

RS-02-155

September 11, 2002

U. S. Nuclear Regulatory Commission  
ATTN: Document Control Desk  
Washington, DC 20555-001Dresden Nuclear Power Station, Units 2 and 3  
Facility Operating License Nos. DPR-19 and DPR-25  
NRC Docket Nos. 50-237 and 50-249Quad 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 U. S. NRC to J. S. Perry (Commonwealth Edison Company), "NRC Inspection Report No. 50-010/97019 (DRP); 50-237/97019 (DRP); 50-249/97019 (DRP) and Notice of Violation," dated December 4, 1997
  - (2) Letter from U. S. NRC to E. Kraft (Commonwealth Edison Company), "NRC Integrated Inspection Report 50-254/96011, 50-265/96011 Notice Of Violation," dated August 10, 1996
  - (3) Letter from U. S. NRC to L. W. Pearce (Commonwealth Edison Company), "NRC Inspection Report No. 50-254/97014 (DRP); 50-265/97014 (DRP), Notice of Deviation and Notice of Violation," dated December 16, 1997
  - (4) Letter from J. M. Heffley (Commonwealth Edison Company) to U. S. NRC, "Dresden Nuclear Power Station Units 1, 2 and 3, Reply to a Notice of Violation," dated January 9, 1998

The purpose of this letter is to provide a formal response to issues discussed in NRC inspection reports for the Dresden Nuclear Power Station (DNPS) and the Quad Cities Nuclear Power Station (QCNPS). In Reference 1, the NRC opened an Unresolved Item (URI) regarding the factor of safety used to qualify the concrete expansion anchors (CEAs) on high energy whip restraints at DNPS. In References 2 and 3, the NRC discussed a similar Inspector Follow-Up Item for QCNPS. In these items, the NRC disagreed with the technical arguments of the licensee, Commonwealth Edison Company (ComEd), now Exelon Generation Company, LLC (Exelon) that justified the use of a factor of safety of 2.0 for CEAs on high energy whip restraints and requested that ComEd provide a schedule to complete additional analyses or upgrade the anchorage capacity.

In Reference 4, ComEd responded to the URI and stated that DNPS and QCNPS had concluded that a factor of safety of 2.0 was acceptable and requested an opportunity to provide information supporting this conclusion. In recent teleconferences between Mr. J. Gavula of the

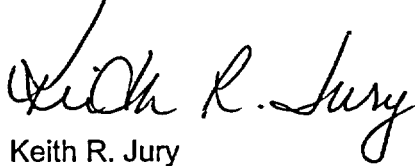
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NRC and Mr. A. R. Haeger and other members of Exelon, Exelon agreed to provide this information in a written response. The attachment to this letter provides the response.

Should you have any questions related to this information, please contact Mr. Allan R. Haeger at (630) 657- 2807.

Respectfully,

A handwritten signature in black ink, appearing to read "Keith R. Jury". The signature is fluid and cursive, with the first name "Keith" and last name "Jury" being clearly legible.

Keith R. Jury  
Director - Licensing  
Mid-West Regional Operating Group

Attachment

cc:           Regional Administrator – NRC Region III  
              NRC Senior Resident Inspector – Dresden Nuclear Power Station  
              NRC Senior Resident Inspector – Quad Cities Nuclear Power Station  
              Office of Nuclear Facility Safety – Illinois Department of Nuclear Safety

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**Unresolved Item**

In a letter from the U. S. NRC to J. S. Perry (Commonwealth Edison Company), "NRC Inspection Report No. 50-010/97019 (DRP); 50-237/97019 (DRP); 50-249/97019 (DRP) and Notice of Violation," dated December 4, 1997, the NRC opened the following Unresolved Item for Dresden Nuclear Power Station (DNPS).

"While resolving improperly installed concrete expansion anchors (CEAs) at the Quad Cities Station, the licensee determined that a safety factor of 2.0 was originally used to qualify the CEAs on high energy pipe whip restraints at both the Quad Cities and Dresden Stations. This design approach was inconsistent with the standard safety factor of 4.0 that was used for CEAs on other types of pipe restraints. After reviewing their justification for using a safety factor of 2.0 and discussing it in detail with them, the NRC disagreed with the licensee's technical arguments.

The NRC determined that additional analyses and/or anchor bolt capacity upgrades would be required for high energy pipe whip restraints, in order to meet the CEA manufacturers' recommended capacities. The NRC staff considered the criteria for CEAs given in IE Bulletin 79-02, and in Revision 2 of the Generic Implementation Procedure developed by the Seismic Qualification Utility Group of Unresolved Safety Issue A-46, to be acceptable. This is considered an Unresolved Item pending the review of the licensee's schedule to complete the additional analyses or upgrade the anchorage capacity."

In a letter from the U. S. NRC to L. W. Pearce (Commonwealth Edison Company), "NRC Inspection Report No. 50-254/97014 (DRP); 50-265/97014 (DRP), Notice of Deviation and Notice of Violation," dated December 16, 1997, a similar item was discussed for Quad Cities Nuclear Power Station (QCNPS).

**Response**

Exelon Generation Company, LLC (Exelon), formerly Commonwealth Edison Company (ComEd), has concluded that the actual factors of safety for the CEAs used for high energy restraints (HERs) at DNPS and QCNPS are adequate to ensure that the restraints will perform their intended function. Further, Exelon has concluded that DNPS and QCNPS are in compliance with the applicable requirements regarding factors of safety for CEAs. Exelon has estimated the costs and occupational radiation exposure to increase the anchorage capacity of these components and has concluded that the costs and additional exposure do not justify the minimal safety benefit that would be achieved.

**Adequacy of Actual Factors of Safety of CEAs for HERs**

Currently, at DNPS and QCNPS, there are, respectively, seven and ten required HERs that are secured by CEAs. An evaluation was performed to determine the actual factors of safety of these CEAs. The factors of safety were evaluated from the ratio of the ultimate capacity of the anchor to the load sustained by the anchor. In most cases, the actual factors of safety were determined to be greater than 4.0. The remaining HERs with CEAs (one at Dresden and five at Quad Cities) have factors of safety in the range of 2.5 to 3.8.

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Based on a review of the industry practice at that time and the conservatism inherent in the HER design, Exelon has concluded that the factor of safety for CEAs used in the high energy whip restraint installation is adequate to ensure that the HERs will perform their intended safety function for the following reasons.

There are inherent conservatisms in the HER design process that ensure additional design margin and hence indirectly increase the factor of safety for the CEAs. Some of the typical conservatisms are as follows.

- The basic assumption for pipe break is an instantaneous complete circumferential break in the pipe resulting in very large loads. In reality, the pipe would "leak before break," as recognized in NUREG-1061, "Report of the U.S. Nuclear Regulatory Commission Piping Review Committee, Evaluation of Potential for Pipe Breaks, Volume 3," dated November 1, 1984, and thus the loads would be smaller.
- Pipe whip responses were typically conservatively calculated using linear analysis techniques. A more rigorous nonlinear analysis considering energy absorption by the members in the load path will result in reduction of the calculated responses.
- Load deformation of the pipe walls resulting in energy absorption and reduced loads was normally ignored in the analysis.
- Only restraints specifically designed for pipe whip and jet impingement loadings are included in the analysis. Other restraints adjacent to the HERs would also assist in resisting loads.

HERs are subjected to one time, non-recurring, and short duration accident load. HERs are not required for normal working loads or sustained loads. Thus, a factor of safety lower than the 4.0 used for working loads, such as pipe supports, is appropriate. This is recognized in other applicable industry standards at the time of the design of these restraints. American Society of Civil Engineers (ASCE) publication, "Structural Analysis and Design of Nuclear Plant Facilities," dated 1980, in discussing structural acceptance criteria for proprietary anchorage devices such as expansion anchors, recommends a load allowable of 50% ultimate strength (i.e., factor of safety of 2.0) for factored strength, and 25% ultimate strength (i.e., factor of safety of 4.0) for service strength. In load combinations for steel and concrete structures, HER loads are considered in factored load combinations (with a load factor of 1.0) because pipe breaks correspond to faulted conditions. No separate load combination for expansion anchors is mentioned. Therefore, based on the load combinations for steel and concrete structures, for expansion anchors subjected to HER loading, a load allowable of 50% ultimate strength using a load factor of 1.0 (i.e., factor of safety of 2.0) for factored strength is appropriate.

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In conclusion, the factors of safety for CEAs associated with required HERs at DNPS and QCNPS are greater than 2.0, and most are greater than 4.0. Based on inherent conservatism in the HER design process, and the fact that factors of safety used in the design are consistent with applicable standards for faulted loads, the factors of safety are considered adequate to ensure that the HERs will perform their intended safety function.

**Applicable Requirements**

NRC Inspection and Enforcement Bulletin (IEB) 79-02, "Pipe Support Base Plate Designs Using Concrete Expansion Anchor Bolts," specifically addresses safety related pipe supports. The bulletin does not address the factors of safety for CEAs for other applications such as HERs. As a result, ComEd's response to the bulletin was directed only at pipe supports. We have been unable to locate any NRC correspondence that expanded IEB 79-02 to applications such as HERs.

DNPS inspection report 50-237/86019; 50-249/86023, dated July 17, 1986, describes the results of a routine inspection specifically regarding IEB 79-02. The inspectors reviewed the DNPS actions regarding pipe supports and concluded that DNPS had complied with the bulletin. Similarly, QCNPS inspection report 50-254/85038; 50-265/85031, dated November 21, 1985, describes a routine inspection that included IEB 79-02. The inspectors concluded that QCNPS had complied with the bulletin.

In a teleconference on June 19, 1997, between members of the NRC and ComEd, the NRC pointed out that the DNPS and QCNPS Updated Final Safety Analysis Reports (UFSARs), Section 3.8.4.6, "Concrete Expansion Anchors," stated that CEAs were installed following the manufacturer's recommendations. This section implied that all CEAs were installed in accordance with manufacturer's recommendations, including the manufacturer's recommended factor of safety. DNPS and QCNPS intended this section to apply to CEAs associated with pipe supports and the IEB 79-02 responses. DNPS and QCNPS have since revised the UFSARs to clarify that this section applies to the IEB 79-02 response.

In conclusion, DNPS and QCNPS are in compliance with the applicable requirements regarding factors of safety for CEAs. For HERs, there are no NRC requirements specifically applicable to CEAs at DNPS and QCNPS. For pipe supports, the DNPS and QCNPS design basis and licensing basis for CEAs is consistent with applicable NRC requirements. The UFSAR description related to CEAs for pipe supports is consistent with the plant design.

**Costs Associated with Upgrading CEAs**

Exelon has estimated the cost and occupational radiation exposure to upgrade the remaining CEA anchor plate assembly for DNPS noted above with a factor of safety of less than 4.0. The estimated cost is in the range of \$73,500 to \$87,500 and the estimated occupational radiation exposure is 1.48 person-rem. The remaining CEA plate assemblies at QCNPS would add further cost and radiation exposure to this estimate. Upgrading these remaining CEAs would therefore represent a significant cost to Exelon and significant occupational radiation exposure to Exelon employees and contractors.

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**Conclusion**

Exelon has determined the actual factors of safety for the CEAs used for high energy restraints at DNPS and QCNPS are sufficient to ensure that the restraints will perform their intended function. Further, DNPS and QCNPS are in compliance with all applicable requirements regarding CEAs. Exelon has estimated the costs and occupational radiation exposure to increase the anchorage capacity of these components and concluded that the costs and additional exposure do not justify the minimal safety benefit that would be achieved. Thus, Exelon requests that the NRC close these inspection items.