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

SAFETY EVALUATION BY THE OFFICE OF SPECIAL PROJECTS

NRC WELDING CATEGORY - WELD DESIGN AND CONFIGURATION

TENNESSEE VALLEY AUTHORITY

SEQUOYAH NUCLEAR POWER PLANT, UNITS 1 AND 2

DOCKET NOS. 50-327 AND 50-328

1.0 SUBJECT: NRC Welding Category - "Weld Design and Configuration"
TVA Category: WELDING
TVA Subcategories: EN 22201, EN 22202, WE 50915, WE 50999, IH 60300, WE 50899

The employee concerns were evaluated by TVA as potentially safety-related and applicable to the Sequoyah site or as potentially applicable to the Sequoyah site on a generic basis. TVA established the Welding Project to formulate a program for each nuclear plant site to address the employee concerns related to TVA's welding program. Many of the concerns which originated at the Watts Bar Nuclear Plant were determined by TVA as possibly being generic, and therefore applicable to all of the TVA nuclear plant sites.

For the Sequoyah site, the TVA Welding Project is divided into two phases. Phase 1 is a review of the records to determine if there are any problem indicators. Most of the final element reports which are TVA's evaluation of employee concerns with a common issue(s) were written on the basis of the Phase 1 efforts. Phase 2 involved a review of ISI and LER records, an audit by Bechtel of the welding program records, and a physical reinspection of specific weldment populations whose samples were selected on an engineering and logic basis.

The NRC staff formed a Welding Task Group with representatives from the Offices of Nuclear Reactor Regulation (NRR), Inspection and Enforcement (I&E), and Region II. The Task Group established an Expert Welding Team through an NRR Technical Assistance contract with Brookhaven National Laboratory (BNL). BNL provided a Technical Evaluation Report (TER) which summarized the opinions of the Expert Welding Team concerning the various welding issues and the actions taken by TVA as addressed in TVA's Element Report drafts of mid-1986. The NRC Welding Task Group also performed independent visual, surface and volumetric reinspections of weldments at the Sequoyah site with help of Region I personnel operating out of the NDE van. The TER and the Inspection Reports were incorporated in the initial Welding SER issued to TVA on November 11,1986. This SER is being provided to address, in more detail, the individual employee concerns and the changes made of the individual employee concerns declared generic to the Sequoyah facility since the initial staff Welding SER.

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The staff believes that there are five essential elements which must be functioning for a welding program to be viable. The staff placed each of the individual employee concerns into one of these essential element categories. A miscellaneous category was established to cover those aspects which are not directly related to the welding program. These program essential element categories are as follows:

Welding Procedures
Welder Qualification/Training
Welding Inspection
Weld Design and Configuration
Filler Material Control
Miscellaneous/One of a Kind

The staff's approach has been to group similar employee concerns within an essential element to establish an "issue" or "issues". The staff reasons that the particular issue(s), if valid, and significant, would generate an adverse condition in the hardware. As part of the overall program for reassessing the TVA welding program implemented during plant construction and operations, TVA and the NRC staff conducted reinspections at the Sequoyah site to determine 1), that the licensee's corrective actions for resolving the issues raised by the employee concerns were being satisfactorily implemented, and 2), that the hardware was suitable for service. NRC staff inspections and evaluations were performed on TVA's record audits program, personnel performing TVA's audits and reinspections, and TVA's records.

The employee concerns considered in NRC Essential Element "Weld Design and Configuration" are as follows:

EMPLOYEE CONCERN NO.	TVA FINAL ELEMENT REPORT RESPONDING TO CONCERN	BRIEF DESCRIPTION OF CONCERN
EX-85-039-003	WP-15-SQN	WATTS BAR: DESIGN DEFICIENCY: WRONG WELD ON BOX ANCHOR
IN-85-405-001	WP-15-SQN	POSSIBILITY OF METAL FATIGUE/ IN-SERVICE FAILURE IN CIRCUM. WELDS CONNECTING SS PIPE TO BOX HANGERS...
IN-85-613-001	WP-15-SQN	THERMAL STRESS CAUSED BY 1/2" - 1" CIRC WELD ON PIPE TO INSTALL BOX HANGER (GENERIC CONCERN)
**WBP-6-007-001	WP-15-SQN	BOX ANCHORS ARE IMPROPERLY DESIGNED PLANT WIDE
XX-85-086-003	I-85-560-SQN	DESIGN DEFICIENCY ON BOX HANGERS WHICH WILL WELD HANGER TO PIPE AND RESTRICT PIPE MOVEMENT

EMPLOYEE CONCERN NO.	TVA FINAL ELEMENT REPORT RESPONDING TO CONCERN	BRIEF DESCRIPTION OF CONCERN
XX-85-068-007	I-85-636-SQN	TVA MANUFACTURED SPOOL PIECE REPLACED DRAVO CODE STAMPED SPOOL PIECE
XX-85-100-001	ERT XX-85-100-001	IMPROPER REPAIR OF AN UNDETERMINED NUMBER OF WELDS.

**This concern was determined by TVA to be generically applicable to SQN subsequent to the writing of the Welding TER/SER.

The employee concern XX-85-086-002 was originally listed as being applicable to Sequoyah, and was subsequently judged by TVA's Welding Project as not being applicable to Sequoyah. The staff has reviewed this concern and has determined that this concern is a duplicate of other concerns already applicable to Sequoyah, and that its removal does not significantly change the distribution of concerns/issues within the five NRC essential element categories. This concern is further discussed in the NRC Miscellaneous/One of a Kind category.

2.0 SUMMARY OF ISSUES

The welding issues involved with the four employee concerns covered in WP-15-SQN and the one concern covered in I-85-560-SQN are summarized as follows:

- Box anchor drawings have a typical detail that show a weld configuration which limits pipe movement because a box anchor weld would fuse to the pipe.

- Restriction of movement during pipe expansion due to box anchor weld fusing to piping could cause fatigue in service.

- There is a possibility of fatigue in service and material degradation due to continuous welding using large diameter electrodes and excessive amperage.

- Thermal stresses could possibly degrade piping where large fillet welds on box anchors attach to process piping.

The issue involved with the employee concern covered in I-85-636-SQN is summarized as follows:

- TVA manufactured a spool piece, substituted it for a Dravo ASME Code stamped spool piece, and then removed the nameplate (including the ASME stamp) from the Dravo piece and placed the nameplate on the TVA manufactured piece.

The issue involved with employee concern XX-85-[illegible]0-001 covered by the ERT Report of the same number is summarized as follows:

- An undetermined number of welds may have been improperly repaired. This issue is based upon a Watts Bar Steamfitter General Foreman having instructed steam fitter welders to repair welds contrary to the requirements of a weld procedure. This foreman was employed at one time as foreman of the Sequoyah Hanger Fabrication Shop. However, there was no direct knowledge of this foreman giving instructions for improper weld repairs at Sequoyah.

3.0. EVALUATION

The four employee concerns addressed in WP-15-SQN and the employee concern in NSRS Investigation Report I-85-560-SQN relate to a box anchor weld touching and fusing to the pipe. The issue of the weld limiting the pipe's motion, and imposing fatigue loads on the pipe was solved in the field for one instance by special steps to allow the plate to move along the pipe. The remaining seven of eight instances where this particular anchor design was used at Sequoyah have been addressed by having the drawings revised to prevent the box anchor weld from fusing to the pipe. Accordingly, the issues of restriction of movement and fatigue are not valid because the conditions that causes the issues had been corrected in the installation or design. The TVA Office of Engineering's evaluation and acceptance of the tests (Hodges memo of April 22, 1983 to Cox) of welding lugs to thin wall, small diameter stainless steel pipe with relatively large fillets found that there were no adverse effects on similar weldments at Bellafonte. The staff considers these results applicable to Sequoyah. The heat affected zone in the pipe at the interior surface of the pipe of such a weld may be sensitized, and conceivably be susceptible to stress corrosion cracking in an aggressive environment. However, the primary water control of a pressurized water reactor steam supply system reduces the oxygen content such that the heat affected zones of stainless steel welds, even though sensitized to an extreme degree, is not expected to result in stress corrosion cracking. Accordingly, this concern does not appear justified for a PWR.

In WP-15-SQN, TVA stated that analyses (CEB-CAS-173) took into account restraint, thermal stresses and fatigue were performed for the box anchor designs used. Based on the stated results of the analysis, the staff concurs with the conclusion of WP-15-SQN that the concern regarding thermal stresses has been adequately addressed.

The employee concern XX-85-068-007 addressed in I-85-636-SQN had as an issue that TVA manufactured a spool piece and then substituted it for a Dravo manufactured spool piece by transferring the Dravo nameplate including the code stamp to the TVA spool piece. This sequence of events was demonstrated by TVA as highly unlikely to have occurred. There were no records of Dravo spool pieces being delivered to Sequoyah and Dravo had no record of having shipped spool pieces to Sequoyah. Sequoyah is not a "Code" plant, and stamps are not applied to spool pieces which are basically pieces of pipe, but are applied to pressure vessels and other pressure retaining devices. TVA provided a possible circumstance for an observer to believe that an ASME "stamp" on a nameplate could have been transferred when the observer witnessed the transfer of a heat number from the original stock pipe material to a piece cut from stock to maintain traceability. We believe TVA adequately demonstrated that there was no issue of substance in this concern.

The issue of employee concern XX-85-100-001 addressed in an ERT Report of the same number is of a foreman, while working at Sequoyah, instructing workers to weld contrary to procedures. The concern was not substantiated at Sequoyah. However, the same foreman had instructed workers to repair welds contrary to requirements in a weld repair procedure at Watts Bar. The reinspections performed by TVA and NRC of many weldments from the Hanger Fabrication Shop where this foreman had worked did not find any weldments which were unsatisfactory for service.

4.0 CONCLUSIONS

The staff has concluded that concerns addressed in TVA element report WP-15-SQN, I-85-560-SQN and I-85-636-SQN have been adequately addressed. The concern addressed in in ERT XX-85-100-001 could not be substantiated. However, inspections by TVA and NRC did not identify any weldment in hangers unsatisfactory for service.