Tennessee Valley Authority, Post Office Box 2000, Soddy-Daisy, Tennessee 37379

October 11, 1995

U.S. Nuclear Regulatory Commission
ATTN: Document Control Desk
Washington, D.C. 20555

Gentlemen:

In the Matter of) Docket No. 50-327
Tennessee Valley Authority)

SEQUOYAH NUCLEAR PLANT (SQN) - REQUEST FOR APPROVAL OF ALTERNATIVE TO AMERICAN SOCIETY OF MECHANICAL ENGINEERS (ASME) CODE REQUIREMENTS - CANOPY SEAL WELDS - UNIT 1

Pursuant to 10 CFR.50.55a(a)(3), TVA is requesting the use of alternatives to the ASME code for repair of three lower canopy seal welds. While in the Unit 1 Cycle 7 refueling outage, boric acid residue was noticed on a control rod drive mechanism (CRDM) during reactor vessel disassembly. A closer inspection indicated that two CRDMs (E-13 and L-13) and one thermocouple penetration (A-5) have signs of minor leakage (boric acid residue) at the lower canopy seal weld.

Repair options have been evaluated and it was determined that the most appropriate repair was the use of weld buildup rather than removing the defect and performing a weld repair. Weld buildup is considered by TVA to be an acceptable repair technique because the canopy seal weld does not provide structural integrity or act as a pressure retaining boundary for the threaded joint. Even though the subject welds do not provide structural strength or serve as a pressure boundary for the threaded joint, the weld buildup over the canopy seal is considered a repair under the rules of ASME Section XI, IWA-4000, because welding is performed on pressure retaining components.

SQN's CRDMs and thermocouple penetrations are Class A vessels as defined by ASME Section III, 1968 Edition. N-518.4 of the 1968 Edition of the ASME Section III code and NB-5271 of later editions of the Section III code require seal welds to receive either a magnetic particle or liquid penetrant examination. TVA has evaluated performance of these examinations and has determined that either examination would be impractical. The affected canopy seal welds are located in a high radiation area (2 rem/hour on contact and 1000 - 1500 millirem/hour at 1 foot) and access to the welds is difficult due to the limited clearance between the adjacent CRDMs.

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Accordingly, TVA has used an alternative examination technique. The alternative examination involved using a remote video camera with a magnification of approximately 8X to 10X to perform a visual examination of the final weld at the enhanced magnification. In addition, fracture mechanic analyses demonstrates that critical flaw size would be sufficiently large for detection using the enhanced visual examination.

Please direct questions concerning this issue to D. V. Goodin at (423) 843-7734.

Sincerely,

R. H. Shell

R. H. Shell
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ENCLOSURE

Unit: 1

System: Reactor Coolant - System 68

Class: 1

Function: Vertically position a control rod in the nuclear core by raising or lowering an interconnecting drive shaft.

Code Requirement: American Society of Mechanical Engineers (ASME) Section XI, 1980 Edition through the 1981 Winter Addenda, Paragraph IWA-4120, "Repairs shall be performed in accordance with the Owner's Design Specification and Construction Code of the component or system. Later editions of the Construction Code or of Section III, either in the entirety or portions thereof, may be used. If repair welding cannot be performed in accordance with these requirements, the following may be used: (a) IWB-4000 for Class 1 components."

Background: During the Unit 1 Cycle 7 refueling outage activity of disassembling the reactor vessel, boric acid residue was noticed on a control rod drive mechanism (CRDM). Further inspection shows that two CRDMs and one thermocouple penetration have started leaking at the lower canopy seal weld (see Attachments 1 and 2).

The CRDMs and a thermocouple penetration are part of the nuclear steam supply system procured from Westinghouse Electric Corporation under Contract 91934. The 1968 Edition of ASME Section III and its addenda establish the design specification and construction code for the CRDMs. The CRDMs and a thermocouple penetration are part of the Class A vessel as defined by ASME Section III, 1968 Edition.

The CRDMs and a thermocouple penetration are fabricated in sections with threaded joints providing the pressure-retaining capabilities. Since the threaded joint provides pressure retention, the canopy seal weld is not pressure retaining and is for leakage control. The 1968 Edition of ASME Section III does not specifically address (either allowing or disallowing) these types of joints. Later editions of ASME Section III address threaded joints and do not allow them as the only seal as described in NB-3671.3. NB-3227.7 addresses the design of canopy seal welds. NB-5271 requires that seal welds receive either a magnetic particle or liquid penetrant examination.

Impractical Requirement: Due to physical space limitations and in consideration of as low as is reasonably achievable (ALARA), the flaws found by visual inspection cannot be removed. In addition, if the flaws were removed, it would be impossible to reproduce the configuration of the material as required by the design in order to restore the canopy seal back to its original design condition as required by IWA-4000 and IWB-4000.

Alternative Requirement: TVA's Code of Record for Repairs and Replacements is ASME Section XI, 1980 Edition through the Winter 1981 Addenda. TVA proposes to use Code Case N-389, which allows the use of later code editions and addenda of Section XI. Code Case N-389 is approved for use in the latest revision of Regulatory Guide 1.147. IWB-3640 and Appendix C of the 1989 Edition of ASME Section XI is used to perform the required fracture mechanics and to design a weld overlay repair of the flawed canopy seal weld. Code Case N-504-1 is also used for guidance. Code Case N-504-1 allows repair by addition of weld material without removal of the underlying defect to be considered as a code repair. IWB-3640 provides criteria for acceptance of flaws without repair in ductile, austenitic materials. The basis for such acceptance is the evaluation of the structural adequacy of the flawed component after considering the predicted flaw growth over the evaluation period. The acceptance criteria is based upon the net section collapse (limit load) criteria which are defined in detail in Appendix C of Section XI. Also, NUREG-0313, Revision 2 is used for guidance. The repair design is based upon conservative treatment of applied stresses, and includes allowance for continued flaw growth, as required by Section XI.

The material used for the repair is Alloy 625 weld material, which is stronger than the underlying base material, more resistant to degradation mechanisms such as stress corrosion cracking, and is highly ductile. The load carrying capability of the repaired location is greater than the original component.

Dye-penetrant examinations that are required by NB-5271 will not be performed due to the space limitations, which prevent examiners the needed access to successfully perform the examination. As an alternative examination, TVA will use a remote video camera with a magnification of approximately 8X to 10X and perform a visual examination of the final weld at the enhanced magnification. The entire process of the repair will be recorded on video tape. The basis for this approach is that postweld dye penetrant examinations are surface examinations, and provides minimal assurance of repair integrity when compared to an enhanced visual examination. Additionally, fracture mechanics analyses demonstrate that

the critical flaw size (i.e., the flaw size, which would lead to the incipient collapse of the repair under code allowable applied stress conditions) is significantly larger than a flaw that would be reliably detected by the enhanced visual examination.

The fracture mechanics analyses assume that an initial flaw is completely through the repair membrane. Thus, there is a large margin in the analyses. TVA considers the fracture mechanics analyses, coupled with the enhanced visual examination, suitable to provide an acceptable alternative to the code required dye penetrant examination.

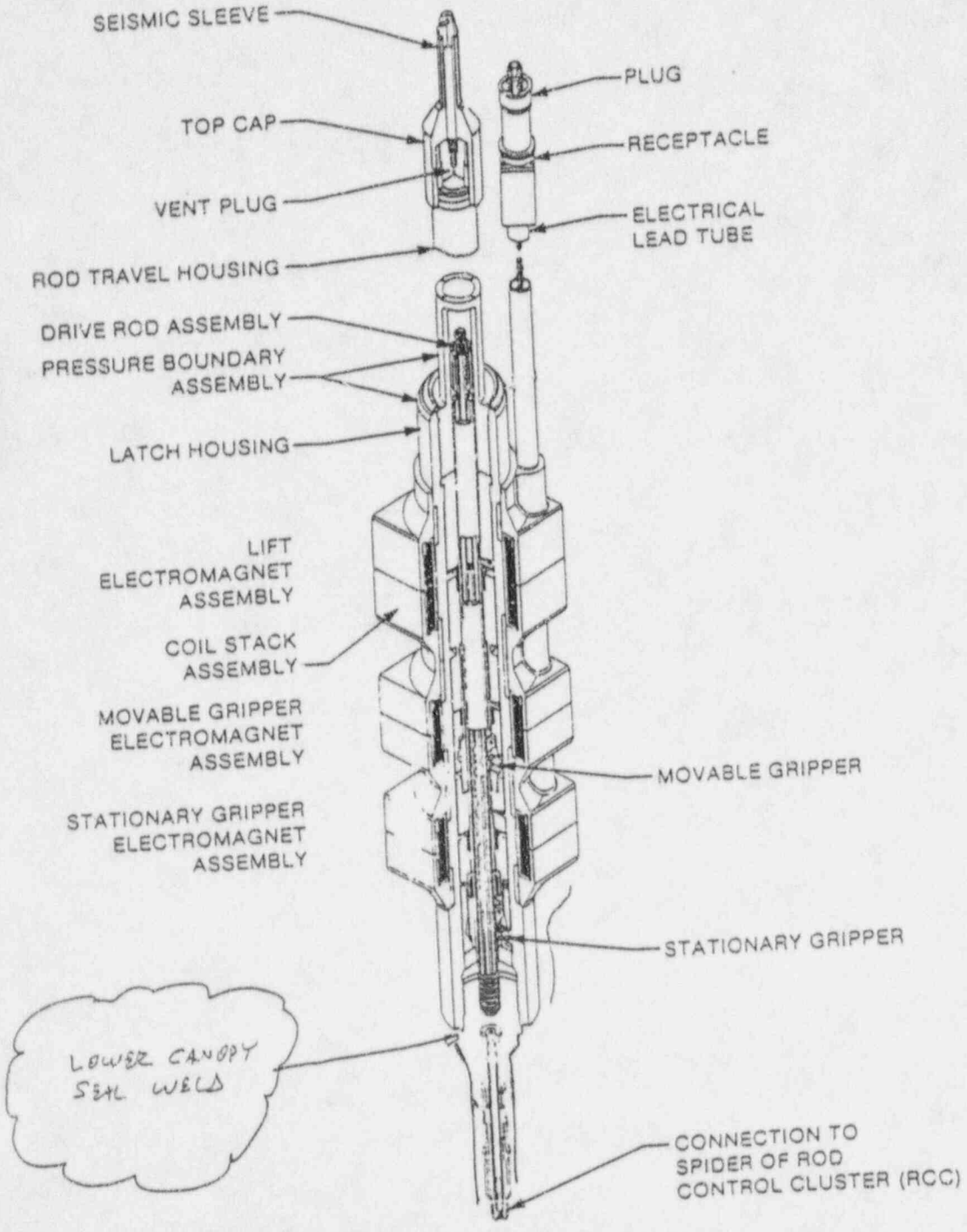

Figure 3.2-1. Cutaway of a Typical Control Rod Drive Mechanism

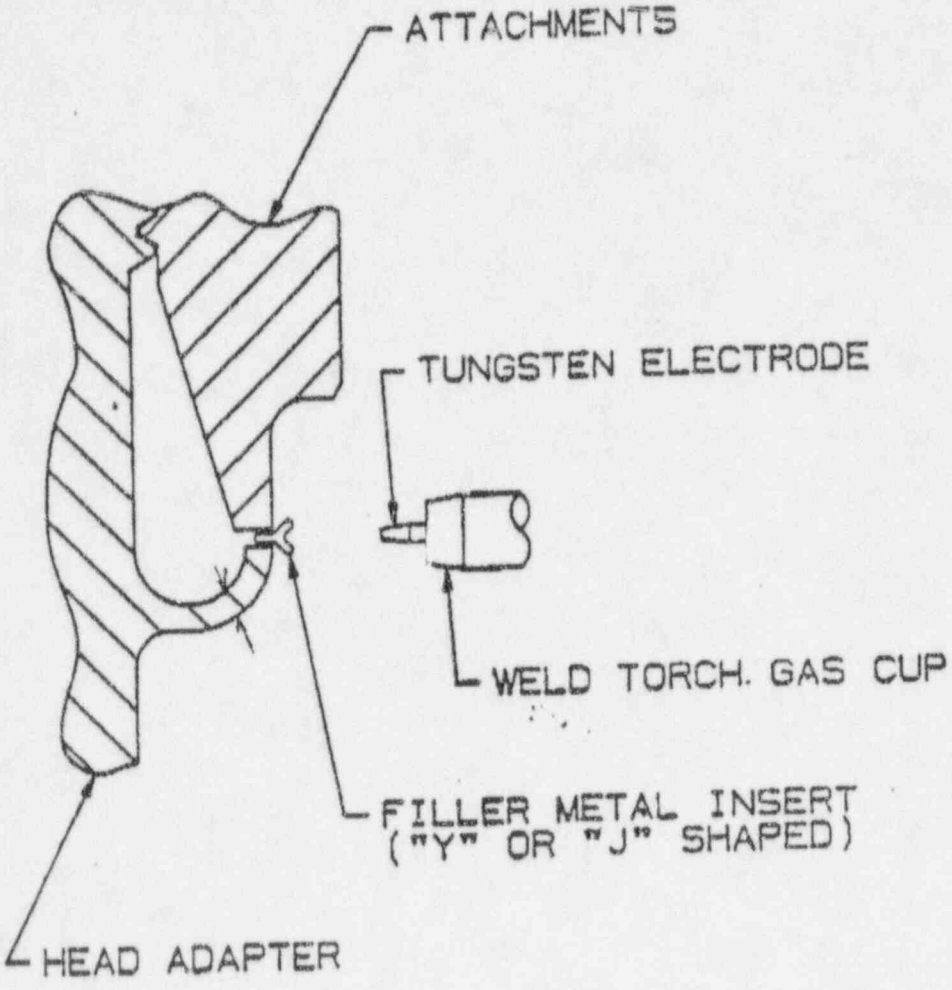

Figure 2-1. Schematic Illustration of Canopy Seal Weld Configuration