

SAFETY EVALUATION  
FOR  
VIRGINIA ELECTRIC AND POWER COMPANY  
NORTH ANNA POWER STATION UNIT 1  
REACTOR VESSEL HEAD PENETRATIONS  
USE OF AN ALTERNATIVE REPAIR TECHNIQUE

BACKGROUND

Virginia Electric and Power Company (VEPCO) plans to inspect selected vessel head penetrations (VHPs) at North Anna Unit 1 during the upcoming outage currently scheduled to begin February 10, 1996. The licensee plans to inspect 12 VHPs that contain thermal sleeves, 4 thermocouple VHPs that are unsleeved, and 4 spare VHPs that are sleeved. If a flaw is identified that exceeds the acceptance criteria in the first group of VHPs, an additional ring (ring 10) of VHPs will be examined. If an unacceptable flaw is found in the 4 sleeved VHPs in ring 10, the 8 sleeved VHPs in ring 9 will be inspected. The sample expansion plan is designed such that the outermost VHP are inspected first and further expansions involve the inspection of the outermost uninspected VHPs.

ASME CODE REQUIREMENTS

There are no requirements in the ASME Section XI, 1983 Edition, Summer 1983 Addenda, the Code of Record for North Anna Unit 1, to inspect the inside diameter of the VHPs. Hence, there are no inservice inspection acceptance standards in Section XI of the ASME Code. Subparagraph IWA-3100(b) states that if acceptance standards for a particular component are not specified in Section XI, then flaws that exceed the original design specifications given in Section III can be used subject to review by the enforcement authority having jurisdiction at the plant site. Proposed acceptance criteria are contained in Westinghouse WCAP 14024, "Inspection Plan Guidelines for Industry/Plant Inspection of Reactor Vessel Closure Head Penetration Tubes." The acceptance criteria were reviewed and accepted with comments by the NRC staff in a letter from W.T. Russell to W. Raisin (NUMARC), "Safety Evaluation for Potential Reactor Vessel Head Adaptor Tube Cracking," November 19, 1993. The NRC comments have been incorporated in WCAP 14024, Rev.1.

VEPCO/WESTINGHOUSE PLANS FOR REPAIR OF FLAWS

VEPCO and Westinghouse have developed repair techniques for flaws exceeding the acceptance criteria known as the embedded flaw repair method. The NRC staff has found that Westinghouse has submitted an acceptable alternative to the ASME Code in WCAP-14519, "RV Closure Head Penetration Tube ID Weld Overlay Repair," A Westinghouse Owners Group Program Report (MUHP-5017), B.W. Bevilacqua, C.C. Kim, E.S. Diaz, November 1995. The NRC staff's safety evaluation of this report is contained in Attachment 2 to this document. The use of this alternative to the Code may be necessary if flaws exceeding the acceptance criteria are found in any of the 52 out of 65 VHPs containing thermal sleeves. Removal of flaws greater than 0.25 inches deep requires the removal of the thermal sleeve due to the geometry of penetrations containing a

thermal sleeve and the availability of tooling. The removal and reinstallation of thermal sleeves involves special tooling, remote machining, and, significant radiation exposure.

#### VEPCO PROPOSED ALTERNATIVE WELD REPAIR

VEPCO has proposed using the embedded flaw repair method as an alternative to the Code requirements if repairs are required to the VHPs. The flaws will be partially removed using electric discharge machining. The excavation will be based on the depth of the measured flaw. The completed weld will be examined volumetrically using eddy current and ultrasonic testing as appropriate. The weld area will be examined using liquid penetrant testing. The reactor vessel head will be examined visually (VT-2) without removal of the insulation during startup at normal operating pressure.

#### STAFF EVALUATION OF THE PROPOSED ALTERNATIVE WELD REPAIR

The staff finds the proposed weld repair to be an acceptable alternative even though the flaw may not be completely removed. The embedded flaw repair will provide sufficient wall thickness to the VHP such that leakage will not occur through the VHP wall during normal operation. Code Case N-504-1, Alternative Rules Repair of Class 1, 2, and 3 Austenitic Stainless Steel," has been approved by the NRC staff for the use of weld overlays over embedded flaws in stainless steel piping. The proposed weld repair follows the guidelines in Code Case N-504-1 including the excavation of the flaw, the weld overlay, and the post weld repair non-destructive evaluation.

#### NRC STAFF CONCLUSIONS

The NRC staff concludes that the use of the embedded flaw repair method following the procedures and processes outlined in WCAP-14519 is an acceptable alternative to the ASME Code since it restores the Code required minimum wall thickness thus providing an acceptable level of quality and safety. The proposed alternative is authorized as requested pursuant to Title 10 of the Code of Federal Regulations (CFR) 50.55a(a)(3)(i) for the repair of flaws exceeding the acceptance criteria for the North Anna Power Station, Unit 1 reactor VHPs.

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