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U. S. Nuclear Regulatory Commission
ATTN: Document Control Desk
Washington, DC 20555-0001

Dresden Nuclear Power Station, Units 2 and 3
Facility Operating License Nos. DPR-19 and DPR-25
NRC Docket Nos. 50-237 and 50-249

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 NRC Inspection Items Regarding Concrete Expansion Anchors

References:

1. Letter from Keith R. Jury (Exelon Generation Company, LLC) to U. S. NRC, "Response to NRC Inspection Items Regarding Concrete Expansion Anchors," dated September 11, 2002

2. Letter from Maitri Banerjee (U. S. NRC) to Christopher Crane (Exelon Generation Company, LLC), "Dresden Nuclear Power Station, Units 2 and 3 & Quad Cities Nuclear Power Station, Units 1 and 2 – Request for Information – Concrete Expansion Anchors (TAC NOS. MB7297, MB7298, MB7299, and MB7300)," dated August 10, 2004

In Reference 1, Exelon Generation Company, LLC (EGC) responded to NRC inspection items regarding concrete expansion anchors (CEAs) for Dresden Nuclear Power Station, Units 2 and 3, and Quad Cities Nuclear Power Station, Units 1 and 2. In Reference 2, the NRC requested additional information regarding the design and factor of safety of CEAs on high energy restraints. The attachment to this letter provides the EGC responses to Reference 2.

EGC requests that, following NRC review of the information provided in this letter, a meeting be held between the NRC and EGC to discuss any further course(s) of action to close this issue.

Should you have any questions related to this information, please contact Mr. David Gullott at (630) 657- 2819.

Respectfully,

Patrick R. Simpson
Manager - Licensing

Attachment

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

Attachment
Response to NRC Request for Information
Regarding Concrete Expansion Anchors

1. Exelon letter to the NRC dated September 11, 2002, indicated that Dresden and Quad Cities UFSAR Section 3.8.4.6, "Concrete Expansion Anchors," that stated CEAs were installed following manufacturer's recommendations, was revised to clarify that this section applied only to the IEB 79-02 response (i.e., not to the concrete expansion anchors for high energy restraints (HERs)). Please indicate what Code, Standard or practice accepted by the NRC for design these CEAs in safety related applications were designed to.

<u>Response</u>

In Reference 1, the NRC formally requested the industry provide information pertaining to the effects of a postulated high-energy line rupture outside primary containment. This letter requested information on systems for which protection against pipe whip is required, the criteria used to determine the design basis piping break locations and orientations, a summary of the loading analysis, and plans to enhance plant mitigation features. The NRC noted that plant structures, systems, and components should be designed and located to accommodate the effects of a postulated pipe failure outside containment. In response to this request, Commonwealth Edison Company (i.e., now Exelon Generation Company (EGC)) developed Special Report 37 for Dresden Nuclear Power Station (DNPS) and Special Report 12 for Quad Cities Nuclear Power Station (QCNPS): Analysis of Effects of Pipe Break Outside the Primary Containment. Reference 2 transmitted specific areas of vulnerability, including proposed plant modifications. Reference 2 also noted the use of expansion anchors for HER devices. In References 3 and 4, the NRC provided Safety Evaluations for QCNPS and DNPS respectively; concluding the approach to mitigating the effects of pipe whip following a postulated pipe rupture was acceptable. EGC has not been able to identify any NRC accepted code, standard or practice, from that timeframe, that established a safety factor for CEAs used in the design of HERs. As outlined in Reference 5, the restraints in question were designed using the industry practices at the time and the current CEA safety factors provide adequate margin for these HERs.

2. Please review the application of the CEAs used as high energy restraints that have factors of safety in the range of 2.5 to 3.8 (one at Dresden and five at Quad Cities), and discuss the safety impact of these CEAs failing to perform their safety function including restraining a pipe whip.

Response

DNPS

There is one HER restraint at DNPS that has a safety factor less than four. This restraint, designated PWHP-3, is designed to protect against a postulated High Pressure Coolant Injection (HPCI) steam line pipe whip that could damage a safety-related motor operator for a valve in the Low Pressure Coolant Injection (LPCI) test return line to the suppression pool.

Postulated Failure Evaluation: HER PWHP-3

The safety impact of the CEAs on this restraint failing to perform their function, including restraining a pipe whip, is the potential loss of one loop of direct suppression pool cooling (i.e., damage to the motor operator prevents opening the LPCI valve). The redundant suppression pool cooling loop and both loops of torus sprays are unaffected by this event. For this postulated high energy line break event, suppression pool cooling is not required to mitigate the event consequences.

This event does not present a significant safety concern. Following the postulated line break, HPCI would automatically isolate on high steam line flow, terminating the high energy line break event. The Reactor Protection System (RPS) can be initiated from the control room to rapidly shutdown the reactor. RPS is not impacted by this event.

The Isolation Condenser would be available to remove shutdown decay heat until conditions were reached to permit initiation of normal shutdown cooling. The main turbine condenser also provides a means for decay heat removal. This redundancy provides assurance that reactor decay heat removal could be established. Further, EGC employs symptom-based emergency operating procedures (EOPs) that include guidance for responding to events that impact containment cooling capability.

QCNPS

There are five HER restraints at QCNPS that have safety factors less than four. These are listed below.

	HER ID	Unit	High-Energy Line	Target Component(s)
1.	# 1	1	Reactor Core Isolation Cooling (RCIC) steam supply	Torus Structure
2.	# 3	1	RCIC steam supply	Torus Structure
3.	JIES-1	1	Turbine steam extraction	*Electrical Division 2* Unit 1/2 Emergency Diesel Generator (EDG) Cooling Water Pump
4.	JIES-2	2	Turbine steam extraction	*Electrical Division 2* Unit 2 EDG Cooling Water Pump Unit 2 Residual Heat Removal (RHR) Service Water (SW) Pump 2C Unit 2 RHR SW Pump 2D
5.	JIHD-1	2	Feedwater drain piping	*Electrical Division 2* Unit 2 EDG Cooling Water Pump Unit 2 RHR SW Pump 2C Unit 2 RHR SW Pump 2D

Postulated Failure Evaluation: HERs #1 and #3

HER #1 and HER #3 provide protection against a postulated RCIC steam line break. Should one of these restraints fail, the suppression pool structure (i.e., part of the primary containment) could be damaged. This event would not present a significant safety concern for the following reasons. Following the line break, RCIC would isolate on high steam line flow, terminating the event in less than 25 seconds. In addition, the RCIC steam piping is located above the torus. As such, any torus damage resulting from a line break would likely be well above the normal torus water line and not result in a torus drain down event (i.e., the normal suppression pool water level fills the torus half full). Additionally, RPS is a fail-safe system (i.e., de-energize to actuate) and can be initiated from the control room to rapidly shutdown the reactor. The RPS function would not be impacted by a RCIC line break event. In addition, two trains of RHR shutdown cooling would be available to remove shutdown decay heat. The main turbine condenser also provides a means for decay heat removal. This redundancy provides assurance that reactor decay heat removal would be available. Additionally, primary containment is not required to mitigate the consequences of this postulated line break. Further, EGC employs symptom-based EOPs that include guidance for responding to events that threaten reactor containment.

Postulated Failure Evaluation: HERs JIES-1, JIES-2, and JIHD-1

These restraints are designed to protect certain electrical cables from a postulated break in a feedwater or a turbine steam extraction line. Specifically, electrical feeds to the RHR SW pumps 2C and 2D, and Unit 1/2 or 2 EDG cooling water pump. A bounding scenario would be failure of HER JIES-2 or JIHD-1, which could impact several of these components. This event would not present a significant safety concern. The RPS can be initiated from the control room to rapidly shutdown the reactor. The RPS function would not be impacted by this event. In addition, any resulting damage is limited to a single division of equipment. Damage impacting the Unit 1/2 or 2 EDG cooling water pumps would only affect the operability of the Unit 1/2 or 2 EDG, respectively. However, the redundant EDG would be available to supply emergency AC power. In addition, the station's electrical distribution system is diverse. AC power is available from a number of sources including offsite power (through the reserve auxiliary transformer), the station blackout diesel and the opposite unit through safety-related 4kV cross-ties. Similarly, the RHR SW system consists of two independent and redundant subsystems. Each subsystem is made up of a header, two pumps, a suction source, valves, piping, heat exchanger, and associated instrumentation. Only one subsystem is required to meet the containment cooling requirements.

Summary

Considering the safety impact evaluation for each HER described above, EGC concludes that failure of a CEA and associated HER would not present a significant safety concern.

3. Exelon letter to the NRC, dated September 11, 2002, discussed some of the inherent conservatisms in the HER design. Please provide the results of analyses that quantify these conservatisms.

Response

The conservatisms cited in Reference 5 were provided to demonstrate the inherent margin in the HER design. These conservatisms were qualitative in nature and intended to demonstrate that additional design margin exists in the expansion anchors. The conservatisms described in Reference 5 (e.g., "leak-before-break" and pipe deformation) reduce the amount of energy being applied to the HER. Another conservatism stated in Reference 5 is allowing support deformation (i.e., energy absorption) through the use of non-linear analytical techniques. Overall, these conservatisms would result in a lower applied force on the expansion anchors than presently calculated. The respective contributions of the conservatisms are dependent on each HER's specific design and as such have not been specifically quantified.

References:

1. Letter from A. Giambusso (Atomic Energy Commission) to B. Lee (Commonwealth Edison), dated December 18, 1972
2. Letter from G. Abrell (Commonwealth Edison) to D. L. Ziemann (U. S. NRC), dated September 16, 1975
3. Letter from D. L. Ziemann (U.S. NRC) to R. L. Bolger (Commonwealth Edison), dated March 8, 1976

4. Letter from D. L. Ziemann (U.S. NRC) to R. L. Bolger (Commonwealth Edison), dated May 12, 1976
5. Letter from Keith R. Jury (EGC) to U. S. NRC, "Response to NRC Inspection Items Regarding Concrete Expansion Anchors," dated September 11, 2002