



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

SAFETY EVALUATION BY THE OFFICE OF SPECIAL PROJECTS

TENNESSEE VALLEY AUTHORITY

SEQUOYAH NUCLEAR POWER PLANT, UNITS 1 AND 2

DOCKET NOS. 50-327 AND 50-328

NRC WELDING CATEGORY - WELDING INSPECTION

I.0 Subject: NRC Essential Element - "Welding Inspection"

TVA Category: WELDING

TVA Subcategories: WE 50905, WE 50735, WE 50206, WE 50535, WE 50711,  
WE 50702, QA 80103, QA 80202, QA 80301, WE 50999,  
WE 50299, IH 60300, WE 50716, WE 50217, WE 50617,  
WE 50618, WE 50620, WE 50799

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 is 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.

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 "Welding Inspection" are as follows:

<u>EMPLOYEE CONCERN NO.</u>	<u>TVA FINAL ELEMENT REPORT RESPONDING TO CONCERN</u>	<u>BRIEF DESCRIPTION OF CONCERN</u>
IN-85-458-001	WP-02-SQN	INSPECTION OF WELDS IS PERFORMED AFTER THE WELDS HAVE BEEN PAINTED.
IN-85-767-003	WP-02-SQN	INSPECTION OF PAINTED WELDS. THE NRC IS INVOLVED HAVING APPROVED THE PROCEDURE FOR INSPECTING PAINTED WELDS
**IN-86-019-001	WP-02-SQN	INSPECTORS WERE DIRECTED TO ACCEPT WELDS THROUGH PAINT.
NS-85-001-001	WP-02-SQN	WELDS WERE INSPECTED SUBSEQUENT TO APPLICATION OF CARBOZINC PRIMER. CATEGORY I STRUCTURES, PIPE HANGERS, CABLE TRAY SUPPORTS AND DUCT SUPPORTS ARE INVOLVED
PH-85-040-001	WP-02-SQN	QA HANGERS WERE FREQUENTLY PAINTED BEFORE THE WELDS WERE INSPECTED. AUX BUILDING, REACTOR BUILDING #1, ELEV. 742 FT. - 0" AND 745 FT., 0". 1983.

<u>EMPLOYEE CONCERN NO.</u>	<u>TVA FINAL ELEMENT REPORT RESPONDING TO CONCERN</u>	<u>BRIEF DESCRIPTION OF CONCERN</u>
WI-85-013-003	WP-02-SQN	CONSTRUCTION SPECIFICATION (G29C), ALLOWS INSPECTION OF WELDS AFTER PAINTING SINCE 1981. STATED TO BE IN VIOLATION OF AWS D1.1.
WI-85-041-006	WP-02-SQN	AWS WELD INSPECTOR(S) DID NOT UNDERSTAND THE "5 MIL" PROVISION FOR INSPECTION OF CARBOZINC COATED WELDS CONTAINED IN REVISIONS OF SPEC G-29C, PROCEDURE
WI-85-041-008	WP-02-SQN	PROCESS SPECIFICATION #3.C.5.4 OF G-29C PERMITTED INSPECTION OF AWS WELDS THROUGH CARBOZINC PRIMER FOR ELEVEN MONTHS AFTER ENGINEERING EVALUATION
*IN-85-007-001	WP-04-SQN	INSPECTION TOOLS FOR WELDING INSPECTORS WERE NEVER ISSUED, i.e., WELD SIZE GAUGES, FIT-UP GAUGES, ETC.
*IN-85-134-002	WP-04-SQN	Q.C. INSPECTORS WERE NOT SUPPLIED WELDING INSPECTION TOOLS. SOME INSPECTORS SUPPLIED THEIR OWN INSPECTION TOOLS.
*IN-85-406-003	WP-04-SQN	NO WELD INSPECTION TOOLS ISSUED PRIOR TO 1979.
**IN-85-339-005	WP-05-SQN	EGT PIPING TOO CLOSE TO WALL TO PERMIT ADEQUATE ACCESS FOR WELDING
PH-85-012-X03	WP-05-SQN	WELDING AND BRAZING INSPECTION OF SAFETY RELATED DUCTWORK DELETED
IN-85-476-004	WP-06-SQN	INDIVIDUALS WITH GROCERY CLERK TYPE BACKGROUND WERE INSPECTING WELDS WITHIN TWO WEEKS
IN-85-981-001	WP-06-SQN	WELDING INSPECTORS INADEQUATELY TRAINED PRIOR TO 1981 (TOO LITTLE TRAINING TIME)
WI-85-041-002	WP-06-SQN	QUALIFICATIONS OF AWS STRUCTURAL WELDING INSPECTORS IS QUESTIONABLE. LEVEL II GRANTED AFTER TWO MONTHS OJT. TOPICAL REPORT HAS BASTARDIZED ANSI N45.2.6.

<u>EMPLOYEE CONCERN NO.</u>	<u>TVA FINAL ELEMENT REPORT RESPONDING TO CONCERN</u>	<u>BRIEF DESCRIPTION OF CONCERN</u>
WI-85-081-007	WP-06-SQN	W. OING INSPECTORS NOT QUALIFIED
XX-85-069-001,RO	I-85-373-NPS	EMPLOYEES CERTIFIED BUT NOT QUALIFIED. THEY DO NOT ACTUALLY HAVE THE OJT TIME THAT IS DOCUMENTED.
XX-85-069-001,R1	I-85-373-NPS	" " " " "
XX-85-069-007	I-85-373-NPS	" " " " "
XX-85-069-X05	I-85-373-NPS	OJT RECORDS FALSIFIED
IN-85-406-002	WP-09-SQN	NO WELD INSP CRITERIA PRIOR TO 1979
IN-85-271-001	WP-11-SQN	WELDS BEING GROUND IN UNITS II SO THAT THEY "LOOK PRETTY"
IN-85-282-002	WP-11-SQN	SURFACE GRINDING MASKS DEFECTS
BEM-5-001-001	WP-16-SQN	BELLEFONTE - G-29C CONFLICTS WITH QA REQUIREMENTS
**BFM-5-001-001	WP-16-SQN	BROWNS FERRY G-29C CONFLICTS WITH QA REQUIREMENTS
SQM-5-001-001	WP-16-SQN	SEQUOYAH - G-29C CONFLICTS WITH QA COMMITMENTS
WBM-5-001-001	WP-16-SQN	WATTS BAR - G-29C CONFLICTS WITH QA COMMITMENTS
**WI-85-030-007	WP-16-SQN	THE WBN FSAR COMMITS TVA TO THE REQUIREMENTS OF AWS D.1.1 FOR STRUCTURAL WELDING. CONTRARY TO THESE REQUIREMENTS, THE G-29 PROCESS SPECIFICATION MODIFIED MANY CRITERIA.
BEM-5-001-002	WP-16-SQN	BELLEFONTE - UNCERTIFIED WELDER FOREMEN REQUIRED TO PERFORM PREWELD INSPECTIONS
BFM-5-001-002	WP-16-SQN	BROWNS FERRY - UNCERTIFIED WELDER FOREMEN PERFORM PREWELD INSPECTIONS.

<u>EMPLOYEE CONCERN NO.</u>	<u>TVA FINAL ELEMENT REPORT RESPONDING TO CONCERN</u>	<u>BRIEF DESCRIPTION OF CONCERN</u>
SQM-5-001-002	WP-16-SQN	SEQUOYAH - UNCERTIFIED WELDER FOREMEN PERFORM PREWELD INSPECTIONS
WBM-5-001-002	WP-16-SQN	WATTS BAR - UNCERTIFIED WELDER FOREMEN PERFORM PREWELD INSPECTIONS
IN-85-212-001	WP-16-SQN	WELD FIT-UP INSPECTION ON DUCT SUPPORTS PERFORMED DURING 1979-1980. PRESENT DUCT SUPPORTS ARE NOT UNDERGOING WELD INSPECTION. WHY AREN'T THE INSPECTIONS BEING PERFORMED?
#IN-85-007-003	WP-17-SQN	VENDOR WELDS SHOULD BE INSPECTED BECAUSE OF BAD QUALITY.
#IN-85-127-001	WP-17-SQN	INCONSISTENCY OF WELD INSPECTION CRITERIA. VENDOR WELDS LOOK VERY BAD.
#IN-85-657-001	WP-17-SQN	VENDOR WELDS DON'T MEET ACCEPTANCE CRITERIA
XX-85-098-001	WP-18-SQN	WELDER COULD NOT PROPERLY WELD PIPE DUE TO LAMINATION
SQM-6-008-001	WP-20-SQN	STAINLESS STEEL UNDERSIZED SOCKET WELDS IN ACCUMULATOR ROOM #5, REACTOR II
XX-85-108-001	I-85-776-SQN	TWO INCH SOCKET WELDS IN UNIT 1 ACCUMULATOR ROOMS AND/OR FAN ROOMS WERE NOT INSPECTED.
XX-85-108-002	I-85-776-SQN	STAINLESS STEEL SOCKET WELDS WERE NOT INSPECTED
**XX-85-054-001	I-85-346-SQN	QC HOLDPOINTS SIGNED OFF BY CRAFTSMEN PERFORMING THE WORK. COLLUSION BETWEEN INSPECTORS AND CRAFT
XX-85-083-001	I-85-652-SQN	WELDING INSPECTION AT SEQUOYAH NOT AS STRICT AS AT WATTS BAR
XX-85-102-011	I-85-735-SQN	NDE INSPECTORS CAN ONLY WRITE NOIs. FOR PRESERVICE RELATED DEFECTS MRs USED.
XX-85-069-003,R1	I-85-738-SQN	ACCEPTANCE OF REJECTED ITEMS BY OTHERS

<u>EMPLOYEE CONCERN NO.</u>	<u>TVA FINAL ELEMENT REPORT RESPONDING TO CONCERN</u>	<u>BRIEF DESCRIPTION OF CONCERN</u>
XX-85-065-001	I-85-750-SQN	PERFORMANCE OF REMOTE VISUAL INSPECTIONS

---

- \* These concerns were addressed in a separate "mini" SER forwarded to PWR-A on February 26, 1987 (attachment 1 to this report).
- \*\* These concerns were made known to the NRC as being generically applicable to Sequoyah by TVA's Employee Concern Program after the writing of the Welding SER. Subsequently, TVA's Welding Project judged some of these employee concerns (and others originally listed as being generically applicable to Sequoyah) as being Watts Bar unique because of reference to Watts Bar or its features, locations, etc.

The following employee concerns, which were originally listed by TVA as being applicable to Sequoyah, were subsequently judged by TVA's Welding Project as not being applicable to Sequoyah. The staff has reviewed these concerns and have determined that these concerns are duplicates of other concerns already applicable to Sequoyah, and that their removal does not significantly change the distribution of concerns/issues within the five NRC essential element categories. These concerns are further discussed in the NRC Miscellaneous/One-of-a-Kind category.

BFM-85-001-001	IN-85-299-003	IN-85-339-005	IN-86-019-001
WI-85-030-007	XX-85-054-001		

## 2.0 Summary of Issues

The issues involved with the eight employee concerns covered in WP-02-SQN are summarized as follows:

- Specifications allow inspection of welds after painting or coating with inorganic zinc primer in violation of FSAR and AWS requirements after tests demonstrated that adequate inspections could not be made.
- Welds may have been inspected through primer.
- Inspectors did not understand the thickness provisions for primer and therefore were not qualified to perform inspections.
- NRC was involved in approving the procedure for inspecting of painted welds.

The issue involved with the three employee concerns covered in WP-04-SQN are summarized as follows:

- Welding inspection tools were not issued to welding inspectors.

The issues involved with the two employee concerns covered in WP-05-SQN are summarized as follows:

- Emergency Gas Treatment (EGT) piping too close to wall for adequate access for welding and inspection.
- EGT piping should have been welded and inspected from the inside of the pipe to assure adequacy.
- Welding and brazing inspection of ducting deleted from the QA program without adequate justification.

The issues involved with the four employee concerns covered in WP-06-SQN and the six employee concerns covered in I-85-373-NPS are summarized as follows:

- Welding inspectors are not qualified to perform inspections, although they are certified.
- Prior to 1981, the Welding Inspector Training and Certification Program allowed welding inspectors to complete their training in two weeks.
- The Training/Qualification Program for AWS welding inspectors is questionable because they have only two months On-the-Job-Training (OJT) which is not documented.
- Employee OJT records have been falsified.
- The Topical Report has been bastrardized regarding TVA compliance with ANSI N45.2.6.

The issue involved with the one employee concern covered in WP-09-SQN is summarized as follows:

- Prior to 1979, there were no specific weld inspection criteria for use by inspection personnel.

The issue involved with the two employee concerns covered in WP-11-SQN is summarized as follows:

- Surface grinding of welds may mask defects.

The issue involved with employee concern IN-85-212-001 covered in WP-16-SQN is summarized as follows:

- Weld fit-up inspections were performed by QC during 1979-80 on duct supports in Unit #1 and #2 but are not being performed on duct supports being installed in reactor building #2. What is the basis for eliminating these fit-up inspections?

The issues involved with the three employee concerns covered in WP-17-SQN are summarized as follows:

- Vendor welds are not of the same quality as TVA field welds.
- Vendor welds are not inspected in the field.

The issues involved with the remaining nine of ten employee concerns covered in WP-16-SQN are summarized as follows:

- Since welding foremen are performing fit-up inspections, is this a violation of TVA's Quality Assurance Program as defined in the FSAR or other commitments?
- If this situation is a violation of the FSAR or other commitments, what are the consequences?

The issue involved with the one employee concern covered in WP-18-SQN is summarized as follows:

- Laminations in pipe prevented making a good butt weld in Unit #2 condenser.

The issues involved with the one employee concern covered in WP-20-SQN and the two employee concerns covered in I-85-776-SQN are summarized as follows:

- Undersized socket welds in the Safety Injection System in Accumulator Room #5, Unit 2
- The construction weld inspection program was inadequate nine or ten years ago and did not assure that all stainless steel socket welds were inspected as required.
- Specifically, socket welds on two inch diameter stainless steel and hangers in Unit 1 accumulator and/or fan rooms were not inspected by the construction organization nine or ten years ago.

The issue involved with the one employee concern covered in I-85-346-SQN is summarized as follows:

- QC hold points were signed off by craftsmen performing the work. This was allowed to happen because of friendship/collusion between the craftsmen and the inspectors.

The issue involved with the one employee concern covered in I-85-652-SQN is summarized as follows:

- The weld inspections at Sequoyah were inadequate because they were not as stringent as the weld inspections at Watts Bar.



The issues involved with the one employee concern covered in I-86-735-SQN are summarized as follows:

- NDE inspectors can only write a notice of indication (NOI) on in service related defects.
- Preservice related defects can be identified only by a maintenance request (MR)

The issues involved with the one employee concern covered in I-85-738-SQN are summarized as follows:

- Previously rejected items (e.g. hangers) are often accepted by someone other than an NDE supervisor or higher level NDE examiner.
- An MR will be written with an NOI rejecting a hanger for a loose bolt or missing part. Later, another NDE examiner will accept the hanger "as is" and there was no documented reason for making such decisions.

The issue involved with the one employee concern covered in I-85-750-SQN is summarized as follows:

- Inspectors made a remote, inadequate visual inspection of suspended rigid ERCW pipe supports in the auxiliary building at the 669' elevation during February/March 1984.

### 3.0 Evaluation

The purpose of establishing categories and issues was to group the employee concerns of similar subject matter so that they could be uniformly addressed. The number of employee concerns relating to a given issue was regarded as an indication of how much effort should be applied to the issue; the more concerns, the more attention given to the issue. A review of the employee concerns determined that the majority of the employee concerns applicable to Sequoyah involved record and paperwork aspects of the welding program and very few had to do with actual welds.

An assessment of TVA's final Element Reports addressing the employee concerns was made by the staff. Generally, the staff agreed that TVA had adequately addressed the concerns. However, the emphasis on our efforts in evaluating the employee concerns has been the hardware, i.e., did the hardware conform to standards to which TVA committed to, and if not, were the welds satisfactory for service. In addition, the staff assessed the programmatic corrective actions taken by TVA to assure the welding program was adequate for future work.

The issues related to welding inspection, inspector qualification/certification and training were generally covered by TVA in their Phase 1

effort, the record review. TVA's Welding Project, as a Phase II effort, had the Bechtel Corporation perform an audit of Sequoyah's welding program records that included weld inspector training, qualification, and maintenance and renewal of qualifications. The issues on welding inspection were covered in both the Phase I and Phase II efforts.

The eight concerns covered by WP-02-SQN relate to inspection of welds through paint. Among the employee concerns listed in earlier versions of WP-02-SQN initially considered by the Welding Expert Team, one, WI-85-030-008, was dropped from consideration for the Sequoyah site, and another, IN-86-019-001 was added by later revisions. The specification covering reinspection of welds (TVA G-29C, Process Specification 3.C.4.5(a) was dated January 25, 1982.

There were caveats that restricted reinspections of welds to those that had been completed by November 2, 1981. This change to G-29C is moot in its application to Sequoyah because this change did not occur until after construction had been completed at Sequoyah. Therefore, this change did not affect the Sequoyah site. Sequoyah's original weld acceptance inspection procedures, both during construction and operation, did not allow for inspection of welds through paint. The only inspections performed at Sequoyah through paint were those permitted for completed systems as a part of the ASME Section XI In-Service Inspection Program or as a part of the TVA Welding Project Reinspections Program. The thickness of paint is not germane to this type of inspections. With regard to employee concern IN-85-767-003 claiming that the NRC approved the procedure for inspection through painted welds, the NRC has not objected to the use of NCIG-01 by TVA for reinspections of completed work. The caveats as to the use of NCIG-02 were established at the beginning of the TVA Welding Project Plan. To our knowledge NCIG-02 was only used as a part of the TVA Welding Project Plan.

For the two concerns covered by WP-05-SQN relating to the inspection of ERT ducting, the reinspections confirmed that the ducts were too close to the wall for welding and inspection, and the butt welds joining sections of duct were not made from the outside. It was determined that the segments of the affected welds close to the wall were made from the inside of the ducts through windows cut in the ducts which were subsequently welded closed (NRC Inspection Reports 50-327/86-09 and 50-328/86-09).

Ten of the concerns covered by WP-06-SQN and I-85-373-SQN involve NDE personnel not having adequate training, knowledge or experience to perform adequate weldment inspections, OJT records not providing a basis for the qualifications held by the inspectors, TVA QA Topical Report TVA-TR75-1A language was crafted in such a manner to obfuscate TVA's noncompliance with ANSI N45.2.6, and OJT records having been falsified.

The issues in WP-06-SQN involve individuals not having the training or experience necessary to be weld inspectors, i.e., that they were not "qualified". The tone and wording of the employee concerns appears to indicate this applied to visual weld inspectors rather than NDE inspectors. TVA demonstrated that

their weld visual inspector training program had requirements which specified formal training time and experience (OJT) necessary for certification. On a programmatic basis, the employee concerns and their issues were addressed. The Expert Welding Team agreed with TVA's evaluation that a program was in place during the construction era (the concerns indicated the time frame) which adequately addressed training, qualification, and certification of both visual and nondestructive testing personnel. The staff concurs with the Expert Welding Team's finding.

The issues in NSRS Report I-85-373-NPS relate to OJT records of weld inspectors having been falsified, or that the inspectors did not actually have the OJT time that was documented. The Expert Welding Team found that the original NSRS Report did not adequately address these concerns and that additional information was necessary to perform an evaluation of TVA's actions. Revision 1 of the NSRS Report includes a Corrective Action Plan as Attachment 8, which provides the necessary information. The extent of missing On-the-Job-Training or Work Time Experience (OJT/WTE) records were determined. Of 141 inspectors (QC and ISI) with certification in 442 NDE disciplines, documentation was found for 116 inspectors with certifications in 299 disciplines. There were incomplete OJT records (varying amounts of time up to that required) for 53 inspectors with 109 discipline certifications. The remaining 34 NDE discipline certification documentations without substantiation were addressed as follows:

- Seven inspectors with eight discipline certifications signed statements attesting to the adequacy of OJT or the applicability of previous WTE prior to certification.
- Four QC and ISI inspectors (seven NDE discipline certifications) could not provide proof of previous experience because their previous employer had gone out of business or the previous employer would not provide the records. A signed statement was obtained from each of the inspectors addressing the adequacy of the OJT and the validity of the WTE required.
- Eight inspectors (17 NDE disciplines) provided signed statements that the OJT prior to certification was adequate.
- One inspector (two NDE disciplines) had a WTE form signed by a TVA Level III indicating he had experience equivalent to a Level I.

TVA's Welding Project had the Bechtel Corporation perform an audit of Sequoyah's welding program records which included welding inspectors' initial, maintenance, and renewal of welding inspection personnel qualifications, and the use of appropriately trained and qualified personnel. There had been other previous internal audits by TVA of welding inspectors training and qualification records after the plant received its operating license, however, no evidence was provided of audits being conducted during the construction time frame. No instances of noncompliance with TVA's procedures for weld inspector's training, initial qualification, maintenance, and renewal were found by the Bechtel audit.

Although the Bechtel Audit found no discrepancies in the NDE personnel records they audited, the responses of the Corrective Action Plan to the recommendations in the NSRS Investigation Report demonstrated that the documentation of OJT/WTE for welding inspectors was not complete. The criteria for the Bechtel audit in this area apparently was limited to the records which were reviewed, and did not include OJT/WTE records as there was no requirements for the retention of these type records. According to the Corrective Action Plan response, for approximately 7% of the inspection discipline training, there was no documentation, and for 53 of 141 inspectors with 109 disciplines, a wide range of undocumented time for OJT/WTE existed. The staff finds the corrective action plan acceptable, however, implementation of the actions in the plan will be evaluated in future inspections.

The issue of employee concern IN-85-406-002 addressed by WP-09-SQN, there being no specific weld criteria present prior to 1979, was shown to be without substance. The NRC Inspection Team found the appropriate weld criteria were referenced in drawings dated to the early days of construction (prior to 1979) and that the criteria were adequate.

The issue of employee concerns IN-85-282-002 and IN-85-271-001 addressed by WP-11-SQN, that surface grinding of welds may mask defects, is without substance. Surface grinding is frequently specified for surface preparation prior to nondestructive examinations. Surface preparation is necessary for a weldment or part to be nondestructively examined which has an unacceptable surface for examination, or to remove artifacts which could interfere with the examination. As-cast sand molded metal surfaces, oxy-fuel cuts, and heavily machined surfaces are common examples where grinding would be used to prepare a surface for further examinations.

The issue of employee concern IN-85-212-001 addressed in WP-16-SQN is the question of why fit-up inspections on duct supports were required during the 1979-80 time frame and are not required during present construction. Only Watts Bar and Bellefonte sites fit this time frame description; therefore, this concern does not appear to be applicable to Sequoyah. Nevertheless, TVA and NRC re-inspections covered this component at Sequoyah, in particular, because of other concerns. The welding was judged adequate for its purpose without repair.

The issue of the remaining nine employee concerns addressed in WP-16-SQN relate to TVA not meeting its FSAR commitments in regards to allowing welder foremen to perform fit-up inspections. This is a case of TVA taking exceptions, interpretations, or unusual approaches to meeting the requirements of ANSI N45.2.5 without requesting an approval from the NRC for the exception. For safety related structures, we would probably require the structures to be inspected for fit-up, and that these inspections be performed by a QC inspector. The surveillance approach taken by TVA was judged adequate because no instances were found of poor fit-up by the TVA and NRC re-inspections.

The issue of employee concern XX-85-C98-001 covered in WP-18-SQN, of laminations in a pipe preventing the making of a good butt weld in a condenser, is outside of the area of NRC cognizance since this item is not safety-related. TVA appears to have provided a reasonable assessment of the concern in WP-18-SQN.

The issue raised by the concern in WP-20-SQN is that the socket welds in the Safety Injection System (SIS) in Accumulator Room #5, Reactor II are undersized. The TVA evaluation found that socket welds in the SIS had been addressed during 1980/81 by NCRs 2398 and 2630 and a 50.55e report. All accessible undersize socket welds had been reinspected and those that were undersized were weld repaired. Inaccessible welds were individually evaluated assuming undersized welds at the 96 percentile of those welds which had been inspected. TVA had adequately addressed the issues raised by this concern.

The issues raised by the concerns in I-85-776-SQN relate to specific weldments (socket welds) in specific plant rooms that were not inspected. The licensee identified the records of the inspections for the safety related socket welds in question, thereby demonstrating that these welds had been inspected. Some class E and G welds (nonnuclear safety classifications) which do not require record retention of inspections were also located in the same rooms. The resolution of these concerns and issues by TVA is adequate.

The issue raised by employee concern XX-85-054-001 covered by I-85-346-SQN is of QC hold-points being signed-off by craftsmen performing the work. The randomness of the inspectors assigned to inspect welds and the established cross-checks in the quality assurance documentation provide an adequate assurance against this event. The issues have been adequately addressed by TVA.

The issue of employee concern XX-85-083-001 addressed in I-86-652-SQN involves weld inspections being more stringent at Watts Bar than at Sequoyah. This could reflect the different codes and standards imposed because of time of construction and for the additional third party inspections at Watts Bar. This issue has been adequately addressed by TVA.

The issues raised by employee concern XX-85-102-011 covered by I-85-735-SQN relate to NOIs not being written for defects found during preservice and inservice defects. The licensee demonstrated that many NOIs were written for many preservice and in-service inspections. TVA has adequately addressed the issues raised by this concern.

The issue raised by employee concern XX-85-069-003, R1 addressed in NSRS Report I-85-738-SQN involves previously rejected items being accepted by another inspector other than an NDE supervisor or higher level NDE examiner. According to the NSRS audit, for all records reviewed, the items were either accepted by a Level III NDE supervisor, or an acting NDE supervisor. There were problems of not following TVA procedures and other criticisms of the system procedures, but none reflected the issues involved. The TVA response to the issue raised by the concern is adequate.

The issue raised by employee concern XX-85-065-001 covered by I-85-750-SQN of inspectors making inadequate visual ISI examinations of piping supports was investigated by the licensee. The licensee found among other facts, that the two individuals claimed to have made the remote inspection together did not perform ECRW hanger inspections together in the stated time period. TVA had performed an adequate review of this concern and we concur with their conclusions.

#### 4.0 CONCLUSIONS

The staff conclusion stated in the Draft Welding SER, dated October 30, 1986, was that during the construction of both Sequoyah units, TVA's implementation of the QA/QC program in the area of welding, while generally effective overall, was ineffective in certain instances. The bases of this finding are as follows: a significant number of deficient welds have been found during the reinspections that required engineering calculations to demonstrate their suitability for service, and these calculations had not been performed during construction. Also, weld configuration discrepancies between the design drawings and the actual hardware installed were identified. The effectiveness of TVA's process for QC inspector training and qualification/certification during plant construction and operation were questionable in the area of visual inspection of welds. The weld deficiencies discussed above should have been detected and actions taken. However, the fact that no welds required repair to meet applicable code requirements indicates an overall effective implementation of the QA/QC aspects in the TVA welding program.

In spite of the deficiencies found in the implementation of the QA/QC aspects of the TVA welding program, most of which were of a programmatic nature, the staff finds that these deficiencies have had no impact on the suitability for service of the plant hardware.

Because the staff conclusions are made on the basis of information generated by a limited sample reinspection, there is still a finite probability that there are deficient welds that have not been identified. The staff concern relates particularly to ASME scope safety-related welds (e.g., piping and pipe support welds and major component support welds). Therefore, the staff recommends that the Sequoyah plant's first 10 year inservice inspection program be augmented and accelerated, i.e., TVA be required to complete inspections of 100% of ASME Classes 1 and 2 piping and pipe support field welds and major component (reactor vessel, steam generators, pressurizers, and reactor coolant pumps) support welds made in the field that are already in the first 10-year in two refueling outages following the restart. The revised first 10-year inservice inspection program should be submitted for staff review and approval in six (6) months after the restart.

Additionally, the staff recommends that TVA consider the following:

- use industry generated standards where possible, particularly the use of AWS/CWI standards for certifying the AWS scope weld inspections;

- amend relevant FSAR sections to reflect changes in commitments and to formalize their intent as stated above; and
- training of personnel in the application of standards adopted.

TVA's progress and completion of actions described in its Corrective Action Plan for resolution of the recommendations in NSRS Investigative Report I-85-373-NPS should be the subject of a future NRC inspection at Sequoyah. This can be accomplished after restart.

V. Addendum

In a letter dated January 30, 1987 TVA committed to an augmented and accelerated inservice inspection as recommended by NRC staff. Details of the inspection program and its acceptance by the staff can be found in Section 3.5 of the staff's SER on the Sequoyah Nuclear Performance Plan.

## Attachment 1

### SEQUOYAH NUCLEAR POWER PLANT, UNITS 1 AND 2 SAFETY EVALUATION REPORT FOR EMPLOYEE CONCERNS ELEMENT REPORT WP-04-SQN, R2

#### I. Subject

Category: WELDING

Subcategory: 50700

Element: WP-04-SQN

The basis for Element Report WP-04-SQN, Rev. 2, dated 11/21/86 forwarded by TVA letter dated December 1, 1986 are the Watts Bar Employee Concerns as follows:

EMPLOYEE CONCERN NO.	DESCRIPTION
IN85-406-003	No inspection tools
IN85-134-002	No tools
IN 85-007-001	No tools

These concerns were evaluated by TVA as potentially safety-related and potentially applicable to Sequoyah (generic). This formatted SER is being provided to link individual employee concerns and TVA Element Reports to our draft SER forwarded by BWEB memorandum of October 30, 1986.

#### II. Summary of Issue

The issue involved with these three employee concerns is summarized by TVA as, "Welding inspection tools were not issued to welding inspectors."

#### III. Evaluation

TVA established the Welding Project to formulate a program for each nuclear plant site to address the employee concerns related to welding. 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 program is divided into two phases. Phase 1 is a review of the records to determine if there are any problem indicators. Phase 2 is a physical reinspection of weldments whose samples and the specimens representing the samples are selected on an engineering and logic basis. The NRC staff also performed an independent physical reinspection of weldments at the Sequoyah site.



The results of the TVA and the NRC reinspections tend to support these concerns for structural welds made to AWS D1.1 in that a significant percentage of the welds were undersized. These results indicate that the weld size may not have been physically measured with tools in all cases during inspections, but instead were estimated by eye using adjacent base metal thicknesses as a guide. This inspection practice was prevalent for these types of structures in the industry during the time frame of Sequoyah's construction. All of the components containing these deficiencies were found by analysis to have met the applicable Code stress requirements and were satisfactory for service as is without weld repair.

#### IV. CONCLUSION

The conclusion was stated in the BNL TER which was incorporated as part of our draft SER dated October 30, 1986. In summary, the staff concludes that the utility performed an adequate investigation with respect to these concerns in that it demonstrated that weld inspection tools had been issued to weld inspectors. However, it was not demonstrated that all weld inspectors had the necessary tools. The TVA and NRC reinspections of welded components demonstrated that the impact on hardware by this programmatic deficiency where some weld inspectors did not have weld inspection tools was minimal.

WP-25-SQN

THE STAFF'S EVALUATION OF WP-25-SQN IS CONTAINED IN THE  
ATTACHED INSPECTION REPORT NOS. 50-327/87-44 AND 50-328/87-44



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

OCT 6 1987

Docket Nos. 50-327/328

Tennessee Valley Authority  
ATTN: Mr. S. A. White  
Manager of Nuclear Power  
6N 38A Lookout Place  
1001 Market Street  
Chattanooga, Tennessee 37402-2801

Gentlemen:

SUBJECT: SPECIAL TEAM INSPECTION OF EMPLOYEE CONCERN ELEMENT REPORTS  
SEQUOYAH REPORT NOS. 50-327/87-44 AND 50-328/87-44

On June 22-26 and July 20-24, 1987, an NRC team conducted a special announced inspection at the Sequoyah Nuclear Plant facility. The NRC team consisted of members of the Office of Special Projects (OSP) staff and three consultants. At the conclusion of the inspection, the findings were discussed with those members of your staff identified in the enclosed inspection report.

Areas examined during the inspection are identified in the report. The NRC team reviewed four Employee Concern Task Group (ECTG) element reports, the associated documentation relevant to those reports and interviewed informed TVA personnel to obtain pertinent information concerning the review and resolution of employee concerns associated with these four reports.

The NRC team review of these four reports indicated that two of the element reports were satisfactory as written. The other two, 4.3 and 4.4, were evaluated and determined to require revision or written explanation to clarify, add details or modify existing corrective actions. You are requested to address item 4.3.2, identified as inadequacies on pages 13 and 14, within 30 days of receipt of this letter. This is a restart item. Your clarification for the items stated on pages 15 and 16, Section 4.4.2, is requested within 90 days of receipt of this letter. This is not a restart item.

The responses directed by this letter and its enclosure are not subject to the clearance procedures of the Office of Management and Budget as required by the Paperwork Reduction Act of 1980, PL 96-511.

~~8710 15005~~  
3pp

Mr. S. A. White

- 2 -

In accordance with Section 2.790 of the NRC's "Rules of Practice", Part 2, Title 10, Code of Federal Regulations, a copy of this letter and its enclosure will be placed in the NRC Public Document Room. If there are any questions concerning this inspection, please contact this office.

Sincerely,

*Stewart D. Ebnetter*  
Stewart D. Ebnetter, Director  
TVA Projects Division  
Office of Special Projects

Enclosure: As stated

cc w/enclosure:  
see next page

Mr. S. A. White  
Tennessee Valley Authority

Sequoyah Nuclear Plant

cc:  
General Counsel  
Tennessee Valley Authority  
400 West Summit Hill Drive  
E11 B33  
Knoxville, Tennessee 37902

Regional Administrator, Region II  
U.S. Nuclear Regulatory Commission  
101 Marietta Street, N.W.  
Atlanta, Georgia 30323

Mr. R. L. Gridley  
Tennessee Valley Authority  
5M 157B Lookout Place  
Chattanooga, Tennessee 37402-2801

Resident Inspector/Sequoyah NP  
c/o U.S. Nuclear Regulatory Commission  
2600 Igou Ferry Road  
Soddy Daisy, Tennessee 37379

Mr. H. L. Abercrombie  
Tennessee Valley Authority  
Sequoyah Nuclear Plant  
P.O. Box 2000  
Soddy Daisy, Tennessee 37379

Mr. Richard King  
c/o U.S. GAO  
1111 North Shore Drive  
Suite 225, Box 194  
Knoxville, Tennessee 37919

Mr. M. R. Harding  
Tennessee Valley Authority  
Sequoyah Nuclear Plant  
P.O. Box 2000  
Soddy Daisy, Tennessee 37379

Tennessee Department of  
Public Health  
ATTN: Director, Bureau of  
Environmental Health Services  
Cordell Hull Building  
Nashville, Tennessee 37219

Mr. D. L. Williams  
Tennessee Valley Authority  
400 West Summit Hill Drive  
W10 B85  
Knoxville, Tennessee 37902

Mr. Michael H. Mobley, Director  
Division of Radiological Health  
T.E.R.R.A. Building  
150 9th Avenue North  
Nashville, Tennessee 37203

County Judge  
Hamilton County Courthouse  
Chattanooga, Tennessee 37402

ENCLOSURE

UNITED STATES NUCLEAR REGULATORY COMMISSION  
OFFICE OF SPECIAL PROJECTS  
TVA PROJECTS DIVISION

Report Nos.: 50-327/87-44 and 50-328/87-44  
Docket Nos.: 50-327 and 50-328  
License Nos.: DPR-77 and DPR-79  
Licensee: Tennessee Valley Authority  
Facility Name: Sequoyah Nuclear Plant  
Units 1 and 2  
Inspection Conducted: June 22-26 and July 20-24, 1987

Inspectors: *George B. Georgiev* 9/21/87  
George B. Georgiev, Team Leader Date

*J. Fair* 9/21/87  
J. Fair Date

Consultants: M. Schuster, C. Czajkowski, W. Marini

Approved by: *Robert A. Hermann* 11/23/87  
Robert A. Hermann, Branch Chief Date

~~8710150062~~  
699

## 1. PERSONS CONTACTED

### 1.1 Licensee Employees

*	C. Whittemore,	TVA Licensing
*	R. D. Briggs,	TVA, DNE
*	J. W. Kelly,	TVA, DNE
*	T. J. Arnsy,	TVA, DNQA
*	J. C. Brady,	TVA, Maintenance
*	T. J. Akers,	TVA, Communications
*	T. J. McGrath,	TVA, ONP
*	T. Knight,	TVA, Sequoyah
*	C. R. McWherter,	TVA, ONP
*	C. R. Brimer,	TVA, DNE
*	E. R. Ennis	TVA, Sequoyah
*	J. R. Inger	TVA, WBN/ECTG
*	R. C. Wenney	TVA, Sequoyah
*	G. B. Kirk	TVA, DNSL/SQN
	T. L. Howard	TVA, DNQA
	L. G. Hebert	TVA, DNQA
	T. A. Flipppo	TVA, DNQA
	J. T. LaPoint	TVA, Sequoyah
	F. Lewis	TVA, QA
	A. Verner	TVA, QA
	R. Grimes	TVA, ECTG
	J. Weishaupt	TVA, ECTG
	S. Lock	TVA, HCTTG
	W. Harris, Jr.	TVA, HCTTG
	G. Wade	TVA, DNE
	D. Chatman	TVA, Maintenance

### 1.2 NRC Resident Inspectors

K. Jenison,	Sr. Resident Inspector
D. P. Loveless,	Resident Inspector
P. E. Harmon,	Resident Inspector

\* Attended Exit Interview at Sequoyah, July 23, 1987

## 2. INSPECTION SCOPE AND OBJECTIVES

This special announced inspection was conducted at TVA's Sequoyah Nuclear Plant (SQN) site. The inspection was performed to review and evaluate four final element reports prepared for Sequoyah by the Employee Concern Task Group (ECTG) in the categories of welding (WP Report) and materials control (MC Reports). The objective of the inspection was to determine the accuracy of the information contained in these four reports and to determine the adequacy of TVA's conclusions and corrective actions.

### 3. DISCUSSION

During this inspection, the NRC team reviewed four element reports. Two of the reports were satisfactorily written and two required revision or additional written explanation to clarify, add details, or modify TVA's existing corrective actions. The four element reports and the associated NRC observations are as follows:

- a. WP-25-SQN, "Improper Weld Repairs"--TVA adequately addressed the issues raised by two employee concerns. No additional work or corrective action is required.
- b. MC-40503-SQN, "Valves (Test 70)"--TVA adequately addressed the issues raised by this employee concern. No additional work or corrective action are required.
- c. MC-40703-SQN, "Heat Code Traceability"--TVA adequately addressed the issues raised by this employee concern. However, the NRC team considered the proposed corrective actions in the small-bore piping materials area to be inadequate. Specifically, the acceptance of 2.5 percent of nodal points for small-bore piping based upon actual material properties and thicknesses is considered unacceptable.
- d. MC-40709-SQN, "Search for Defective Material"--TVA did not adequately address the issues raised by the employee concern for the following reasons:
  - o TVA did not review all applicable suppliers identified in NRC Bulletin 83-07. TVA must review all revisions to the safety-related supplier list for the applicable time frame, and ascertain that it has addressed all suppliers appearing on these revisions and on the attachments to NRC Bulletin 83-07.
  - o Vendors not listed in the approved vendor list have supplied safety-related materials. TVA has not reviewed enough of those vendors to determine whether those unlisted vendors may have supplied fraudulent materials. TVA must review an adequate number of suppliers of piping, tubing, and fittings who do not appear on the safety-related suppliers' list to determine whether potentially fraudulent Ray Miller, Inc. material was procured through them.
  - o Additional information is needed to confirm the validity of a statement made to TVA by Dravo Corporation personnel with reference to materials that Dravo procured from Ray Miller, Inc. TVA must obtain additional information from Dravo to ascertain that the material purchased by Dravo (as identified in NRC Bulletin 83-07) was not subsequently supplied to TVA.



#### 4. INSPECTION DETAILS

The NRC team reviewed four element reports and the associated documentation relevant to those reports. In addition, the NRC team interviewed informed TVA personnel to obtain pertinent information concerning the review and resolution of employee concerns associated with these four reports. Each of these reports is addressed below.

##### 4.1 Element Report WP-25-SQN, "Improper Weld Repairs"

###### 4.1.1 Documents Reviewed

- ° Element Report WP-25-SQN
- ° Sequoyah Plan of Action report "Wall Degradation in Fluid Piping Caused by Erosion and Other Specified Mechanism"
- ° Sequoyah Inspection Report "System 67 (ERCW) Localized Erosion Downstream of Butterfly and Ball Valves Utilized in Throttling Service"
- ° Administrative Instruction AI-9, "Control of Temporary Alterations and Use of the Temporary Alterations Order"
- ° Administrative Instruction AI-19, "Plant Modifications After Licensing"
- ° DNE calculations, "Essential Raw Cooling Water Corroded Piping Qualification"
- ° The document packages for Maintenance Requests A-117635, A-087982, A-232960 and A-285930.
- ° The document packages for Work Plans 11249, 11250, 11304, 11505, 11731, and 11558

###### 4.1.2 Discussion and Observations

This element report addresses two employee concerns, XX-85-100-001 and 2850162-005. The concerns involved temporary weld repairs using weld overlay and patch plates which are not in accordance with the ASME Code. The report states that weld overlays were used at the Browns Ferry Nuclear Power Plant and that the weld repair patches were used at Sequoyah. The NRC team reviewed only the information relevant to Sequoyah.

The review of the information contained in the documents referenced above revealed that on several occasions 12 patch plates were welded on the essential raw cooling water (ERCW) system. The details of those weld repairs follows:

- ° In September 1983, a leak was observed at a tee located on the ERCW system. Maintenance Report MR-A-049430 was generated as a result of this observation. The repair was completed on October 4, 1983 by welding a carbon steel patch plate on the west side of the tee, located between 1-FCV-67-146 and 1-FCV-067-152.

- In November 1983, another leak was observed on an elbow located on the ERCW system. MR-A-087982 was generated as a result of this observation. The repair was completed on November 14, 1983 by welding a carbon steel patch plate on the elbow downstream of O-VLV-067-551B.
- A baseline ultrasonic testing (UT) program was developed to check the pipe wall thicknesses every 6 months on the ERCW system.
- In February 1984, the UT measurement identified two pipe wall thinnings on a tee downstream of 1-FCR-067-147 and on a spool piece between O-VLV-67-551A and 1-FCV-067-146. MR-A-232980 and MR-A-232958 were generated as a result of this observation. The repairs were completed on April 9, 1984 by welding two carbon steel patch plates on the thin areas.
- In August 1984, a leak was observed on a pipe on the north side of 2-FCV-067-146. MR-A-285930 was generated as a result of this observation. The repair was completed on August 18, 1984 by welding a carbon steel patch plate on the pipe.
- In September 1984, the UT measurement identified wall thinning on the south side of a pipe downstream of O-FCV-067-146. Work Plan WP-11246 was generated as a result of this finding. The weld repair was completed on September 17, 1984 by welding a stainless steel patch plate on the thin area.
- In September 1984, the UT measurement identified wall thinning on the inside radius of an elbow downstream of O-VLV-067-551B and on the top of spool piece between O-VLV-067-551A and 1-FCV-067-146. WP 11250 was generated as a result of this finding. The repair was completed by welding two stainless steel patch plates on the thin areas.
- In October 1984, a leak was observed on the south side of a tee between 1-FCV-067-146 and O-FCV-067-152. WP-11304 was generated as a result of this observation. The repair was completed by welding a stainless steel patch plate on the leaking area.
- In April 1985, the UT measurement identified wall thinning on the bottom of a saddle tee located on a 30-inch pipe at the 24-inch connection. WP-11558 was generated as a result of this finding. The repair was completed by welding a stainless steel patch plate at the bottom of the saddle tee. Subsequent inspection of the internal surfaces of the pipe performed by an ISI level 3 inspector established that the pipe did not show any cavitation or wall thinning. Therefore, the original UT measurements were found to be incorrect.
- In April 1985, the UT measurements identified wall thinning on the south side of a tee between 1-FCV-067-146 and O-FCV-067-152. WP-11505 was generated as a result of this finding. The tee was repaired by welding a stainless steel patch plate on the thin area.

- ° In August 1985, a leak was observed on a 2-inch branch connection downstream of 2-FCV-067-146. WP-11731 was generated as a result of this finding. The repair was completed by welding a stainless steel patch plate over the leaking area.
- ° In late August 1985, TVA decided to replace all degraded pipe and to coat the internal surfaces of the pipe with Belzone coating. All existing patch plates were removed, except for the one installed under WP-11558. This patch plate was not replaced because an inspection of the internal surfaces of the pipe by an ISI level 3 inspector established that the pipe did not show any signs of cavitation or wall thinning.
- ° The current long-range plans provide that each of the existing three component cooling system (CCS) heat exchangers be replaced with two plate-type heat exchangers. This will require the installation of 6 new heat exchangers. The following Engineering Change Notices (ECN) have been written for this modification: ECN 6474, heat exchanger C; ECN 6486 heat exchanger A; ECN 6429, heat exchanger B; ECN 6656, bypass; ECN; 6788 and ECN 6789, header changeouts
- ° After this modification is completed, the need to throttle using butterfly valves will be eliminated which, in turn, will eliminate the pipe cavitation problems associated with the discharge from the CCS heat exchangers.

The NRC team's review of the information pertaining to this issue confirmed that TVA has used reinforcement patches as temporary repairs to ASME Class 3 and ANSI Standard B31.1 pipe fabricated systems in cases of leakage or where pipe wall thinning has been identified by UT. In all cases, the work was performed and controlled in accordance with the requirements of the governing maintenance and modification procedures (AI-9 and AI-19) using either MRs or WPs. The work was also reviewed by the authorized nuclear inservice inspector (ANII). The ANII had indicated on the written documentation that temporary repairs such as patch plates fall outside the jurisdiction of the ASME Code Section XI. Therefore, the concern that TVA makes weld repairs that are not in accordance with the ASME Code was substantiated. However, in all cases, the repairs were performed by welders and welding procedures qualified in accordance with the requirements of ASME Code Section IX and the work was documented in accordance with the TVA's ASME Section XI Repair and Replacement Program; thus, the plant's safety operation and performance was never compromised.

#### 4.1.3 Conclusions

Patch plate welds were used to repair the ERCW system from September 1983 through August 1985. These repairs fall outside the jurisdiction of ASME Code Section XI; thus, the concern that TVA makes repairs that are not in accordance with the ASME Code was substantiated. However, the NRC team concluded that the safe operation and performance of the plant was not at any time compromised because the repairs were performed in accordance with the TVA's ASME Code Section XI Repair and Replacement Program. TVA has also replaced most of the patch plates and the three CCS heat exchangers will be replaced with six plate-type heat exchangers.