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ComEd

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SVP-99-151

U.S. Nuclear Regulatory Commission
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Quad Cities Nuclear Power Station, Units 1 and 2
Facility Operating License Nos. DPR-29 and DPR-30
NRC Docket Nos. 50-254 and 50-265

Subject: Response to Questions Related to Containment Overpressure Analysis

References: (1) Letter from J. P. Dimmette, Jr. (ComEd) to USNRC, "Request for License Amendment Pursuant to 10 CFR 50.90 Credit for Containment Overpressure," SVP-99-012, dated January 29, 1999.

(2) Teleconference between R. M. Pulsifer (USNRC) and Commonwealth Edison (ComEd) Company, dated July 1, 1999.

In the Reference (1) submittal, Commonwealth Edison (ComEd) Company requested a license amendment related to the use of containment overpressure to support the Net Positive Suction Head (NPSH) available for the Emergency Core Cooling Systems (ECCS) at Quad Cities Nuclear Power Station, Units 1 and 2. In the Reference (2) teleconference, the NRC forwarded several questions related to the submittal which concerned the impact of the higher calculated suppression pool temperatures on the Core Spray and Residual Heat Removal motor bearings. The attachment to this letter provides our response to these questions.

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Should you have any questions concerning this letter, please contact Mr. C.C. Peterson at (309) 654-2241, extension 3609.

Respectfully,

Joel P. Dimmette, Jr.
Site Vice President
Quad Cities Nuclear Power Station

Attachment: Response to Questions Related to Containment Overpressure Analysis

cc: Regional Administrator – NRC Region III
NRC Senior Resident Inspector – Quad Cities Nuclear Power Station

In the Reference (1) submittal, ComEd provided the following assessment of the higher calculated suppression pool temperature on the Core Spray (CS) and Residual Heat Removal (RHR) motor bearings:

F.5.1 Motor Bearing Cooling Water Temperature

"The original FSAR analysis of post-accident suppression pool temperature determined a maximum pool temperature of approximately 177° F, while the original NPSH analysis determined a maximum pool temperature of 179° F. Recent re-analysis with 2 sigma uncertainty adders determined a maximum temperature of approximately 182° F. The CS motor and RHR motor bearings are cooled by the suppression pool water following an accident. The effect of the increased peak pool temperature on the motor bearings has been reviewed and determined to be acceptable."

In the Reference (2) teleconference, the NRC asked three questions related to this information. The following provides the answers to these questions.

(1) Provide details of the review and how was it determined to be acceptable?

Bearing and lubrication information contained in the station Equipment Qualification (EQ) documentation and supporting information was reviewed to determine the impact on the RHR and CS motor bearings. In summary, the higher suppression pool peak temperature following a postulated design basis Loss of Coolant Accident (LOCA) was found to be acceptable because the motor bearing lubrication is qualified for use at the increased pool temperature Based on engineering judgement, the small increase in suppression pool temperature for a short period of time was judged to have an insignificant effect on motor bearing life. The details of this evaluation are as follows.

The RHR and CS pump motors are General Electric (GE) vertical induction air-cooled motors and are similar except for horsepower rating. The motors use duplex angular contact ball thrust/guide bearings lubricated and cooled by an upper oil reservoir assembly and a lower radial ball bearing lubricated and cooled by a lower oil reservoir assembly. In addition, the upper oil reservoir assembly contains a cooling coil, which is supplied cooling water from the respective pump discharge and returned to the pump suction. The GE motor outline drawings state the thrust bearing cooling water requirement as four (4) gallons per minute (gpm) with an inlet temperature of 165° F maximum for a short period of time. In addition, the drawing also requires the lubricant to have a viscosity of 150 Saybolt Universal Seconds (SUS) at 100° F and 45 SUS at 210° F.

The RHR system also has a heat exchanger located upstream of each motor cooling coil that was designed to reduce the coil cooling inlet water temperature (reactor water) in the shutdown cooling mode of operation as described in Updated Final Safety Analysis Report (UFSAR), Sections 5.4.7.2.1 and 5.4.7.2.2. These heat exchangers use RHR Service Water (RHRSW) with a Technical Specifications maximum temperature limit of 95° F. Because the RHRSW system requires operator action to initiate, supplemental cooling of the

RHR pump fluid would not be provided in the short term, Low Pressure Coolant Injection (LPCI) mode of operation, but would be available in the long term, containment cooling mode of operation, when the peak suppression pool temperature occurs. In addition, the cooling requirements of the RHR pump motor thrust bearing are established by the more limiting shutdown cooling mode of operation. For these reasons, additional review for peak pool temperature during a design bases LOCA was judged as not required for the RHR pump motors.

Specific to the CS pumps, in 1996 a Problem Identification Form (PIF) was generated concerning UFSAR Table 6.2-3 which listed a peak pool temperature of 177° F, which exceeded the requirements for the CS motor bearings. The increase in cooling temperature has the effect of decreasing oil viscosity, which has the effect of decreasing the oil film thickness necessary for normal bearing operation and at the same time decreasing the thermal life of the oil. The qualification data report for these motors is contained in the Station's EQ binders and was reviewed for this concern. The CS pump motors are EQ qualified for a period significantly longer than the required 12 days of post LOCA operation at 150° F room temperature. The report states that Mobil Oil Company indicates that DTE oil can resist thermal breakdown and operate satisfactorily at 250° F and at 200° F the thermal life of the oil will be approximately 26,280 hours (1095 days). The upper oil reservoir steady state temperature would be about 200 ° F with 165 ° F cooling water. Quad Cities Station uses Mobil DTE 797 oil in the CS and RHR motors as recommended by GE and supported by test data. The report also states that the bearings have a life of 50,000 hours (2083 days). Note that typical run times on the RHR and CS pump motors do not exceed 500 hours (21 days) per year. Based on discussions with GE, the upper oil reservoir temperature is expected to be 211° F with a cooling water temperature of 177° F and a maximum room temperature of 150° F. At this temperature the Mobil DTE 797 oil has a viscosity of approximately 43 SUS. Based on information in the bearing vendor manual the expected life of the bearings at a continuous 211° F would result in a 35% decrease in the normal 50,000 hour bearing life. Based on the suppression pool temperature being above 165° F for less then a day the decrease in bearing life was judged to be insignificant. Therefore, the PIF associated with the post LOCA pool temperature was closed.

The GE long term post LOCA containment analysis supporting the Reference (1) submittal determined that the suppression pool would be above 165° F for about one day with a peak temperature of 182° F. Based on review of the above information, the lubrication continues to be qualified for use at the increased pool temperature and based on engineering judgement the small increase in suppression pool temperature for a short period was judged to have an insignificant effect on bearing life.

(2) Provide design specification of the motor bearing temperature.

As indicated above, the RHR and CS pump motors are GE vertical induction air-cooled motors and are similar except for horsepower rating. The motors use duplex angular contact ball thrust/guide bearings lubricated and cooled by an upper oil reservoir assembly, and a lower radial ball bearing lubricated and cooled by a lower oil reservoir assembly. In addition, the upper oil reservoir

assembly contains a cooling coil, which is supplied cooling water from the respective pump discharge and returned to the pump suction. The GE motor outline drawings state the thrust bearing cooling water requirement as four gpm with an inlet temperature of 165° F maximum for a short period of time. In addition, the drawing also requires the lubricant to have a viscosity of 150 SUS at 100° F and 45 SUS at 210°F.

(3) **Does the increased peak pool temperature have any effect on the motor qualified life?**

The increased peak pool temperature does not have a significant impact on the motor qualified life. The GE long term containment analysis supporting the Reference 1 submittal determined that the suppression pool would be above 165° F for about one day with a peak temperature of 182° F. As indicated above, the lubrication to the pump motor bearings is qualified for use at the increased pool temperature and based on engineering judgement the small increase in suppression pool temperature for a short period was judged to have an insignificant effect on bearing and therefore motor life. In addition, because the motors are air-cooled the increased peak pool temperature does not have an impact on other motor components. For these reasons, the increased peak pool temperature does not have a significant impact on the motor qualified life.

This conclusion is supported by operational experience. In 1991, a piping error was discovered that prevented RHRSW flow to the Unit 2C & 2D RHR motor heat exchanger. An operability evaluation performed at the time determined that the piping error was from original plant construction and that the plant had operated in shutdown cooling with reactor water well above 165° F for several hours since plant startup. Shutdown cooling is initiated at < 100 psig (about 338° F). A review of pump motor performance did not show any adverse history. Since the CS motors have the same bearings and have the same size oil reservoir and cooling coil as the RHR motors the Operability Evaluation for the RHR motors is directly applicable.