UNITED STATES
NUCLEAR REGULATORY COMMISSION
WASHINGTON, D.C. 20555-0001

SAFETY EVALUATION BY THE OFFICE OF NUCLEAR REACTOR REGULATION

RELATED TO THE INSERVICE INSPECTION PROGRAM REQUESTS FOR RELIEF FOR

COMMONWEALTH EDISON COMPANY

DRESDEN NUCLEAR POWER STATION, UNITS 2 AND 3

DOCKET NOS. 50-237 AND 50-249

1.0 INTRODUCTION

The Technical Specifications for Dresden Nuclear Power Station, Units 2 and 3, state that the inservice inspection and testing of the American Society of Mechanical Engineers (ASME) Code Class 1, 2, and 3 components shall be performed in accordance with Section XI of the ASME Boiler and Pressure Vessel Code (Code) and applicable Addenda as required by 10 CFR 50.55a(g), except where specific written relief has been granted by the Commission pursuant to 10 CFR 50.55a(g)(6)(i). 10 CFR 50.55a(a)(3) states that alternatives to the requirements of paragraph (g) may be used, when authorized by the NRC, if (i) the proposed alternatives would provide an acceptable level of quality and safety, or (ii) compliance with the specified requirements would result in hardship or unusual difficulties without a compensating increase in the level of quality and safety.

Pursuant to 10 CFR 50.55a(g)(4), ASME Code Class 1, 2, and 3 components (including supports) shall meet the requirements, except the design and access provisions and the preservice examination requirements, set forth in the ASME Code, Section XI, "Rules for Inservice Inspection of Nuclear Power Plant Components," to the extent practical within the limitations of design, geometry, and materials of construction of the components. The regulations require that inservice examination of components and system pressure tests conducted during the first ten-year interval and subsequent intervals comply with the requirements in the latest edition and addenda of Section XI of the ASME Code incorporated by reference in 10 CFR 50.55a(b) on the date twelve months prior to the start of the 120-month interval, subject to the limitations and modifications listed therein. The applicable edition of Section XI of the ASME Code for the Dresden Nuclear Station, Units 2 and 3, third 10-year inservice inspection (ISI) interval is the 1986 Edition. The components (including supports) may meet the requirements set forth in subsequent editions and addenda of the ASME Code incorporated by reference in 10 CFR 50.55a(b) subject to the limitations and modifications listed therein and subject to Commission approval. However, the licensee has prepared the third ten-year interval inservice inspection program plan for Dresden Nuclear Power Station, Units 2 and 3, to meet the requirements of the 1989 Edition of the ASME Code.

In a letter dated February 24, 1994, as supplemented by letter dated April 6, 1994, Commonwealth Edison Company (ComEd, the licensee) submitted the Dresden Nuclear Power Station, Units 2 and 3, Third Ten-Year ISI Program Plan, Revision 3, and associated requests for relief PR-14, Revision 1, PR-18, and CR-17. Relief request PR-18 is evaluated in the following sections of this safety evaluation. The previous revisions to the Third Ten-Year plan and Relief Request CR-17 will be evaluated under a separate cover. Relief Request PR-14, Revision 1, was granted by the NRC by letter dated May 25, 1994.

2.0 RELIEF REQUEST PR-18, REVISION 0

The licensee has requested relief from Section XI, IWA-5250(a)(2) requirements for removing bolting and performing a VT-3 visual examination for corrosion if leakage occurs at a bolted connection. The licensee has proposed an alternative approach consisting of a combination of torquing at pressure and visual examination to verify the structural integrity of bolting at leaking mechanical connections in non-borated systems.

2.1 Licensee's Basis for Relief

The licensee states: "There is strong support for the requirement to remove the bolting at leaking bolted connections and examine them for corrosion in the highly corrosive borated water environment experienced at Pressurized Water Reactors, where many incidences of bolting rejection (and even failure) due to corrosion have been recorded. However, there is little industry evidence to support this requirement within the relatively non-corrosive environments experienced in Boiling Water Reactor (BWR) systems (excluding Standby Liquid Control). Data gathered in the Electric Power Research Institute (EPRI) report NP-5769, "Degradation and Failure of Bolting in Nuclear Power Plants" showed that incidence of failure of pressure retaining bolting due to corrosion in non-borated systems across the industry is very small. Bolting is more likely to be damaged by its removal than it is to be considered rejectable due to corrosion from a non-borated system. * * *

"In addition the removal of the bolting will not ensure the leak-tightness of the bolted connection. A bolted connection is much more likely to leak from problems associated with the gasket than from degradation of the bolting and so removing and examining the bolting would not necessarily attack the root cause of the leaking connection.

"A more appropriate action to take in the event of a leaking bolted connection would be to stop the leakage at the bolted connection, which will eliminate the corrosive environment, and [performing] a test that will demonstrate the structural integrity of the bolting. This type of approach will assure a superior level of quality for the following reasons:

- The code required visual exam will not positively indicate the structural integrity of the bolting and will only give a qualitative assessment of the bolts surface.

- The code does not currently require that leakage at a bolted connection be stopped prior to the resumption of service. This allows the reinstallation of the bolt into an environment that could cause further degradation of the bolting. By requiring that the leakage at the bolted connection be stopped, the possibility of further reduction in load carrying capacity due to corrosion or any other environmentally assisted degradation of the bolt is eliminated.

"The cessation of leakage at the bolted connection would be attempted by incrementally retorquing all of the bolts in the bolted connection to the maximum allowed by station procedures (a value less than the bolts yield strength). This re-torquing of the bolted connection would be done with the system pressurized, either during hydrostatic testing, or with the system in operation. The cessation of leakage would be verified by a VT-2 certified inspector.

"In addition to stopping leakage at the bolted connection the re-torquing would provide a demonstration of the structural integrity of the bolting. In the case of "hard joints" (one in which the joint can be shown to have metal-to-metal contact) the overwhelming majority of the load on the bolt is due to the pre-load provided by the torquing. For "hard joints", torquing the bolt while the system is under pressure places the bolt into the highest condition of stress (within 1%) that it will experience during operation. This bounds all sustained and occasional loads that would be addressed in the design of the bolted connection. If this retorquing is accomplished without failing the bolt, then the bolt will experience no higher loading during a cycle of operation and the structural integrity of the bolting has been adequately demonstrated.

"Using this methodology the bolt has been shown at the time of the inspection to have adequate structural integrity. In addition, because the leak at the bolted connection has been stopped the possibility of additional corrosion has been eliminated and no further degradation of the joint will occur."

2.2 Alternate Testing

The licensee proposes: "In lieu of removing the bolting at a leaking connection and subjecting it to a VT-3 examination, Dresden Station proposes that the bolts be torqued to a value not to exceed the maximum allowable torque specified for the bolting by station procedures. If this process does not stop the leakage then the bolting will be removed and inspected in accordance with the code requirements stated in IWA-5250(a)(2). If this procedure does stop the leakage and the joint can be classified as a "hard joint" then no further inspection will be required. If this procedure does stop the leakage and the joint can not be classified as a "hard joint" the relative stiffness of the mating surfaces, gasket material, and bolting material will be evaluated to determine if the torquing of the bolt to its maximum allowable torque will provide adequate assurances that the bolt will maintain its integrity. If this can be demonstrated, then the bolting will be deemed satisfactory for continued operation.

"In the event that bolting removal and inspection is required then one bolt will be removed and VT-3 examined. The bolt selected for removal will be the bolt closest to the source of leakage. If the removed bolt shows evidence of degradation, then all the remaining bolting in the connection shall be removed and VT-3 examined. The removal of only one bolt is supported by subparagraph IWA-5250(a)(2) in the 1990 Addenda of Section XI, which allows for the provision described above."

3.0 EVALUATION

The requirement for removal and VT-3 examination of bolting at leaking mechanical connections is to verify that the bolting is not degraded due to corrosion. The licensee proposes to stop the leakage, if possible, and verify the structural integrity of the bolting by torquing the bolts, while the system is at pressure, to a value not to exceed the maximum allowable stress by torquing to the maximum value specified for the bolting by station procedures. For "hard joints," torquing the bolt while the system is under pressure places the bolt into the highest condition of stress that it will experience during operation. This bounds all sustained and occasional loads that would be addressed in the design of the bolted connection. If this retorquing is accomplished, then the bolt will experience no higher loading during a cycle of operation and the structural integrity of the bolting has been adequately demonstrated. If leakage can not be stopped, then one bolt will be removed and examined. The bolt selected for removal will be the bolt closest to the source of leakage. If the removed bolt shows evidence of degradation, then all the remaining bolting in the connection shall be removed and VT-3 examined. The removal of only one bolt is in accordance with the provisions of subparagraph IWA-5250(a)(2) in the 1990 Addenda of Section XI.

Retorquing bolts in connections classified as hard joints is considered acceptable for non-borated systems since the bolting stresses would not be expected to exceed Code allowables with the approach described by the licensee. If leakage is not stopped, the provisions of the Code to remove and examine one bolt will be followed. This approach has been previously reviewed and found acceptable by the staff.

For joints that can not be classified as a "hard joint," the licensee stated that the relative stiffness of the mating surfaces, gasket material, and bolting material will be evaluated to determine if the torquing of the bolt to its maximum allowable torque will provide adequate assurances that the bolt will maintain its integrity. The licensee has not provided sufficient information to evaluate the manner in which it will assure that the maximum bolt allowable stress will not be exceeded. Therefore, use of this relief request for joints not classified as "hard joints" is denied.

Compliance with the code creates the hardship of requiring that bolting be removed at leaking mechanical connections for the purpose of performing a VT-3 examination. In some cases this could result in systems having to be depressurized and an increased radiation exposure to workers. The proposed alternative allows retorquing of bolts to stop leakage at the joint. If the leakage does not stop, then one bolt is required to be removed and a VT-3

examination must be performed on the bolt, in accordance with subparagraph IWA-5250(a)(2) in the 1990 Addenda of Section XI. This alternative provides adequate assurance of the structural integrity of the bolted connection, and imposition of the Code requirements would not result in a compensating increase in the level of quality and safety.

4.0 CONCLUSION

The licensee's proposal to verify the structural integrity of leaking bolted connections by torquing the connection with the system pressurized and stopping the leakage, as outlined in Relief Request PR-18 (Revision 0), is found acceptable by the staff and the Relief Request PR-18, Revision 0, is authorized pursuant to 10 CFR 50.55a(a)(3)(ii). Use of Relief Request PR-18 for joints not classified as hard joints is denied. Compliance with the code would result in hardship or unusual difficulty without a compensating increase in the level of quality and safety.

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