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U.S. Nuclear Regulatory Commission
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Subject: Dresden Nuclear Power Station, Unit 2
Reactor Pressure Vessel Head Stud Flaw Evaluation Report, Revised
NRC Docket No. 50-237

References:

a) Teleconference between Nuclear Regulatory Commission (NRC) and Commonwealth Edison (ComEd) dated April 14, 1998

b) M.H. Richter (ComEd) letter to T.E. Murley (NRC) concerning "Structural Margins Evaluation for Reactor Pressure Vessel Head Studs," GE-NE-523-93-0991, dated October 3, 1991

c) General Electric Report GENE-B13-01920-58, "Dresden Unit 2 Vessel Head Stud Flaw Evaluation," dated May 1998

d) J. M. Heffley (ComEd) letter #98-0121 to USNRC dated April 14, 1998, "Reactor Pressure Vessel Head Stud Flaw Evaluation Report"

In a recent teleconference (reference a) between the Nuclear Regulatory Commission (NRC) and the Commonwealth Edison Company (ComEd) we discussed the Dresden Unit 2 Reactor Pressure Vessel Head Stud flaw identified in stud number 81. This discussion centered around the reference 6 structural margin evaluation performed by General Electric (GE) which was used in reference d to support continued operation of Unit 2 with the flawed reactor head closure stud number 81 in place. During that discussion, an assumption stated in reference b regarding the limiting load case (stud tensioning) was challenged by Simon Sheng of the NRC staff. ComEd agreed to provide a quantitative justification to support the analysis. During the follow-up review of the analysis by its author, General Electric, it was determined that this assumption was not valid.

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The purpose of this letter is to transmit the reanalysis of the subject studs performed by General Electric (reference c), which is attached. This reanalysis showed the limiting load case to be normal/upset condition rather than stud tensioning. However, the overall conclusion from the reanalysis is that continued operation of Dresden Unit 2 with the cracked vessel head closure stud in place is justified.

Background

On March 8, 1998, during the In-Service Inspection of the unit 2 reactor pressure vessel head studs, two studs, number 52 and number 81, were determined to contain flaw indications. No recordable indications were identified in the remaining 90 head studs. End-shot ultrasonic testing (UT) detected the flaw indications at 56"- 57" from the top of the studs, with a 75% Distance Amplitude Curve (DAC). Stud number 52 was replaced with a new stud. Stud number 81 was inadvertently left in place while a stud with no indications (number 91) was mistakenly replaced with a new stud.

Currently Dresden Unit 2 is operating with one Reactor Pressure Vessel Head (RPV) Stud, number 81, containing a flaw indication, in place following reactor vessel closure. Dresden Station is planning to replace stud number 81 during the next refueling outage (D2R16).

Technical Discussion

The Dresden RPV head contains 92 studs. All of these studs receive an end-shot UT inspection during every refueling outage with a technique qualified in accordance with Appendix VI of the 1989 edition of ASME Section XI. The depth detection threshold of the end-shot technique utilized is 0.157".

There are three fundamental differences between the initial analysis (reference b) and the revised analysis (reference c, enclosed). First, the initial analysis examines only the stud tensioning load case. This load case was thought to bound all other load cases based on Engineering judgment. The revised analysis determined that this was not the case. Secondly, the initial analysis assumes that the inspection method limit of detection masks the presence of actual flaws and thereby applies unnecessarily restrictive safety factors. In the revised analysis, safety factors intended for "postulated" flaws are applied, i.e. Appendix G of ASME section XI. Thirdly, a more realistic approach has been used to determine crack growth. This reflects the actual duration during D2R15 in which the material was exposed to the conditions where it was susceptible to crack growth.

The analysis of reference c (enclosed) assumes stud number 81 to be incapable of sustaining any load. Although inservice inspection determined that the remaining 91 studs were not flawed, the analysis conservatively assumes a hypothetical edge flaw of 0.157" depth, the threshold for endshot detection, in each stud. Each design basis load case was

evaluated to determine the allowable depths for postulated flaws. The resulting limiting load case, normal start-up, determined the allowable edge flaw depth to be 0.390″. This allowable edge flaw depth was determined using the ASME Section XI safety factors recommended for hypothetical flaws in Appendix G. As a result of the D2R15 outage duration, the studs were subject to a crack growth environment for only a brief interval between tensioning and pressure testing. At the previously determined growth rate, the postulated crack growth is limited to 0.050″. Therefore, when anticipated growth is added to the hypothetical threshold of detection depth crack, the anticipated end of cycle flaw depth (0.207″) is considerably below the allowable edge flaw depth (0.390″).

The reduction in total stud cross sectional area resulting from assuming stud #81 has failed is also considered as required in paragraph IWB-3610 of ASME Section XI. In addition, the evaluation assumes that the remaining ninety-one studs each have hypothetical edge cracks at the allowable edge crack depth of 0.390″. The results determined the closure assembly bolt area requirements will meet the Code requirements of IWB-3610 if the remaining 91 studs were flawed to a depth of 1.1″. These evaluations demonstrate the redundancy present in the design of the reactor closure of Dresden Unit 2.

The overall conclusion from the reanalysis is that continued operation of Dresden Unit 2 with the cracked vessel head closure stud (#81) in place is justified.

Please direct any questions regarding this matter to Mr. Frank Spangenberg, Dresden Regulatory Assurance Manager, at (815) 942-2920 extension 3800.

Sincerely,

J.M. Heffley
Site Vice President
Dresden Station

Enclosure – Dresden Unit 2 Vessel Head Stud Flaw Evaluation, May 1998

cc: Regional Administrator, Region III
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