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Downers Grove, Illinois 60515

August 6, 1992

Dr. Thomas E. Murley, Director
Office of Nuclear Reactor Regulation
U.S. Nuclear Regulatory Commission
Washington, D.C. 20555

ATTN: Document Control Desk

Subject: Dresden Station Units 2 and 3
Quad Cities Station Units 1 and 2
Response to Additional Questions;
Assessment of ECCS Operability without
the Room Cooler Heat Removal Capability
NRC Docket Nos. 50-237/50-249 and 50-254/50-265

References: (a) L.N. Olshan to T.J. Kovach letter dated March 4, 1992

(b) J.L. Schrage to T.E. Murley letter dated May 8, 1992

(c) Teleconferences on May 21 and May 29, 1992 between CECo (J. Schrage, et al) and NRR (L. Olshan, S. Jones).

Dear Dr. Murley:

In Reference (a), the NRC transmitted a Request for Additional Information (RAI) pertaining to a Commonwealth Edison (CECo) analysis (for Dresden and Quad Cities stations) which justified operability of the ECCS systems when the associated room coolers are unavailable. CECo provided a response to the RAI in Reference (b). Subsequent to the response, the NRC and CECo conducted two teleconferences (Reference(c)) to clarify CECo's response to the RAI. During the teleconferences, the NRC presented additional questions related to the original analysis. The questions and CECo's responses are described in the Attachment and associated Enclosures.

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If there are any further questions or comments, please direct them to John L. Schrage at 708-515-7283.

Sincerely,

John L. Schrage
Nuclear Licensing Administrator

Attachment: Response to Additional Questions

Enclosure 1: CECo Calculation RSA-D-92-02; An Alternate Method of ECCS Pump Room Transient Response for Dresden and Quad Cities Stations

Enclosure 2: CECo Calculation RSA-D-92-04; An Evaluation of Loss of HPCI Room Cooler at Dresden Station

cc: A. Bert Davis, Regional Administrator-RIII
B.L. Siegel, Project Manager-NRR
L.N. Olshan, Project Manger-NRR
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ATTACHMENT

Response to Additional Questions

Assessment of ECCS Operability without the Room Cooler Heat Removal Capability

1. **During the 1986 test, a flow of 8800 gpm was converted to a heat load. How was this done, and what was the heat load?**

The heat load (at the RHR flow of 8800 gpm) was obtained by multiplying the heat load at rated flow (10700 gpm) by the ratio of the actual flow to the rated flow.

Q = [actual flow/rated flow] * [1- motor efficiency] * [pump horsepower] * 2

Q = heat load in horsepower
actual flow = 8800 gpm
rated flow = 10700 gpm
motor efficiency = 92%
pump horsepower = 600hp

Q = [8800/10700] * 0.08 * 600 * 2 = 157.92hp = 5.29 E 06 BTU/hr

2. **Provide justification for the air flows which are assumed for natural circulation. This should include a model for natural circulation throughout the Reactor Building.**

In response to this question, CECo performed a confirmatory evaluation of ECCS room transient response for Dresden and Quad Cities Stations. The purpose of this additional evaluation was to demonstrate the conservatism of the original analysis; and revise the Torus area boundary condition to better approximate actual conditions during a design basis LOCA/LORC. The model used in this confirmatory evaluation is similar to the original model with the following exceptions:

- Through-wall heat transfer
- Explicit modeling of Torus area and the first elevation of the Reactor Building
- Inclusion of three additional volumes (earth, torus water, external atmosphere)

This evaluation is documented in Enclosure 1. Section 2.3 of Enclosure 1 provides the description of the natural circulation model utilized in the confirmatory evaluation. This model includes the volume of the Reactor Building and the associated heat slabs above EL-517. These were not explicitly modeled in the original analyses.

3. **Provide additional support and justification for the heat transfer coefficients employed in the HPCI room calculations. Justify the level of conservatism of the heat transfer coefficients used in the calculations, particularly in the HPCI Room calculation.**

CECo utilized a three-step approach to respond to these questions. The first step consisted of a search of applicable technical documents to verify the original heat transfer coefficients and/or identify more appropriate heat transfer coefficients. The results of this search, including the source documents are described in the Appendix to Enclosure 2. As can be seen, the data supports the selection of a surface heat transfer coefficient ranging from 1.0 to 5.0 BTU/hr/ft2-°F.

The second step utilizes the heat transfer coefficient values obtained from the search of technical documents. CECo performed a confirmatory calculation of the HPCI room utilizing the original model and a surface heat transfer coefficient of 1.0 BTU/hr/ft2-°F. The results of the calculation (Section 3.1 of Enclosure 2) indicated that the temperature of the HPCI room would remain below 185 °F for at least 40 hours.

CECo performed an additional confirmatory calculation utilizing a more realistic model of the heat structures in the HPCI room. The modified model subdivided the heat structures representing the walls, floor, and ceiling of the HPCI room into into six separate structures. Heat transfer coefficients for these structures ranged from 1.08 for the floor to 1.63 for the ceiling. These values were based upon ASHRAE recommendations. This model is considered to be the most representative of anticipated room heatup while still maintaining conservatism relative to the heat load. The results of this additional calculation (Section 3.2 of Enclosure 2) indicate that the temperature of the HPCI room will remain below 185 °F for nearly three days.

Since the accident analyses credit HPCI for a maximum of four (4) hours following the most limiting design basis accident , the confirmatory calculations justify the original calculation with respect to the availability of HPCI without the associated room cooler (given more conservative heat transfer coefficients).

The third and final step utilizes accepted analytical methods to demonstrate the effect of varying the surface heat transfer coefficients on the overall steady state heat transfer coefficient (for a typical heat slab such as a HPCI Room wall). This analysis is described in the Appendix of Enclosure 2. The results indicate that the overall steady state heat transfer coefficient curve (as a function of the surface heat transfer coefficient) becomes relatively constant after a threshold value. This threshold value is approximately equal to the thermal conductivity of concrete (1.05 BTU/hr/ft-°F). Based upon the nature of the heat slabs in the original model (steel reinforced concrete) this confirmatory calculation indicates that the value of the surface heat transfer coefficient does not significantly impact the overall heat transfer coefficient.

4. What is the impact on the original calculation of a steam leak from the HPCI Gland Seal Condenser?

In response to this question, CECo performed an evaluation to estimate the value of a postulated HPCI gland seal steam leak. This evaluation was based on the worst case design seal leakage predicted for a locked HPCI turbine rotor. The design seal leakage for this case is 2160 lb/hr. Under these conditions, the HPCI system is designed to isolate on high room temperature within 15 minutes.

The CECo evaluation assumed continuous operation of the HPCI turbine (non-locked rotor conditions). In this condition, the turbine would continue to supply cooling water to the gland seal condenser (which is not available under locked rotor conditions). Given these assumptions, the seal leakage is estimated to be approximately 10% of the maximum leakage (216 lb/hr).

Based upon the estimate of postulated steam leakage, CECo performed a confirmatory calculation of HPCI room transient response. This calculation assumed a steam leak of 216 lb/hr from the HPCI system.. In this calculation, CECo utilized three different sets of heat transfer coefficients ranging from 2.0 to 5.0 (see Section 2.3 of Enclosure 2). The results indicate that under the most limiting scenario, significant time (12-24 hours) is required to reach 185 °F in the HPCI room, even with a high rate of steam leakage into the room.

Since the accident analyses credit HPCI for a maximum of four (4) hours following the most limiting design basis accident , the confirmatory calculations justify the original calculation with respect to the availability of HPCI without the associated room cooler (given a postulated steam leak from the gland seal condenser).

5. Provide justification for a constant Torus area boundary condition of 104 °F

In response to this question, CECo performed a confirmatory evaluation to demonstrate the effect of allowing the Torus area boundary condition to vary in accordance with the heat transfer from the Torus and the ECCS rooms. An initial boundary condition of 104 °F was utilized based upon the design basis temperature which is maintained by normal Reactor Building ventilation (Quad Cities UFSAR 9.4.7.1). The most limiting ECCS room (Dresden 2A LPCI Room) was evaluated to provide a bounding value. The results of the confirmatory evaluation (Enclosure 1) indicate that the temperature of the Dresden 2A LPCI room will remain less than 181 °F during the thirty days following a LOCA/LORC accident. These results demonstrate the conservatism inherent in the original analysis.

ENCLOSURE 1

CECo Calculation RSA-D-92-02

An Alternate Method of ECCS Pump Room Transient Response for Dresden and Quad Cities Stations