



UNITED STATES
 NUCLEAR REGULATORY COMMISSION
 REGION II
 101 MARIETTA STREET, N.W.
 ATLANTA, GEORGIA 30323

Report Nos.: 50-327/86-09 and 50-328/86-09

Licensee: Tennessee Valley Authority
 6N38 A Lookout Place
 1101 Market Street
 Chattanooga, TN 37402-2801

Docket Nos.: 50-327 and 50-328

License Nos.: DPR-77 and DPR-79

Facility Name: Sequoyah 1 and 2

Inspection Conducted: January 21-24 and 28-30, 1986

Inspectors:	<u>B. R. Crowley</u> for	<u>3/13/86</u>
	B. R. Crowley	Date Signed
	<u>B. R. Crowley</u> for	<u>3/13/86</u>
	D. E. Smith	Date Signed
	<u>B. R. Crowley</u> for	<u>3/13/86</u>
	P. Cortland	Date Signed

Accompanying Personnel: J. J. Blake, January 23 and 24, 1986

Approved by:	<u>J. J. Blake</u>	<u>3/13/86</u>
	for J. J. Blake, Section Chief	Date Signed
	Engineering Branch	
	Division of Reactor Safety	

SUMMARY

Scope: This special, announced inspection involved 119 inspector-hours on site to evaluate TVA's welding review program for Sequoyah. The areas reviewed/observed included Bechtel audit activities, TVA reinspection activities, qualification of Bechtel and TVA audit and inspection personnel, assessment of the TVA phase 1 plan and review of the APtech study.

Results: No violations or deviations were identified.

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REPORT DETAILS

1. Persons Contacted

Licensee Employees

- *P. R. Wallace, Plant Manager
- *L. E. Martin, Project Manager - Staff of Deputy Manager, Nuclear Power
- *J. W. Coan, Project Manager - Welding Project
- *R. W. Olson, Sequoyah Modifications Manager
- *S. P. Stagnolia, Construction Programs Project Engineer - Welding
- *G. J. Pitzl, Operations Programs Project Engineer - Welding Project
- R. M. Jessee, Engineering Programs Project Engineer - Welding Project
- H. S. Beckner, Audit Coordinator - Welding Project
- M. E. McCrary, Section Manager - QC NDE Training Section
- J. H. Fox, Supervisor, Welding and Materials Section - Operations
- D. H. Mickler, Coordinator
- *R. Bentley, NDE Engineer
- *T. T. Gilbert, ISI Unit Supervisor

Other licensee employees contacted included QC inspection personnel, engineers, construct personnel, health physics personnel, security office members, and office personnel.

Other Organization

- *A. M. Vuksan, Audit Team Leader, Bechtel Corporation
- *D. R. Cady, NDE Level III Examiner, Bechtel Corporation
- M. J. Dutru, NDE Level III Examiner, Bechtel Corporation

NRC Resident Inspectors

- *K. Jenison, Senior Resident Inspector
- *L. Watson, Resident Inspector

*Attended exit interview

2. Exit Interview

The inspection scope and findings were summarized on January 24 and 30, 1986, with those persons indicated in paragraph 1 above. The inspector described the areas inspected and discussed in detail the inspection findings. No dissenting comments were received from the licensee.

Inspector Followup Item 327, 328/86-09-01, Applicable Codes for NDE of Pipe Welds - paragraph 5.b.(2).

Inspector Followup Item 327, 328/86-09-02, Revision of MT Procedure to Provide for Calibration of MT Yoke - paragraph 5.b.(2).

Inspector Followup Item 327, 328/86-09-03, Clarification of Terms "Adequate for Service" and "Meets All Requirements" Relative to TVA Welding Program - paragraph 5.d.

Inspector Followup Item 327/86-09-04, PT Inspection of Weld 1AFDF-92C - paragraph 5.b.(3)(c).

The licensee did not identify as proprietary any of the materials provided to or reviewed by the inspector during this inspection.

3. Licensee Action on Previous Enforcement Matters

This subject was not addressed in the inspection.

4. Unresolved Items

Unresolved items were not identified during the inspection.

5. Sequoyah Welding Program Evaluation

Due to a number of specific and general allegations/concerns relative to the adequacy of TVA's welding program, TVA determined that additional reviews were needed to determine the adequacy of the TVA welding program and TVA welds. A Welding Project was formed within the Office of Engineering to resolve current welding issues and determine actions to be taken to ensure that future welding activities are in accordance with TVA commitments. In the NRR public meeting on TVA Welding Issues on January 7, 1986, TVA outlined their plan to resolve all welding issues. Included was an action plan for each site consisting of the following:

PHASE I

- Review TVA commitments to NRC
- Verify that written program reflects commitments
- Assemble quality indicators of "Welding Concerns" by type and plant
- Trend and evaluate effect of "Quality Indicators" on programs
- Issue adequacy statement regarding written programs to implement/control welding

PHASE II

- Perform welding program implementation audit
 - o Construction Program Implementation
 - o Operations Program Implementation
- Evaluate need for additional reinspections
- Implement any additional reinspections and deficiency resolutions (both individual and generic cases)
- Welding project will issue final reports, each plant

TVA made the decision to reinspect a sample of welds at the Sequoyah site. On January 17, 1986, TVA submitted their "Welding Program Description" and Welding Related Activities Action Plans for Sequoyah, Units 1 and 2 and Watts Bar Unit 1.

During the period January 21-24, 1986, a NRC team consisting of B. R. Crowley (Region II), D. E. Smith (NRR), and P. Cortland (I&E) performed an on-site review/observation of audit and reinspection activities of TVA and their contractor (Bechtel Corporation) as detailed in the paragraphs below. A followup inspection was performed on January 28-30, 1986 by B. R. Crowley (Region II).

a. Bechtel Audit Activities

To satisfy phase II of the TVA action plan, TVA hired Bechtel to perform an independent welding program implementation audit. The inspectors reviewed Bechtel's audit program as described below. The review included review of objectives, organization, internal procedures and policies, responsibilities, sampling methodology, and populations sampled.

(1) Documents Review

- "TVA Program Description" submitted to NRC on January 17, 1986.
- "Welding Project Program Description - Audit Work Plan" submitted to NRC on January 17, 1986
- Bechtel "Audit Plan for Sequoyah Nuclear Power Plant"
- Bechtel Quality Audit Checklist "TVA 01-NO", Revision 0, dated January 13, 1986
- Bechtel Quality Audit Checklist "TVA 01-OC", dated January 13, 1986
- Item 17 in the Bechtel package, Reactor Cooling Pump Platform, including Maintenance Request MR A545951
- Welding Procedure Specification GT-88-0-1
- Procedure Qualification Record PQR-GT-88-0-1
- EP 3.13 Engineering Document

(2) Organization

The Bechtel audit was performed at the direction and under the general management of the TVA Welding Project Manager. The

Bechtel audit team consisted of four auditors and one lead auditor. TVA personnel assisted as necessary.

(3) Sample Selection and Size

TVA specified the minimum number of items to be examined for the two TVA organization to be audited (Office of Nuclear Operations and Office of Construction) and the systems/structures to be audited. Bechtel selected the specific systems/structures to be audited. The guidelines on selection included the stipulation that the items to be audited be safety-related in order to have meaningful records. This criteria usually meant that class 1 or 2 systems were required. In addition, "employee concerns" were considered in the selection process. Bechtel reviewed all "employee concerns" related to welding and considered them significant if the concerns would potentially affect the safety-related portion of the plant and enough information was provided to perform the audit (Bechtel intends to examine all welding-related "employee concerns" whether significant or not).

One or more packages were selected from each major system with emphasis on the Main Steam Loops. Seventeen packages were selected, each included one or more weld joints and all of the joints in the package were reviewed (see Table 2 of Bechtel's Audit Plan for Sequoyah Nuclear Power Plant). In addition, five welds from the TVA reinspection program (see paragraph b. below) were added to the audit plan. A random selection was attained by having different team members select one of the eligible welds that appeared on the layout for the specific system. Each of the five team members had several areas to review in all of the packages; no one member reviewed an entire package.

The items selected for audit covered the entire time span of construction and operations. The welds selected corresponded with the welding fabrication effort in that a high proportion of the welds (about 40%) were fabricated during the period of maximum construction effort.

Records reviewed far exceeded that required in the Bechtel Audit Plan. An increased sample of the following records was included in the audit:

- NDE Examiner Certification Records
- Welding Qualification Records
- Welding Material Qualification Records
- Welding Procedures and Support PQRs
- NCRs

For audit of Nonconformance Reports (NCRs), the auditors randomly picked 20 welding related NCRs out of approximately 200.

(4) Audit Elements

The key elements of the Bechtel audit were specified as follows:

- Implementation of technical and welding program requirements
- Adequacy of design output documents
- Initial welder or welding operator qualifications
- Maintenance of welder or welding operator qualifications
- Renewal of welder or welding operator qualifications
- Initial welding inspection personnel qualifications
- Maintenance of welding inspection personnel qualifications
- Renewal of welding inspection personnel qualifications
- Use of appropriate welding procedures
- Use of appropriate inspection procedures
- Use of appropriately trained and qualified personnel
- In-process control of welding
- Documentation of the above activities
- Nonconformances and corrective actions
- Training programs adequacy
- Additional areas of concern as determined by a review of employee concerns

(5) General Observations

The NRC inspectors made the following observations:

- Bechtel is competent to perform an audit of the TVA QA system in the areas of welding. Audit personnel had many years of experience and the level of experience was appropriate for the task and met or exceeded the audit work plan requirements.
- Although the audit is programmed, to determine applicability by engineering judgement, the random selection and extensive numbers of records reviewed should provide part of the basis for resolving some of the major welding issues.
- Bechtel was reviewing the documents related to a specific package to verify that the documents specified were present. The documents reviewed included qualification and certification records of the welders and inspectors identified in the packages.

Bechtel was not determining if the documents were administratively correct and technically suitable for the application. This was by design as TVA stated in note 1 on page 4 of the Welding Project Program Description - Audit Work Plan, "The technical or engineering adequacy of the design output documents is not to be researched; their adequacy is to be

checked in the sense of completeness of information for the organization or individual who must use the document to continue forward with the program." TVA and Bechtel indicated that the idea was to perform an implementation audit to insure that where the program required a document, the document was present and complete but the adequacy of the document was not to be researched.

- Bechtel was not performing any type double-check of their own work and stated that their people were competent and the nature of the work did not require double-checking. Further investigation, revealed that a sort of double-check was being performed, although not being documented. During the NRC inspection, Bechtel decided to institute a system of documented double-checks.
- The training program audit was in terms of the training requirements of the time as stated in TVA documents and not the adequacy of the training. For VT examiners, a 32 question test was given and test papers were available for the examiners audited. As documentation of the general level of skill, for the examiners whose records were audited, all except one was qualified for MT/PT.

b. TVA Reinspection Program

The final Sequoyah reinspection plan, as implemented at the site, is included as Attachment 2 to Enclosure 2 to the TVA submittal to the NRC dated January 17, 1986, and is identified as "Sequoyah Reinspection of Selected Welds - Reinspection Plan", R1, January 16, 1986.

In accordance with the Reinspection Plan, the applicable codes are as follows:

- Structural Steel and Support Welds - NCIG-01, "Visual Weld Acceptance Criteria for Structural Welding at Nuclear Power Plants"
- Piping Welds - USAS B31.1 (1967 Edition) or USAS B31.7 (1969 Edition with 1970 Addenda) as applicable

The team reviewed/examined/observed the following relative to the reinspection activities:

(1) Plan Review

The reinspection plan was reviewed. In general, the plan required physical reinspection (NDE including visual) of approximately 100 welds in each of the following categories or groups:

- Group 1 - Selected piping and attachment welds in Class 3 and ANSI B31.1 systems (ERCW, CCW, and AFW) at various elevations in the auxiliary building. The sample will include carbon and stainless steel lines.
- Group 2 - Welds of supports for piping (relative to above lines).
- Group 3 - Welds of cable tray supports and conduit supports in the Auxiliary Building.
- Group 4 - Structurally significant welds on miscellaneous structural steel in the Auxiliary Building.
- Group 5 - HVAC support welds in the Auxiliary Building.

In addition, butt welds were visually examined for a portion of spiral welded pipe used as ductwork (Group 6).

For structural steel and support welds, the plan specified that the principle attributes to be addressed were the presence, size, length and location of welds. In addition, structurally significant weld discontinuities detected through coatings were to be reported. The generic type of filler metal, austenitic (non-magnetic) or ferritic (magnetic), was reported.

For piping welds, the NDE inspection was to be that required by the construction code of record. Visual inspection was to be applied to all welds and the generic type of filler material was to be checked.

(2) Procedure Review

The inspectors reviewed the following NDE procedures being used to inspect the welds listed in paragraphs (3), (4), and (5) below.

- N-MT-1, R4, "Magnetic Particle Examination of Nuclear Power Plant Components"
- N-VT-6, R0, "Visual Examination of Structural Welds Using the Criteria of NCIG-01"
- N-PT-1, R6, "Liquid Penetrant Examination Using the Color Contrast Solvent Removable Method"
- N-VT-3, R4, "Visual Examination of Weld Ends, Fitups, and Dimensional Examinations of Weld Joints"

The procedures were not reviewed to make a detailed comparison with code requirements, but to verify that in general, the procedures comply with requirements and were adequate to perform the required inspections.

During review of the procedures, the inspectors noted that procedures N-MT-1 and N-PT-1 were written to ASME Boiler and Pressure Vessel Code, Sections III and XI. However, the "criteria" paragraph, page 5 of the R1, 1/16/86 edition of the "Sequoyah Reinspection of Selected Weld - Reinspection Plan" specifies that, "Pipe welds will be reinspected to the B31.1 (1967 Edition) or B31.7 (1969 Edition with 1970 Addenda) code of record using the visual and nondestructive examination methods (other than volumetric) and acceptance criteria." TVA agreed to evaluate this apparent conflict and insure that the codes specified in the inspection plan were being met. Pending review of TVA's evaluation, this matter is identified as Inspector Followup Item 327, 328/86-09-01, Applicable Codes for NDE of Pipe Welds.

In addition, the inspectors noted that procedure N-MT-1 did not provide details for checking calibration of the MT Yoke. During observation of MT inspection (see paragraph (3)(a) below), the inspectors noted that the yoke was being calibrated even in the absence of procedure requirements. At the conclusion of the NRC inspection, TVA was in the process of revising procedure N-MT-1 to provide details for checking calibration of the MT Yoke. Pending review of the revised procedure, Inspector Followup Item 327, 328/86-09-02, Revision of MT Procedure to Provide for Calibration of MT Yoke, is identified.

(3) Observation of In-Process Inspections (Piping)

- (a) In-process magnetic particle (MT) inspection of the following welds was observed and compared with applicable procedure (N-MT-1, R4):

<u>Weld</u>	<u>Size</u>	<u>System</u>	<u>Class</u>
1-AFDF-33	8"	Auxiliary Feedwater	3
OER-1995E	24"	Emergency Rawcooling Water	3

- (b) In-process visual (VT) inspection of the following welds was observed and compared with applicable procedure (N-VT-3, R4):

<u>Weld</u>	<u>Size</u>	<u>System</u>	<u>Class</u>
CBT-1WP	3"	Chemical Batch Tank	TVA-G
CBT-2WP	3"	Chemical Batch Tank	TVA-G
CBT-3WP	3"	Chemical Batch Tank	TVA-G

- (c) In-process liquid penetrant (PT) inspection of the following welds was observed and compared with applicable procedure (N-PT-1, R6):

<u>Weld</u>	<u>Size</u>	<u>System</u>	<u>Class</u>
2AFDF-25AA	4"	Auxiliary Feedwater	3
2AFDF-25BB	4"	Auxiliary Feedwater	3
1CC-1979	2"	Component Cooling	3
1CC-1980	2"	Component Cooling	3
1CC-1981	2"	Component Cooling	3
1CC-2091	2"	Component Cooling	3
1CC-2092	2"	Component Cooling	3
1CC-2147	2"	Component Cooling	3
1CC-2148	2"	Component Cooling	3
1AFDF-92A	4"	Auxiliary Feedwater	3
1AFDF-92B	4"	Auxiliary Feedwater	3
1AFDF-92D	6"	Auxiliary Feedwater	3
1AFDF-92E	6"	Auxiliary Feedwater	3

Vendor certification records for the following penetrant materials used to inspect the above welds were reviewed:

<u>Material</u>	<u>Type</u>	<u>Batch Nos.</u>
Cleaner/Remover	SKC-NF/ZC-7B	85E048, 83M066, and 85D017
Penetrant	SKL-HF/S	83D030
Developer	SKD-NF/ZP-9B	85C020 and 82L010

During observation of PT inspection of welds 1AFDF-92D and 92E, the team noted that weld 92C in the same line had been cleaned for PT but appeared to have an inadequate surface for PT inspection. The weld had some minor surface preparation, but was generally in the as-welded condition and was very rough.

A later review of the inspection, documentation for the current reinspection revealed that the PT examiner had rejected the weld for linear indications caused by inadequate surface preparation. However, review of the original fabrication documentation from 1984 revealed that the weld had been PT inspected and passed. In addition, the original fabrication documentation indicated the weld was welded using the GTA process. The rough surface of the weld gives the appearance of a SMA process weld. TVA was in the process of evaluating questions relative to this weld at the conclusion of the NRC inspection. Pending review of TVA's resolution to this problem, Inspector Followup Item 327/86-09-04, PT Inspection of Weld 1AFDF-92C is identified.

(4) Observation of In-process Inspections (Spiral Welded Air Ducts)

In field butt welds for spiral welded air ducts, TVA inspectors noted a number of circumferential butt welds that appeared to be welded less than 360° when viewed from outside the duct. The areas that appeared not welded were a few inches in length next to the reactor building wall which were inaccessible when the ducts were installed. TVA's construction personnel recalled that during construction when a portion of a weld was inaccessible, access was gained to the inside by either cutting a window in the duct or through a manway and the inaccessible portion welded from the inside.

The team observed the following four typical areas in the purge air system in the Unit 2 reactor building annulus that appeared to be welded less than 360°:

Area 1	-	330° Az 687' Elev. 24" duct
Area 2	-	83° Az 702' Elev. 10" duct
Area 3	-	75° Az 702' Elev. 10" duct
Area 4	-	10° Az 705' Elev. 24" duct

Evidence existed on the ducts, i.e., nearby welded closed windows, to indicate that access had been gained to the inside.

Later during the inspection, TVA cut inspection windows in the ducts near the four areas listed above to verify that areas that appeared to be unwelded were actually welded on the inside. The inspectors observed the welds inside the ducts in the four areas noted.

(5) Observation of In-process Inspection (Supports)

The inspectors observed in-process visual inspection of the following support welds:

Package 27 - HVAC Support, 47A920-28-1, 1A, 1B
SMi-0-317-24-27 Sheets 1, 2, and 3 Elevation 734 (approximately 34 welds)

Package 28 - Conduit Support Elevation 734 (approximately 21 welds)

The TVA examiners carefully and thoroughly examined every weld for defects detectable through paint. In case of doubt, as in the length of welding slag, the paint was removed by scrapping. The examiners documented indications in writing and used sketches and photographs. The paint thickness was also measured. The examination criteria used for structural welds was the Visual Weld Acceptance Criteria developed by the Nuclear Construction Issues Group (NCIG-01, Rev. 1).

The TVA inspection identified the following discrepancies with the weld for the supports listed above:

- One fillet weld low by 1/16 in. for more than 25% of length.
- One weld made in the overhead position between two pieces of square tubing connected at an angle did not have the required fillet weld.
- Two intermittent welds were 2 in. long on 6 in. centers, but the drawing specified 2 in. long on 4 in. centers.
- The intermittent welds mentioned above were staggered in their placement, but the drawing specified that the welds should be side by side.
- The intermittent weld symbol on the drawing was incorrect as it required a full penetration weld at a flare-bevel connection.
- The edge of one weld had surface slag of an excessive length.

(6) Review of Inspection Records

The inspectors reviewed a sample of NDE reports for the following welds:

Group 2 - Items 1, 5, 7, 8, 9, and 16

Group 3 - Items 3 and 6

The records were reviewed for general content and completeness.

(7) Inspection Sample Distribution

The inspectors reviewed the TVA inspection sample distribution for each category or group of welds as defined in paragraph 5.b.(1) above. The following describes the distribution:

<u>Group</u>	<u>Item</u>	<u>Weld Type</u>	<u>System</u>	<u>No. of Welds</u>
1	-	Pipe	CBT	27
1	-	Pipe	SEN	12
1	-	Pipe	EA	132
1	-	Pipe	CVCS	5
1	-	Pipe	CC	54
1	-	Pipe	AFD	42
1	-	Pipe	ERCW	62
Group 1 Total				234

<u>Group</u>	<u>Item</u>	<u>Weld Type</u>	<u>System</u>	<u>No. of Welds</u>
2	1	Pipe Support	ERCW	35
2	5	Pipe Support	CC	62
2	7	Pipe Support	CC	59
2	8	Pipe Support	ERCW	87
2	9	Pipe Support	ERCW	48
2	16	Pipe Support	CC	4
2	17	Pipe Support	CC	24
2	19	Pipe Support	CC	52
2	20	Pipe Support	CC	3
2	22	Pipe Support	CVCS	12
2	23	Pipe Support	ERCW	12
2	25	Pipe Support	Aux. Boiler	10
2	26	Pipe Support	Aux. Boiler	8
2	29	Pipe Support	HVAC Chiller	43
Group 2 Total				459

<u>Group</u>	<u>Item</u>	<u>Weld Type</u>	<u>System</u>	<u>No. of Welds</u>
3	3	Conduit Support	-	89
3	6	Conduit Support	-	221
3	11	Cable Tray Support	-	12
3	13	Cable Tray Support	-	12
3	14	Cable Tray Support	-	28
3	15	Instrument Support	-	10
3	21	Cable Tray Support	-	7
3	28	Conduit Support	-	97
Group 3 Total				476

<u>Group</u>	<u>Item</u>	<u>Weld Type</u>	<u>System</u>	<u>No. of Welds</u>
4	18	Pipe Rupture Protection Barrier	-	98
4	31	Structural Steel Deck-E1 714	-	<u>24</u>
Group 4 Total				122

<u>Group</u>	<u>Item</u>	<u>Weld Type</u>	<u>System</u>	<u>No. of Welds</u>
5	2	HVAC Support	-	30
5	4	HVAC Support	-	57
5	24	HVAC Support	-	4
5	27	HVAC Support	-	54
5	12	HVAC Support	-	<u>20</u>
Group 5 Total				165

<u>Group</u>	<u>Item</u>	<u>Weld Type</u>	<u>System</u>	<u>No. of Welds</u>
6	30	Spiral Welded Duct	-	15
Group 6 Total				<u>15</u>

The items within each group were rather evenly divided between Units 1 and 2. In general, the items represented the entire time frame of construction and operations and as the major construction effort was in 1976-1978, the systems/structures reinspected reflected this. As noted in the above table, the reinspection plan requirement to inspect 100 welds in each of the first five groups was well exceeded.

(8) Inspection Results

At the conclusion of the inspection, TVA had identified some problems with the welds they had inspected. In general, the problems found with structural welds were slightly under-sized fillet welds. In general, the problems found with piping welds were surface in nature. At the conclusion of the inspection, TVA was still evaluating their inspection results to determine the significance of their findings.

In addition, TVA found some welds in spiral welded air ducts that appeared to be welded less than 360° (see paragraph (4) above for a discussion of this problem).

c. Review of Audit and Inspection Personnel Qualifications

(1) Bechtel Audit Personnel

Four auditors, one lead auditor and a NDE Level III examiner were responsible for performing the independent welding audit. The inspectors reviewed the following records for these personnel:

Auditors - Summary of Education and Experience History

- Letter Statement of Qualification as Auditors to ANSI/ASME N45.2.23 and Regulatory Guide 1.146

Lead Auditor - Summary of Education and Experience History

- Record of Recertification as Audit Team Leader

Level III Examiner - NDE Level III Certification Records Including Eye Test and Summary of Education and Experience History

Combined, the four auditors had 66 years of experience relative to the area being audited. The auditor with the least experience had five years and the auditor with the most experience had 33 years experience. The lead auditor had approximately 30 years of related experience. The level III examiner had 18 years NDE experience.

Personal interviews revealed that audit personnel were very knowledgeable in the areas being audited.

(2) TVA Re-Inspection Personnel Qualifications

For the reinspection, TVA utilized four Certified Welding Inspectors (CWIs) for structural welds and ten SNT-TC-1A level II NDE examiners for pipe welds. All inspectors and examiners were TVA personnel. In addition, Bechtel provided a CWI (for structural welds) and a level III NDE examiner (for pipe welds) to serve as independent overview personnel for this reinspection effort. The NRC inspectors reviewed the following records for the inspection personnel:

CWIs (four TVA and one Bechtel)

- Eye tests
- AWS CWI Certification Records
- Evidence of VWAC (Visual Weld Acceptance Criteria) Training
- Statement of NDE Certifications

TVA Level II Examiners (six examiners inspecting the pipe welds listed in paragraph b.(3) above)

- Eye tests
- NDE Level II certification records including education and experience summary

Bechtel NDE Level III Examiner

- Eye tests
- NDE Level II certification records including education and experience summary

Records indicated that inspection personnel were very experienced in the NDE methods being used. Personal interviews and observation of inspections, revealed that inspection personnel were very knowledgeable in the NDE methods being applied.

d. Review of the TVA Welding Project Program Description and Sequoyah Phase I Action Plan

On January 23, 1986, the inspectors received a copy of the January 17, 1986, TVA submittal relative to the TVA welding program. The inspectors made a preliminary review of the following documents from the submittal:

- Enclosure 1 - "TVA Welding Project Program Description"
- Enclosure 1, Attachment IA - "Welding Project - Phase I, Steps 1 and 2 - Nuclear Operations Work Plan"
- Enclosure 1, Attachment IB - "Welding Project - Phase I, Steps 1 and 2 - Office of Engineering Work Plan"
- Enclosure 1, Attachment IC - "Welding Project - Phase I, Steps 1 and 2 - Office of Construction Work Plan"
- Enclosure 2 - "TVA Action Plan - Welding Related Activities SQN Units 1 and 2"
- Enclosure 2, Attachment I - "SQN Determination of Service Suitability of Welds"

In review of these documents, the inspectors noted that the terms "adequate for service" and "meet all commitments" appear to be used interchangeably. The following are examples:

- Page 2, Enclosure 1 - "Verify the weldments made by TVA in the field meet commitments and requirements or are adequate for service"
(6 lines from bottom)
- Page 3, Enclosure 1 - "-- adequate to meet TVA commitments, code and regulatory requirements"
- Page 4, Enclosure 1 - "Weldments - meet requirements or are adequate for service"
- Page 12, Enclosure 1 - "Reinspection of TVA welds will be conducted to determine compliance with program commitments or suitability for service"
- Figure 2 - "Adequate to meet TVA Code and Regulatory requirements"

The inspectors pointed out that these terms should not be used interchangeably but as two separate steps. The first step should be to determine if commitments/requirements were met and the second step to determine adequacy for service. TVA acknowledged the above comments. Pending further review of the TVA submittals and inspection programs, this matter is identified as Inspector Followup Item 327, 328/86-09-03, Clarification of Terms "Adequate for Service" and "Meets All Requirements" Relative to TVA Welding Program.

e. Review of Aptech Study of Welding Quality

Aptech Engineering Services reviewed the Sequoyah welding program to determine if the quality of welds at the plants were sufficient for their service.

At the time of the NRC inspection, the Aptech report had not been submitted to the NRC. The inspectors made a preliminary review of the Aptech report (obtained at the site) and the accompanying TVA document. The documents were identified as follows:

- AES 8511598AQ-1 Evaluation of Quality of Welds at Sequoyah Nuclear Plant by Aptech Engineering Services, Inc., January 1986
- Attachment 1 to Enclosure 2 to TVA's submittal dated January 17, 1986 - SQN Determination of Service Suitability of Welds

The Aptech Study involved three tasks as follows:

- The first task was to review the overall welding quality assurance program including a review of welding, construction, and inspection procedures, control of material and weld consumables, and qualification of welders and inspectors. In addition to the

program review and as a check on implementation of the program, Aptech selected at random two welds for detailed examination of documentation supporting these welds.

In summary, Aptech found that the program contained the necessary checks and balances to ensure high quality welding.

- The second task was to consider the preservice inspection (PSI) and inservice inspection (ISI) results as quality indicators and review these records and address the significance of the data on operational safety and derive conclusion regarding construction practices.

Aptech concluded that indication rates, based on ISI, provide greater confidence in the quality of the welds than the 95% confidence/95% probability level common in the nuclear industry.

- The third task was to review the operational experience for indications of deficient weld quality as reflected in operation performance. This review was based on a review of Licensee Event Reports (LERs).

Aptech concluded that no LERs have been generated which relate to poor welding.

Aptech noted the following:

- that the quality of shop welds made by certified vendors has not been questioned and therefore, Aptech did not evaluate them.
- that TVA does not place requirements on the traceability of a heat number of a welding electrode to a particular joint.
- that in some cases, the acceptance criteria for welds was more lenient than the code of record, but technical justification existed for deviations.

Within the areas inspected, no violation or deviations were identified.