant at power 5.0 E-01
5. Probability of inlet service water temperature exceeding 80°F 5.5 E-04 (based on historical data in 2.6.1)

The probability of postulated events occurring simultaneously is 2.7 E-13.

Although the staff may not agree with these specific probability values, the staff believes the likelihood of this sequence of events to be negligibly low and thus concludes that a limit in the Technical Specifications is not appropriate.

3.0 Conclusion

Based on the foregoing evaluation of the service water system capabilities with the balanced flows as measured in the augmented testing performed during this past outage, and with reliance on the improved periodic and post-maintenance testing being developed by the licensee to ensure that these flows are maintained, the staff concurs that operation of the service water system as described produces no reduction in the margin of safety. The staff also concludes that the operation as described produces no significant increase in the consequences of accidents previously analyzed, and that the possibility of a new accident not previously analyzed has not been created. Finally, no change in Technical Specifications (i.e., additional fire pump requirements or addition of a service water inlet temperature limit) is required.

Dated: May 1, 1987

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