



**QUALITY  
TECHNOLOGY  
COMPANY**

Sweetwater, TN 37874

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ERT INTERIM REPORT

PAGE 1 OF 35

CONCERN NO. IN-86-068-001

CONCERN: Heat Exchangers "A", "B" & "C", 737 Elev. Unit 1, (60' long) are of poor design. Internal tube sheets (21 Ea. Exchanger) are allowed to "Float" (not rigidly attached to the interior of shell), which causes tube sheet warpage, and premature tube failure due to tube/tube sheet contact. Tubes are currently being replaced in these exchangers due to tube failure during startup testing.

INTERIM REPORT

PREPARED BY: J. T. Nation

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**DETAILS**

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**I. SCOPE AND PURPOSE:**

This Interim Report represents a partial investigation of the Concern, and an evaluation of the limited findings as of the date of this Report. The evaluation is based on a comparison of the Standards of Tubular Exchanger Manufacturers Association (TEMA) to the TVA and Joseph Oat Corporation (JOC) drawings, specifications and other documents, as identified in this Report. The evaluation includes presentation of questions to identify the unresolved, or the lack of investigation to resolve questionable, aspects of the findings and/or Concern.

This Interim Report documents the partial investigation findings, the evaluations and the unresolved questions, and provides a conclusion regarding the validity and significance of the Concern. The unresolved questions provide a basis for completing an investigation of the Concern.

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**DETAILS, continued****II. REFERENCES:****A. TVA and Supplier Documents/Documentation:**

1. Contract 76K35-83210 and Joseph Oat Corporation (JOC) documents for Component Cooling Heat Exchangers:
  - a. JOC Drawings No. 5760 (Revision 902, dated 2/15/85), No. 5761 (Revision 905, dated 2/14/85), No. 5762 (Revision 2, dated 9/29/76) and No. 5763 (Revision 4, dated 10/4/76).
  - b. JOC Heat Exchanger Data Sheets, as part of "Installation and Maintenance Instructions", Job No. J-2301, stamped 1/18/77.
  - c. TVA Design Specification WBNP-DS-3835-2612-00, Specification 2612, "Component Cooling System Heat Exchangers for WBNP Units 1 and 2, Revision 0 and Revision 1, not dated.
  - d. TVA Inspection Reports No. 3, No. 4 and No. 6, dated 8/5/76, 8/25/76 and 10/21/76, respectively.
2. TVA Construction Specification No. N4M-936, Bellefonte Nuclear Plant, "Retubing of the Component Cooling Water Heat Exchangers", Revision 0, dated 3/16/84 and Revision 1 dated 9/24/84.
3. TVA Memorandum WBP 840720 058, ENDES (J. C. Standifer) to NUCPR (T. G. Campbell), dated 7/20/84, "Watts Bar Nuclear Plant Units 1 and 2 - Component Cooling Water Heat Exchanger Retubing", "Retubing with AL-6X Tubing".
4. TVA Workplans (WP) for Retubing Component Cooling System Heat Exchangers (CCSHX):
  - a. WP No. 2403, CCSHX "B", dated 5/28/85.
  - b. WP No. 2597, CCSHX "A", dated 12/4/84.
  - c. WP No. 4459, CCSHX "C", dated 6/10/84.

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DETAILS, continued

II. REFERENCES, continued

A. continued

5. TVA WBNP Final Safety Analysis Report (FSAR), Chapter 9, Section 9.2.2, "Component Cooling System."

B. Other Documents/Documentation:

1. Tubular Exchanger Manufacturers Association (TEMA), Standards of, Sixth Edition, 1978.
2. ANSI N45.2-1971, "Quality Assurance Program Requirements for Nuclear Power Plants".
3. US NRC Report Nos. 50-390/84-59 and 50-391/84-45, dated 11/8/84, Notice of Violations 390/84-49-01 through 390/84-59-04, for period of July 21-September 21, 1984.
4. US NRC Report Nos. 50-390/85-08 and 50-391/85-08, dated 3/29/85, closure of Violations (above), for period of January 21-February 28, 1985.
5. ERT Investigation Report for related Concerns No. IN-86-068-002 and IN-86-210-001, dated 11/5/85.
6. ERT Concern No. IN-86-189-001, regarding "Bent tubes" for CSHX "B", Transmittal No. T50124, dated 8/25/85.

III. CLARIFICATION:

The following provide clarification and/or information regarding the Concern:

A. Additional Concern Information:

1. The following is contained in the statement for related Concern No. IN-86-068-002, but applies to and is considered part of the Concern addressed in this Interim Report:

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**DETAILS, continued****III. CLARIFICATION, continued****A. 1. continued**

"...Internal tube sheets (21 each exchanger) are poorly manufactured, with poor hole alignment, varying sizes/bevels of tube holes, and are allowed to "float" (not rigidly attached to interior shell), which results in tube sheet "warping" and poor support of tubes. During operation, this warpage and lack of support permits tube vibration and causes tube failure. Tube sheet were leveled with angle iron brackets for 1/2 of re-tubing, then brackets were removed (not part of permanent installation). Tube sheets "warped" to original position, which is thought to be the cause of initial tube failure..."

2. No additional information was obtained from the Concern files or Concern Individual (CI) regarding the Concern identified in this Interim Report.

**B. Clarification of Concern Terminology:**

The following is a clarification of some of the terminology in the Concern:

1. The terms "internal tube sheets" and "tube sheet" are recognized to mean baffles or support plates located inside the CSHX shell.
2. The term "warping" is understood to mean misalignment and/or similar deflection or movement.
3. The term "float" means "not rigidly attached", as indicated in the Concern.

**C. Identification of Items/Activities:**

The following information is for identification of the items and activities referenced in the Concern:

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DETAILS, continued

## III. CLARIFICATION, continued

## C. continued

## 1. The Heat Exchangers:

The three (3) Component Cooling System Heat Exchangers (CCSHX), located on elevation 737.0, between column lines A-5, A-10, T and R, in the Auxiliary Building, Units 1 & 2. The reference and system identifiers are as follows:

<u>Reference Designation</u>	<u>Unit-System Designation</u>
CCSHX "A"	1-HTX-070-0001A
CCSHX "B"	2-HTX-070-0001B
CCSHX "C"	0-HTX-070-0001C

The CCSHX are classified as ASME Section III-Class 3, TVA Class C, and Seismic Category I.

## 2. The re-tubing of the CCSHX:

The tubes (3200 each CCSHX) were replaced in late 1984 to early 1985. The CCSHX were re-tubed with high alloy steel (AL-6X, ASME SB-676) tubing to replace the original copper-nickle (90-10 CuNi, ASME SB-111-706) tubing. Reportedly, the tubes were replaced because of the low velocity of the raw water and the resulting pitting corrosion of the original tubes.

The CCSHX re-tubing is addressed in the ERT Investigation Report, dated 11-5-85, for related Concerns No. IN-86-068-002 and IN-86-210-001.

## D. Summary of Concern Aspects:

The following is a summary of the aspects of the Concern, as determined by evaluation of the information contained in the ERT Concern files:

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**DETAILS, continued****III. CLARIFICATION, continued****D. continued****1. Design aspects:**

- a. The CCSHX are of poor design. The only specific example provided by the CI is the Baffles/Support Plates, and the effect on the Tubes.
- b. Baffles/Support Plates, as designed, are allowed to "float" (not rigidly attached to interior shell).
- c. Baffles/Support Plates, as designed, result in "warping" (misalignment) of the Baffles/Support Plates.
- d. Baffles/Support Plates, as designed, result in poor support of the Tubes.
- e. Baffles/Support Plates, as designed, result in Tube vibration.
- f. Tube "premature" failure, due to the above design aspects.

**2. Construction/Manufacturing aspects; these aspects apply to the Baffles/Support Plates, unless otherwise noted:**

- a. Poor alignment of Tube holes.
- b. Varying sizes and bevels of Tube holes.
- c. During the re-tubing of the CCSHX, the Baffles/Support Plates were leveled with temporary brackets; upon removal of the brackets, the Baffles/Support Plates "warped" to original position.
- d. Tube "premature" failure, due to the above Construction/Manufacturing aspects.

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DETAILS, continued

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## IV. FINDINGS:

The findings are based on partial investigation of this Concern and the completed investigation of related Concerns No. IN-86-068-002 and IN-86-210-001; refer to Section V of this Interim Report for evaluation and questions for these findings, as applicable to the Concern:

## A. General Findings:

The following findings relate to general provisions in the Contract (No. 76K35-83210) documents:

1. TVA Design Specification WBNP-DS-3835-2612-01, dated 3/27/75, Specification 2612, "Component Cooling System Heat Exchangers for Watts Bar Nuclear Plant, Units 1 and 2", Revision 1, contains the following:

- a. Section 6, "Materials and Workmanship", item b, states:

"Contractor, subcontractors, and/or suppliers of materials, components, or subassemblies shall submit drawings or data sheets on which shall be indicated the latest (unless otherwise approved) applicable ASME, ASTM, ANSI, and TEMA Specifications and standards relating to the design and materials used in each application in the various components, parts, or subassemblies comprising the contractual assembly."

- b. Section 17, "Tubes", item c, states:

"Tube support plates shall be spaced and connected by means of heavy wall pipe or solid rods welded to tube sheets and baffles. Bolted tie rods with nuts welded to tube sheets and bolts acceptable."

Previously (revision 0), Section 17, item c, stated:

"Bolted tie rods will not be acceptable."

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**DETAILS, continued****IV. FINDINGS, continued****A. continued**

2. The JOC Drawing No. 5761 shows the following for applicable codes:
  - a. ASME, Section III, Class 3, 1974, with Winter 74 addenda.
  - b. TEMA Class R (no edition or date)
  - c. SA-36 (no date) for Baffles and Tie Rods
  - d. SA-53 Welded (no date) for Spacers
  
3. The JOC Data Sheets show the following:
  - a. ASME, Section III, Class 3 (no edition)
  - b. TEMA Class R (no edition or date)
  - c. "C.S." (no specification/date) for Baffles.
  
4. The JOC Drawings (No.s 5760 through 5763) show the following:
  - a. Spacers of Schedule 40 (heavy wall) pipe between baffles and support plats.
  - b. Tie-Rods of 1 inch diameter solid rod.
  - c. Tackwelds for Tie-Rods to Tubesheets.
  - d. Tackwelds for nuts to baffle/plate at "rear end" of CCSHX.
  
5. The JOC Drawings (above) do not show the following:
  - a. "Welds" in lieu of tackwelds.

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**DETAILS, continued****IV. FINDINGS, continued****A. 5. continued**

- b. The "heavy wall pipe" (Spacers) or "solid rods" (Tie Rods) to be "welded" or tackwelded to all baffles and support plates.
- c. Any "nuts" at "tube sheets"; the tube sheets are tapped/threaded to receive the Tie Rods.
- d. Nuts to be "welded" or tackwelded to tie rods.

**6. TVA Inspection Reports for Contract No. 76K35-83210, for inspections at the place of manufacture (Joseph Oat Corporation), show the following:**

- a. Report No. 3, dated 8/5/76, states "Layout and burning of tube supports...in progress."
- b. Report No. 4, dated 8/25/76, states that the "Support plates are stacked and are being drilled or the OD turned," that "the rods and spacers...are in subassembly stage," and that "inspection shows workmanship, including fitup welding and machining, well within specifications and contractor's QA Manual."
- c. Report No. 6, dated 10/21/76, states that "the rods were tackwelded in place after assembly" for CSHX "A", that "Tube support inspection i.e., chilling, reaming, chamfering, deburring and degreasing prior to tube bundle assembly", and that "Workmanship to this point is acceptable".

None of the Inspection Reports indicate an unacceptable condition for the baffle/support plate, tie rod or spacer activities. However, the Reports have a very limited description of the inspection and fabrication activities, as shown above, and none of the Reports reference or otherwise indicate that Drawings were used for the inspections.

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**DETAILS, continued****IV. FINDINGS, continued****B. Specific Findings:**

The following findings relate to the specific provisions in the TEMA Standards, as compared to the Joseph Oats Corporation (JOC) drawings and other contract documents:

**1. Type of Traverse Baffles/Support Plates:**

- a. TEMA, Section 5, Paragraph R-4.1, states (in part):

"The segmental or multi-segmental type of baffle or tube support plate is standard. Other type baffles are permissible. Baffle cut is defined as the segment opening height expressed as a percentage of the shell inside diameter. Baffles shall be cut near the centerline of a row of tubes, of a pass lane, or of a tube lane when square pattern is used, or outside the tube pattern. Baffles shall have a finish of 250 RMS or better on the outside diameter and baffle cut edge. Standard baffle cuts for segmental baffles are illustrated in Figure R-4.1. Figure R-4.2 illustrates a vertical cut with multi-segmental baffles but these baffles may also have horizontal or rotated cuts."

The "Figure R-4.1" shows "Horizontal", "Vertical" and "Rotated" baffle cuts.

The "Figure R-4.2" shows "Double" and "Triple" segmental baffle cuts.

- b. The JOC Drawing No. 5763 shows the CCSHX baffles and support plates to be the "Horizontal" type and to be similar to the "Double" type of cuts for "Multi-Segmental" as shown in TEMA.

The dissimilarity of the "Double" cuts is that TEMA shows the three baffles to be in two planes, whereas the JOC Drawing shows the three baffles in three planes.

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DETAILS, continued

## IV. FINDINGS, continued

## B. 1. continued

- c. The JOC Drawings do not show a finish, such as "250 RMS or better", on the outside diameter and baffle cut edges.

## 2. Tube Holes in Baffles/Support Plates:

- a. TEMA, Section 5, Paragraph R-4.2, states:

"Where the maximum unsupported tube length is 36 inches or less, or for tubes larger in diameter than 1 1/4 inches O.D., standard tube holes are drilled 1/32" over the O.D. of the tubes. Where the unsupported tube length exceeds 36 inches for tubes 1 1/4 inches diameter and smaller, standard tube holes are drilled 1/64" over the O.D. of the tubes. For pulsating conditions, tube holes may be drilled smaller than standard. Any burrs shall be removed and the tube holes given a workmanlike finish. All baffle hole drilling will have a maximum over-tolerance of .010 inches."

- b. The JOC Drawings (No.s 5760 through 5763) do not show a tolerance for the baffle hole drilling.

JOC Drawing No. 5763 shows holes for the following

49/64 inch diameter holes for Tubes.

1-1/32 inch diameter holes for Tie-Rods.

Based on the design diameters for the Tubes (0.750 inches) and the Tie-Rods (1.000 inch), the above hole diameters are:

1/64 inch larger for Tube holes.

1/32 inch larger for Tie-Rod holes.

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**DETAILS, continued****IV. FINDINGS, continued****B. continued****3. Transverse Baffle and Support Clearances:****a. TEMA, Section 5, Paragraph R-4.3, states (in part):**

"The transverse baffle and support plate clearance shall be such that the difference between the shell design inside diameter and the outside diameter of the baffle shall not exceed that indicated in Table R-4.3. However, where such clearance has no significant effect on shell side heat transfer coefficient or mean temperature difference, these maximum clearance may be increased to twice the tabulated values.

The "Table R-4.3" does not provide clearances for shells larger than 60 inches inside diameter; the CCSHX are 68 inches inside diameter.

TEMA, Section 12, Paragraph RGP-RCB-4.3, Table RGP-RCB-4.3 shows a clearance of 0.300 inches for 61 to 69 inch inside diameter shells.

**b. The JOC Drawings (No.s 7560 through 5763) do not show a clearance dimension or tolerance for the baffles/support plates.**

JOC Drawing No. 5763 shows two outside diameters for the baffles/support plates:

67-3/4 inches for "A" (middle) and "C" (lower) details.

67-5/8 inches for "B" (upper) detail.

Based on the shell design inside diameter of 68 inches, the clearances equate to:

0.250 inches for "A" and "C" details.

0.375 inches for "B" detail

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**DETAILS, continued****IV. FINDINGS, continued****B. continued****4. Thickness of Baffles/Support Plates:****a. TEMA, Section 5, Paragraph R-4.41, states:**

"Table R-4.41 shows the minimum thickness of transverse baffles and support plates applying to all materials for various shell diameters and plate spacings."

The "Table R-4.41" does not encompass shell diameters over 60 inches; the CSHX design diameter is 68 inches.

TEMA, Section 12, Paragraph Table RGP-RCB-4.41, encompasses 61 to 100 inches diameter shells. The Table shows that the "plate thickness" is based on the "Distance between adjacent full diameter baffles, supports or the unsupported tube length between other type baffles." The Table shows the following thickness for the indicated "unsupported tube length":

1/2 inch for "Over 24 to 36" inches

5/8 inch for "Over 36 to 48" inches

3/4 inch for "Over 48 to 60" inches.

**b. TEMA, Section 5, Paragraph R-4.43, "Special Precautions", states:**

"Special consideration must be given to baffles and support plates subjected to pulsations, to baffles and support plates engaging finned tubes, and to longitudinal baffles subjected to large differential pressures due to high shell side fluid pressure drop.

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**DETAILS, continued****IV. FINDINGS, continued****B. 4. continued**

- c. The JOC Drawing No. 5763 shows the baffle thickness to be 5/8 inches. The Drawing shows the baffle spacing to be 33 inches (typical) for the twenty-one (21) baffles.
- d. The JOC Data Sheet states the baffle thickness to be 0.5 inches. The Data Sheet states eleven (11) baffles and 60.0 inches spacing for the baffles.

Refer to Section B.5, below, for findings regarding Spacing of Baffles/Support Plates.

**5. Spacing of Baffles/Support Plates:**

- a. TEMA, Section 5, Paragraph R-4.51, "Minimum Spacing", states:

"Segmental baffles normally should not be spaced closer than 1/5 of the shell I.D., or 2 inches, whichever is greater. However, special design considerations may dictate a closer spacing."

- b. TEMA, Section 5, Paragraph R-4.52, "Maximum Spacing", states:

"Tube support plates shall be so spaced that the unsupported tube length does not exceed the value indicated in Table R-4.52 for the tube material used."

The "Table R-4.52", for 3/4 inch outside diameter Tubes ("Alloy Steel" and "Nickel-Copper" Materials), indicates a "maximum unsupported span" of 60 inches.

- c. TEMA, Section 5, Paragraph R-4.53, "Baffle Spacing", states:

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DETAILS, continued

## IV. FINDINGS, continued

B. 5. c. continued

"Baffles normally shall be spaced uniformly, spanning the effective tube length. When this is not possible, the baffles nearest the ends of the shell, and/or tubesheets, shall be located as close as practical to the shell nozzles. The remaining baffles normally shall be spaced uniformly."

- d. The JOC Drawing No. 5763 shows the spacing to be 33 inches, typical between adjacent baffles (21 total).

The Drawing uses the designation "baffle" for all the plates; the term "support plate" is not used.

- e. The JOC Drawing No. 5762 shows the shell inside diameter to be 68 inches;  $1/5$  of 68 inches equals 13.6 inches.
- f. The JOC Data Sheet shows a spacing of 60 inches and eleven (11) baffles.
- g. The JOC Drawing No. 5763 shows the front end baffle to be  $30-3/8$  inches from the front end tubesheet (inside or shellside face) and the rear end baffle to be on center of the shell inlet nozzle.

Based on dimensions on the other JOC Drawings, the front end baffle is  $7-3/4$  inches off center of the shell outlet nozzle (24 inch size).

## 6. Tie Rods and Spacers for Baffles/Support Plates

- a. TEMA, Section 5, Paragraph R-4.7, states:

"Tie rods and spacers, or other equivalent means of tying the baffle system together, shall be provided to retain all transverse baffles and tube support plates securely in position. Tie rods and spacers should be of a material similar to that of the baffles."

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DETAILS, continued

## IV. FINDINGS, continued

## 6. a. continued

Paragraph R-4.71, "Number and Size of tie Rods", references "Table R-4.71" for suggested tie rod count and diameter. However, the "Table R-4.71" does not show values for shell diameters over 60 inches; the Paragraph indicates (asterisk) that Section 12 applies.

- b. TEMA, Section 12, Paragraph RGP-RCB-4.71, "Number and Size of Tie Rods", states:

"Table RGP-RCB-4.71 shows suggested tie rod count and diameter for heat exchangers above 60 inches in diameter. Other combinations of tie rod number and diameter with equivalent metal area are permissible; however, no fewer than eight tie rods, and no diameter less than 3/8" should be used"

The "Table RGP-RCB-4.71", for 61 to 100 inch shell diameters, shows a minimum of twelve (12), 5/8 inch diameter Tie Rods.

The twelve (12), 5/8 inch diameter rods equate to a minimum metal area of 3.68 square inches.

- c. The JOC Drawing No. 5762 shows a total of twelve (12), 1.0 inch diameter Tie Rods. However, the JOC Drawing No. 5763 shows that only part of the twelve (12) Tie Rods pass through each of the baffle details, as follows:

Eight (8) for the "A" detail.

Ten (10) for the "B" and "C" details.

The eight (8), 1.0 inch diameter Tie Rods have a total area of cross-section of 6.28 square inches.

- d. The JOC Drawing No. 5761 shows the following material types:

(1) SA-36 for baffles and tie-rods.

(2) SA-53 (welded) for spacers.

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**DETAILS, continued****IV. FINDINGS, continued****B. 6. continued**

- e. The JOC Drawing No. 5763 shows the system of tie-rods and spacers for longitudinal restraint of the baffles.

Refer to Section IV.A of this Interim Report for general findings regarding the tie-rods and spacers, specifically the connecting requirements.

**C. Special Findings:**

The following findings relate to the re-tubing activities for the CSHX:

1. The TVA Memorandum WBP 840720 058, dated 7/20/84, states (in part):

"Since the "C" heat exchanger is partially retubed with AL-6X, at this time, with all the 90-10 CuNi tubes removed, we recommend that the installed tubes be left in the bundle if they have been inserted correctly. Straightening of the bundle by jacking the baffles will not damage these installed tubes as long as reasonable control and judgment is used during this activity. The shells can be entered through the access holes that you have recently cut and the baffles can be jacked and pulled into their original positions. The new tubes can then be installed and guided through the baffle holes as necessary. The most important point we would like to emphasize and recommend on the "A" and "B" exchangers is that the tubes should be removed and reinstalled so that each removed tube is surrounded by installed tubes. This is more fully explained in the attached BLN CONST retubing specification. This method provides each new tube with a guide of installed tubes which prevent the new tube from missing or jumping a baffle hole, even if the baffles are slightly shifted or rotated. This method also provides a uniform tube removal pattern which will prevent the baffles in the shell from shifting due to uneven weight distribution. The periphery tubes may cause problems due to not being completely surrounded by installed tubes."

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**DETAILS, continued****IV. FINDINGS, continued****C. 1. continued**

The TVA Memorandum indicates that there was a problem with baffle alignment for CSHX "C" (see Section IV.C.5, below) re-tubing activities, and recommends new methods for CSHX "A" and "B" re-tubing.

2. The BLN Construction Specification N4M-936 (referenced in the TVA Memorandum WBP 840720 058, above), Section 3.4.5, Revision 1 (9/24/84), states:

"Remove tubes in groups of approximately 800 tubes each as described in section 3.4.6, replace the entire tube group, and roll the group into both tubesheets before removing the next group. This will prevent misalignment of the baffles within the shell and prevent tubes from missing or jumping a baffle hole during tube replacement."

"NOTE"

"If necessary, all tubes can be pulled at the floating tubesheet end to break the tube-to-tubesheet joint. The portion of the tubes that extends beyond the tubesheet can be cut off. (See section 3.4.7 and 3.4.8) However, not more than 800 tubes can be removed from the shell (or tubesheets) at any one time, and the fixed tubesheet must be bolted to the shell flange with the test collar."

The Specification, Sections 3.4.5 and 3.4.6, Revision 0 (3/16/84), previously stated:

"Remove tubes in groups of 300-400 tubes each, replace the entire tube group, and roll the group into both tubesheets before removing the next group of 300-400 tubes. This will prevent misalignment of the baffles within the shell during tube replacement."

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**DETAILS, continued****IV. FINDINGS, continued****C. 2. continued**

"Remove the tubes in groups so that every other horizontal tube row is replaced, starting at the bottom up to the top of the exchanger. Remove the alternate rows from the bottom to complete the retubing. (this "laddering up" keeps one row of tubes directly under the row being retubed to ensure that the end of the inserted tube does not drop down and misalign with the baffle tube hole.) Remove the bottom row of tubes last."

3. The Workplan No. WP-2403, for re-tubing CCSHX "B", shows the following in the Workplan Instructions, dated 5/28/85:

- a. Section B, "Pulling [Old] Tubes", Step B.1, states (in part):

"Note: To minimize possibility of rolling the baffle plates, the tubes should be pulled symmetrically, i.e., pull 10-20 tubes from the left side, then 10-20 from the right side, etc."

- b. Section B, Step B.2, states (in part):

"Maintenance engineer verify acceptability of tube sheet and baffle plate holes."

- c. Section C, "Inspection Holes [in Shell]", Step C.4, states:

"Maintenance Engineer to inspect baffle plates for proper orientation when holes [in shell] are cut. Acceptance Criteria-Baffle plates level in the horizontal plane. Record results of inspection."

The recorded inspection results, signed and dated 8/1/85, state:

"Plates not level."

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**DETAILS, continued****IV. FINDINGS, continued****C. 3. continued****d. Section C, Step C.7, states:**

"If baffle plates are not level, it will be necessary to jack the baffle plates into proper position. Weld angle to the HTX shell as necessary to provide an anchor point for jacking...Jack baffle plates to proper position. Indicate which baffle plates require jacking on Drawing 5763 in Appendix C."

The Step C.7 is signed by the "Maintenance Engineer" and dated 8/1/85. The "Drawing 5763 in Appendix C" did not have any indication or notation as to which baffle plates, if any, required jacking.

**e. Section D, "Installing New Tubes", Step D.6, states (in part):**

"Remove jacks and temporary angles (if installed in Step C.7) prior to installation of all new tubes."

The Step D.6 is signed by the "Maintenance Engineer" and dated 8/7/85.

4. The Workplan Instructions for CCSHX "A" (WP-2597, dated 12/4/84) has instructions similar to the Workplan for CCSHX "B", above.
5. The Workplan for CCSHX "C" (WP-4459, dated 6/10/84) does not show instructions similar to those for CCSHX "A" and "B", above.

The TVA Memorandum WBP 840720 058, dated 7/28/84 (see Section IV.C.1, above) refers to the CCSHX "C" and "jacking the baffles", and states that "the baffles can be jacked and pulled into their original positions." For CCSHX "C", the Memorandum and personnel statements indicate that all of the old tubes were removed at one time and the baffles lost their original alignment.

CONCERN NO. IN-86-068-001

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DETAILS, continued

V. EVALUATIONS AND QUESTIONS, continued

A. 2. continued

Refer to Sections V.A.3 and V.B.3, below, for related evaluations and questions.

Questions:

- a. Are the tie-rods and/or spacers to be welded to the baffles and/or support plates, as indicated in the Design Specification?

If not, what does the Design Specification mean by "welded to...baffles"?

If so, why isn't this shown on the Drawings?

- b. Is the tie-rod/spacer system, as shown on the Drawings, required to "retain all transverse baffles and tube support plates securely in position"?

If not, what is the technical justification for apparent exception to the TEMA standards?

If so, why did the baffles and/or support plates become misaligned during the re-tubing activities?

- c. Are the nuts at the rear end of the tie-rods required to be kept tightened for the system to function properly?

If not, what is the purpose for the nuts?

If so, what tightness and/or torque is required, and why isn't the requirement shown in the Drawings or other documents?

If so, how is the tightness maintained (considering possible effects of thermal expansion and/or contraction) during operation of the CSHX?

CONCERN NO. IN-86-068-001

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**DETAILS, continued****V. EVALUATION AND QUESTIONS, continued****A. 2. continued**

- d. Are the "tackwelds" (as shown on the Drawings) technically the same as "welds" (as indicated in the Design Specification)?
- e. See Design Specification; does "bolted tie rods" mean threaded tie rods? Fully threaded or threaded at ends only?
- f. See Design Specification; are the "nuts" to be "welded to tube sheets and bolts"? Both "tube sheets"? Does "bolts" mean the tie rods?
- g. See Design Specification; does "Bolted tie rods...acceptable" mean in lieu of the "heavy wall pipe or solid rods welded to tube sheets and baffles"?

**3. The "poor support of Tubes" aspect (III.D.1.d):****Evaluation:**

To some extent the baffles and support plates are supported by, or cause load to be applied to, the Tubes, in lieu of the inverse. During the re-tubing of the CSHX, the baffles/support plates had to be jacked and temporarily supported to attain proper alignment, and reportedly displaced after removal of the temporary supports. As previously stated, the in-place tie-rod system does not appear to "retain all transverse baffles and tube support plates securely in position" according to the TEMA standards. Without the baffles/support plates being secure, it is not reasonable to expect full support of the Tubes.

The Drawings or other documents do not indicate which plates are baffles, which are tube support plates, or if all the plates or details provide a dual function. Fifteen (15) of the plates could bear on a portion of the shell, but only five (5) would bear on the lower surface of the shell, as shown on the Drawings.

CONCERN NO. IN-86-068-001

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**DETAILS, continued****V. EVALUATION AND QUESTIONS, continued****A. 3. continued**

The 33 inch spacing between adjacent baffles, as shown on the Drawings, appears to be consistent with the TEMA standards. However, this observation is based on the premise that all twenty-one (21) baffles also function as support plates. Only eight of the twelve tie-rods are shown to support all of the plates or details. Also, the Data Sheet shows the spacing to be 60 inches, which is the maximum permitted in the TEMA standards and which is contrary to the Drawings.

**Questions:**

- a. Do the CCSHX have eleven (11) baffles at 60 inch spacing and 0.5 inch thickness, as stated in the JOC Data Sheets?

If not, what is the affect of the incorrect Data Sheets?

If so, are the JOC Drawings in error?

- b. What is the intended (design) "unsupported span" for the CCSHX tubes? What is the actual (considering the effects of "warpage" or misalignment as indicated in Section V.A.2, above)?

- c. Are all the CCSHX "baffles" to function as "tube supports plates", and vice versa?

If not, which are which?

- d. What effect does the "warpage" or misalignment (See Section V.A.2, above) have on the Tubes that are not supported by all the designated tube support plates?

- e. Are the Tubes designed for loads induced by the support system?

The original (90-10 CuNi, 18 BWG) Tubes?

The replacement (AL6X steel, 20 BWG) Tubes?

CONCERN NO. IN-86-068-001

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**DETAILS, continued****V. EVALUATION AND QUESTIONS, continued****A. continued****4. The "tube vibration" aspect (III.D.1.e):****Evaluation:**

Neither the Design Specification, nor the other contract documents, specifically identify whether or not Tube vibration and/or pulsating conditions are applicable to and/or are addressed in the design of the CCSHX. The TEMA standards indicate that the purchaser must specify pulsating conditions and must specifically request a vibration analysis; otherwise the manufacturer may not address these conditions in the design of the unit.

The TEMA standards state that shellside flow may produce excitation forces which result in destructive tube vibration, and state that the vibration depends on flow rate, tube and baffle materials, unsupported tube spans, and other factors. The "unsupported tube spans" is one of the factors referenced in the Concern. This aspect of the Concern is addressed in Section V.A.3, above. Based on the TEMA standards, this aspect is essential in evaluating and designing for Tube vibration. However, it does not appear that pulsating conditions and Tube vibration was addressed in the design of the CCSHX.

**Questions:**

- a. Are the CCSHX, specifically the tubes, subject to pulsating conditions?

If not, what precludes such conditions?

If so, why weren't such conditions specified in the contract documents? And, what affect does this have on the existing design and future operation of the units?

CONCERN NO. IN-86-068-001

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**DETAILS, continued****V. EVALUATION AND QUESTIONS, continued****A. 4. continued**

- b. Have the CCSHX, specifically the tubes and tube supports/spans, been analyzed and designed to preclude destructive tube vibrations.

If not, what is the technical basis for the exclusion?

If so, where is the documentation of analysis and design?

5. The "Tube 'premature' failure" aspect (III.D.1.f)

**Evaluation:**

This aspect of the Concern asserts that the CCSHX tubes would or could be subject to "premature" failure due to the conditions indicated in the other aspects, above. The singular and/or cumulative effects of "float", "warpage", "poor support" and "Tube vibration" would be destructive to and could cause failure of the Tubes. Such failure is further encouraged by Tube corrosion (reportedly the reason for re-tubing the CCSHX), wall thickness reduction (ERT Investigation Report for Concerns No. IN-86-068-002 and IN-86-210-001), and Tube damage during installation (ERT Concern No. IN-86-189-001).

The Concern also indicates that the re-tubing of the CCSHX was "due to tube failure during startup testing". The TVA Memorandum states that the CCSHX Tubes were replaced "because of the low water velocity and resulting pitting corrosion of the 90-10 C.Ni tubes." The replacement Tubes are "AL-6X high alloy steel tubes", which is consistent with the reason stated for replacement. However, the original Tubes were 18 BWG (0.049 inch wall thickness) and the replacement tubes are 20 BWG (0.035 inch wall thickness), which reduces the gain in material yield strength (15 versus 30 ksi) for overall consideration of structural and/or mechanical integrity. Premature failure of the Tubes, due to the aspects indicated in the Concern, is plausible.

CONCERN NO. IN-86-068-001

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**DETAILS, continued****V. EVALUATION AND QUESTIONS, continued****A. 5. continued****Questions:**

- a. Was "corrosion" the only reason for replacement of the Tubes in the CCSHX?

If not, what are the other reasons?

- b. Are the replacement Tubes (AL-6X, high alloy steel, 20 BWG) structurally and mechanically of greater strength and serviceability than the original Tubes (90-10 CuNi, 18 BWG)?

If not, what effect does this have on the integrity of the existing Tubes?

- c. What is the expected (design) operational-life of the existing Tubes?
- d. What measures have been established to ensure that the Tubes will not fail prematurely?

**B. Regarding the Construction/Manufacturing aspects:**

1. The "Poor alignment of Tube holes" aspect (III.D.2.a):

**Evaluation:**

This aspect of the Concern needs to be investigated by actual examination/measurement of the existing configuration; such investigation was not performed as part of this Interim Report or previous investigation. However, some of the reviewed documents/documentation indicate a deficiency in alignment of Tube holes for either the holes within-a-plate or from-plate-to-plate.

As indicated in Section V.B.3, below, "jacking and temporary supports" were used during the re-tubing activities to attain alignment. The specific extent and cause of the misalignment is not identified in the

CONCERN NO. IN-86-068-001

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**DETAILS, continued****V. EVALUATION AND QUESTIONS, continued****B. 1. continued**

Work Plans or other documentation. The Workplan Instruction for CCSHX "B" indicates that the maintenance engineer was to verify acceptability of the baffle plate holes, however, this acceptability appears to be for cleanness and surface condition, and not for configuration. The Workplan also states that "Plates [are] not level", regarding a maintenance engineer inspection for "proper orientation" of the baffle plates.

The Drawings show that the Tube hole pitch and location for the baffles is the same as for the tubesheets. However, the Drawings do not show a tolerance for the hole configuration. The TVA Inspection Reports, for inspections at the place of manufacturing, indicate acceptance of the drilling of holes and workmanship in general, however, the Reports do not indicate the use of the Drawings for the inspection of these activities/items.

The lack of specified tolerances and the lack of documentary evidence of adequate verification/inspection, regarding the alignment of tube holes in the baffles/support plates, afford credibility to this aspect of the Concern.

**Questions:**

- a. What was the allowable (design) tolerance for alignment (within-a-plate and from-plate-to-plate) of Tube holes in the baffles/support plates?
- b. What is the actual or as-constructed (inspection/verification) configuration/alignment of the holes?
- c. What effect does "poor alignment of Tube holes" have on the CCSHX Tubes?

CONCERN NO. IN-86-068-001

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**DETAILS, continued****V. EVALUATION AND QUESTIONS, continued****B. 1. continued**

d. Did the TVA inspector(s), at the place of manufacturing and during fabrication, have and use the Drawings?

If so, why aren't the Drawings noted on the Inspection Reports?

2. The "Varying sizes and bevels of Tube holes" aspect (III.D.2.b):

Evaluation:

This aspect of the Concern needs to be investigated by actual examination/measurement of the existing configuration; such investigation was not performed as part of this Interim Report or previous investigation. However, some of the reviewed documents indicate that this condition could exist.

The Drawings show only one size of Tube hole for all baffles/support plates. However, the Drawings do not show a tolerance for the size and perpendicularity, and do not show beveling, for the holes.

As noted in Section V.B.1, above, the Workplan refers to "plates not level", and the TVA Inspection Report refers to acceptance of hole drilling without reference to use of the Drawings; these references support, more than refute, the aspect of the Concern.

The lack of specified tolerances and the lack of documentary evidence of adequate verification/inspection, regarding the size and configuration of Tube holes in the baffles/support plates, afford credibility to this aspect of the Concern.

CONCERN NO. IN-86-068-001

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DETAILS, continued

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## V. EVALUATION AND QUESTIONS, continued

## B. 2. continued

## Questions:

- a. What were the allowable (design) tolerances for size and configuration (angularity, beveling) of Tube holes in the baffles/support plates?
  - b. What is the actual or as-constructed (inspection /verification) size and configuration of the holes?
  - c. What effect does "varying sizes and bevels of Tube holes" have on the CCSHX Tubes?
3. The "re-tubing...temporary brackets" aspect (III.D.2.c):

## Evaluation:

The Workplans and TVA Memorandum indicate the use of jacking and temporary support methods for attaining alignment of the baffles/support plates during the re-tubing of the CCSHX. The documentation indicates that temporary brackets were used to level baffles for re-tubing CCSHX "C", and may have been used for CCSHX "A" and "B". The documentation provides for removal of the temporary brackets. As to whether or not the baffles/support plates "warped" to original position or deflected in some manner, after removal of the brackets, the documentation does not specifically indicate. However, the Workplan for CCSHX "B" indicates that the "Plates [were] not level" after installation of the replacement tubes.

This aspect of the Concern needs to be investigated by actual examination/measurement of the existing configuration to appropriately determine the validity of the "warped" aspect and/or the extent of "warped" condition.

CONCERN NO. IN-86-068-001

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DETAILS, continued

V. EVALUATION AND QUESTIONS, continued

B. 3. continued

Questions:

- a. Which of the three CCSHX required and involved the use of jacking and temporary support brackets/angles to level/align the baffles/support plates for tube removal/installation?
  - b. To what extent (magnitude and direction) were the baffles/supports displaced by the jacking?
  - c. To what extent did the baffles/supports displace upon removal of the jacks? Upon removal of the temporary brackets/angles?
  - d. What effect did/does the jacking and displacement have on the CCSHX Tubes?
4. The "Tube 'premature' failure" aspect (III.D.2.d):

Evaluation and Questions:

The evaluation and questions in Section V.A.5, above, are also applicable to this aspect, except that the effects additionally include "poor alignment" and "varying sizes and bevels" of Tube holes. Again, the singular and/or cumulative effects would be destructive to and could cause failure of the CCSHX Tubes.

CONCERN NO. IN-86-068-001

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**DETAILS, continued****VI. CONCLUSIONS:**

The concern is substantiated (INTERIM).

Based on the partial investigation, the limited findings and the interim evaluations, it is concluded that the Concern is substantiated, i.e., that most, if not all, of the aspects of the Concern have substantial validity. The baffle, support plate, tie-rod and spacer items and system, for the Component Cooling System Heat Exchangers (CCSHX), are concluded to be deficient or questionable in characteristic and/or documentation, as indicated below and as further identified in this Interim Report.

The documents/documentation, for design and construction/manufacture of the CCSHX baffle, support plate, tie-rod and spacer items and system, do not adequately describe or furnish documentary evidence of the quality of the items and of the activities affective quality. The Design Specification requirements for the items, even though inappropriately sparse in content, were not correctly translated into the Drawings for the manufacturing activities. As a procurement document, the Design Specification lacks provisions for basic technical requirements. Neither the Design Specification, nor the Drawings, include or identify appropriate quality standards and inspection criteria.

The Drawings do not include appropriate quantitative (such as tolerances) or qualitative (such as surface finish) criteria for determining that the important activities (such as drilling, machining and other fabrication) have been satisfactorily accomplished. The TVA Inspection Reports, as source inspection documentation, do not demonstrate an adequate inspection of the manufacturing activities or verification of conformance of the items to the applicable Drawings. The Inspection Reports identify cost and schedule data, but do not reference or identify that the Drawings were used to perform inspection and acceptance of the items.

The TEMA standards, as design input and guidance, were not adequately translated into the Design Specification and the Drawings as applicable specified design requirements. The Design Specification and other contract documents do not provide for, or demonstrate the performance of, a design analysis for adverse

CONCERN NO. IN-86-068-001

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**DETAILS, continued****VI. CONCLUSIONS, continued**

conditions such as vibration and pulsating conditions, and do not delineate adequate inspection and acceptance criteria. The Data Sheets, as part of the Installation and Maintenance Instructions, contain design data that is significantly different than shown on the Drawings.

During the re-tubing of the CCSHX in 1983/1984, the baffle/support plate/tie-rod system was subjected to indeterminate "jacking" stress/strain to attain alignment for installation. These activities affecting quality were not adequately prescribed and controlled, and were not verified/inspected and documented by QA personnel under the QA program. The use of such "jacking", as indicated in the Workplans and TVA Memorandum for the re-tubing activities, demonstrates inadequacy in the design and/or fabrication of items. This apparent inadequacy affords credibility to most, if not all, of the aspects of the Concern.

Additionally, the conditions identified in the ERT Investigation Report for related Concerns No. IN-86-068-002 and IN-86-210-001, particularly the condition of indeterminate wall thickness of the existing CCSHX Tubes, augment the significance of the conditions identified in this Interim Report. Both Reports must be considered jointly regarding the cumulative effects on the integrity of the CCSHX Tubes.

The Tubes for the CCSHX are the focal point of the Concern. The destructive effect that cumulative or singular conditions, as indicated above, would or could have on the integrity of strength and serviceability of the Tubes is the essence of the findings, evaluations and questions presented in this Interim Report.

CONCERN NO. IN-86-068-001

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DETAILS, continued

VII. SIGNIFICANCE:

The conditions reflected in this Interim Report are potentially significant conditions adverse to quality. The conditions, including evaluation of significance, determination of cause and affect, and remedial and preventative corrective action do not appear to have been adequately identified, documented, reported to appropriate levels of management, and addressed in a manner consistent with quality assurance program requirements for nuclear power plants. The conditions identified in this Report reflect nonconformance or deficiency in characteristic, documentation and/or procedure, which renders the quality of the affected Seismic Category I structures/systems/components unacceptable or indeterminate. This deficiency in design and/or construction if left uncorrected, could adversely affect the safety of operations of WBNP, and represents a significant breakdown in a portion of the quality assurance program under 10CFR50, Appendix B.

PREPARED BY: J. T. Nation 3-6-86  
DATE

REVIEWED BY: On Theo 3/6/86  
DATE



**QUALITY  
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COMPANY**

Sweetwater, TN 37874

(615)365-4414

ERT INVESTIGATION REPORT

PAGE 1 OF 2

CONCERN NO: XX-85-088-X04

**CONCERN:** Sequoyah - Welding certifications were altered by the use of correction fluid. Process markings such as file indexes and page counts, as well as any marks, notations or any data that did not look like engineering data on the back of the document, were deleted with correction fluid.

**INVESTIGATION  
PERFORMED BY:** William R. Pickering

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**DETAILS**

**PERSONNEL CONTACTED:** (Confidential)

**DOCUMENTS REVIEWED:**

Administrative Instruction #7, Revision 36, Records Charts and Quality Assurance Records"

41CFR101-11.506 - Code of Federal Regulations.

Welder Qualifications: Reels 25,274  
25,275  
25,276  
25,277  
25,278

**SUMMARY OF INVESTIGATION:**

This concern is substantiated. The investigation encompassed a review of welder qualification records photographed between December 1984 and March 1985.

**FINDINGS:**

Welder Performance Qualification Records were photographed for permanent record retention. The original "hard copies" were destroyed as allowed by 41CFR101-11.506. Records photographed within the stated dates did have information that was obliterated by the use of white out. Administrative Instruction #7 Section 4.0.F states "correction to QA records are permitted and shall be accomplished by drawing a single line through errors in the record...affixing the persons initials and date adjacent to each correction." Contrary to this requirement, corrections were made to the Welding Performance Qualification Record's photographed between December 1984 to March 1985 utilizing correction fluid (white-out).

CONCERN NO: XX-85-088-001

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DETAILS, continued

FINDINGS, continued

The items altered by use of correction fluid were unique identification numbers and the number of pages applicable to a document. These numbers are used solely for document retrievability and are assigned to each document photographed. Although the Welder Performance Qualification Record is a Quality Assurance record, the obliteration of the document identification numbers and associated page counts is not significant to the quality information applicable to the welders certification.

OBSERVATION:

Reviewing rolls 25,274 though 25,278 identified no obliteration of relevant information applicable to the welder's certifications.

CONCLUSION:

This concern is substantiated. Correction fluid was used to correct errors on the Welder Performance Qualification Records photographed from December 1984 to March 1985. These records are Quality Assurance Records and Sequoyah procedures forbid corrections by use of correction fluid.

PREPARED BY: William R. Ruten

2-4-86  
DATE

REVIEWED BY: O. B. Shew

3/1/86  
DATE

## REQUEST FOR REPORTABILITY EVALUATION

1. Request No. XX-85-088-X04 (ERT Concern No.) \_\_\_\_\_ (ID No., if reported)
2. Identification of Item Involved: Quality Assurance Records  
(Nomenclature, system, manuf., SN, Model, etc.)
3. Description of Problem (Attach related documents, photos, sketches, etc.)

Welding certifications were altered by use of correction fluid.

4. Reason for Reportability: (Use supplemental sheets if necessary)

- A. This design or construction deficiency, were it to have remained uncorrected, could have affected adversely the safety of operations of the nuclear power plant at any time throughout the expected lifetime of the plant.

No  Yes \_\_\_\_\_ If Yes, Explains: N/A

AND

- B. This deficiency represents a significant breakdown in any portion of the quality assurance program conducted in accordance with the requirements of Appendix B.

No \_\_\_\_\_ Yes  If Yes, Explains: The use of correction fluid on

Quality Assurance Records as a "common practice" to make corrections to

those records lends itself to potential falsification.

OR

- C. This deficiency represents a significant deficiency in final design as approved and released for construction such that the design does not conform to the criteria bases stated in the safety analysis report or construction permit.

No  Yes \_\_\_\_\_ If Yes, Explains: N/A

OR

REQUEST FOR REPORTABILITY EVALUATION

D. This deficiency represents a significant deficiency in construction of or significant damage to a structure, system or component which will require extensive evaluation, extensive redesign, or extensive repair to meet the criteria and bases stated in the safety analysis report or construction permit or to otherwise establish the adequacy of the structure, system, or component to perform its intended safety function. No  Yes  If Yes, Explain: N/A

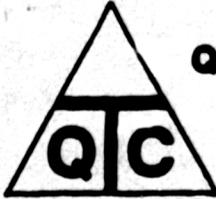
OR  
E. This deficiency represents a significant deviation from the performance specifications which will require extensive evaluation, extensive redesign, or extensive repair to establish the adequacy of the structure, system, or component to perform its intended safety function. No  Yes  If Yes, Explain: N/A

IF ITEM 4A, AND 4B OR 4C OR 4D OR 4E ARE MARKED "YES". IMMEDIATELY HAND-CARRY THIS REQUEST AND SUPPORTING DOCUMENTATION TO NSRS.

This Condition was Identified by: [Signature] 365-7134  
ERT Investigator Phone Ext.  
[Signature] 365-4464  
ERT Project Manager Phone Ext.

Acknowledgment of receipt by NSRS

Signed \_\_\_\_\_ Date \_\_\_\_\_ Time \_\_\_\_\_



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**P.O. BOX 600**

**Sweetwater, TN 37874**

**(615)365-4414**

**ERT INVESTIGATION REPORT**

**PAGE 1 OF 4**

**CONCERN NO: XX-85-023-X02**

**CONCERN: Sequoyah; Craft and inspection personnel falsified anchor pull-tests and applicable documents, (Mid-1977, Unit 2, Annulus).**

**INVESTIGATION**

**PERFORMED BY: T. Hough**

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**DETAILS**

**PERSONNEL CONTACTED: (CONFIDENTIAL)**

CONCERN NO: XX-85-023-X02

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**DETAILS, continued****DOCUMENTS REVIEWED:**

1. SNP Inspection Instruction - 93 (II-93) "Testing of Expansion Anchors Set in Hardened Concrete and Grouted Anchors"  
R-0 (2/22/77), R-1 (3/22/77), R-16 (8/1/84).
2. General Construction Spec. G-32 "Bolt Anchors Set in Hardened Concrete" R-0 (9/72), R-4 (4/21/76), R-5 (7/21/77), R-6 (2/17/81), and R-10 (4/1/85).
3. SNP 47A050 "General Notes" (Support Typical)
4. Craft Time Cards (1978)

**SUMMARY OF INVESTIGATION:**

This concern was not substantiated. Interviews were conducted with (27) individuals involved in the installation of concrete expansion anchors (CEA's) at Sequoyah during the time frame specified in the concern. No collaborating/objective evidence was found to allow substantiation of the concern. This investigation was conducted intermittently from 11/25/85 to 2/21,86.

**FINDINGS:**

The investigation of this concern was approached in two ways; review of applicable documentation and interview of personnel involved in CEA installation during 1977. As noted during the investigation of a related concern (XX-85-023-001), applicable documentation proved difficult to obtain. This is due to the fact that work plans were not utilized at SNP until 1981. This fact, when combined with the myriau of documented exceptions to anchor pull-testing (Ref: 47A050 notes and applicable procedures) and the unlikelihood of finding documentation proving falsification of pull-testing, dictated that the investigation effort be concentrated on the interviewing of personnel.

Personnel records and cost accounting records were reviewed to determine appropriate personnel to interview. A list was developed comprising personnel certified to conduct inspections of CEA's and

CONCERN NO. XX-85-023-X02

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**DETAILS, continued****FINDINGS, continued**

those persons involved in CEA installation. The list was narrowed by determining whom within the list are still employed locally (i.e., immediately available for interview). Interviews were conducted to verify involvement (during specified time-frames), determine compliance with procedural requirements, and ascertain knowledge of wrongdoing activities.

Results of the interview process are as follows:

- o Acquaintance with the individual alleged to have been involved in falsification activities could not be established, (even after prompting).
- o Knowledge of alleged wrongdoing activities was limited to WBNP and was denied in relation to Sequoyah. Several craft personnel and a few inspection personnel made reference to activities such as cutting off "Red-Head" CEA's, welding bolts to the backs of base-plates, etc., but only at WBNP, not at SNP. (Reference various other ERT concerns).
- o With few exception, inspection personnel interviewed expressed concern regarding the quantity of "47A050 Notes" generated and the ability of anyone to keep abreast of the "050 Notes" and subsequent changes. (Reference various other ERT concerns)

**CONCLUSIONS:**

This concern is not substantiated.

This conclusion is based on the following:

- o The "47A050 Notes" allowed numerous exceptions to pull-testing, i.e., there were few personnel knowledgeable about exactly when a pull-test absolutely had to be performed.

CONCERN NO. XX-85-023-X02

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DETAILS, continued

CONCLUSIONS, continued

- o No documentation could be obtained that would support occurrence of this wrongdoing activity (falsifying pull-test records)
- o No collaborating testimony was obtained from personnel involved in CEA installation in the Sequoyah Unit-2 Annulus during 1977.

PREPARED BY: \_\_\_\_\_

*[Handwritten Signature]*

3/7/86

DATE

REVIEWED BY: \_\_\_\_\_

*[Handwritten Signature]*

3/7/86

DATE

## REQUEST FOR REPORTABILITY EVALUATION

1. Request No. XX-85-023-X02 (ERT Concern No.) \_\_\_\_\_ (ID No., if reported)
2. Identification of Item Involved: CEA Pull Testing  
(Nomenclature, system, manuf., SN, Model, etc.)
3. Description of Problem (Attach related documents, photos, sketches, etc.)

Craft and Inspection Personnel Falsified Pull Testing Documentation

(Not Substantiated)

4. Reason for Reportability: (Use supplemental sheets if necessary)
- A. This design or construction deficiency, were it to have remained uncorrected, could have affected adversely the safety of operations of the nuclear power plant at any time throughout the expected lifetime of the plant.

No X Yes \_\_\_\_\_ If Yes, Explain: \_\_\_\_\_

- AND
- B. This deficiency represents a significant breakdown in any portion of the quality assurance program conducted in accordance with the requirements of Appendix B.

No X Yes \_\_\_\_\_ If Yes, Explain: \_\_\_\_\_

- OR
- C. This deficiency represents a significant deficiency in final design as approved and released for construction such that the design does not conform to the criteria bases stated in the safety analysis report or construction permit.

No X Yes \_\_\_\_\_ If Yes, Explain: \_\_\_\_\_

OR





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ERT INVESTIGATION REPORT

PAGE 1 OF 2

CONCERN NO. XX-85-088-003

CONCERN: "Knoxville: Sequoyah welding certifications were altered by the use of correction fluid before they were photographed in Knoxville. Process markings such as file indexes and page counts, as well as any marks, notations, or any data that did not look like engineering data on the back of the document, were deleted with correction fluid."

**INVESTIGATION**

PERFORMED BY: Wm. R. Pickering

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**DETAILS**

PERSONNEL CONTACTED: CONFIDENTIAL

**SUMMARY**

This concern is not substantiated. This investigation encompassed a review of activities applicable to microfilming of quality documentation in Knoxville and at the Sequoyah Nuclear Power Station.

**FINDINGS**

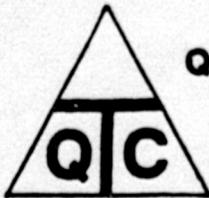
Documents are microfilmed in many locations within TVA. The microfilm has no special identifier to flag where a document may have been photographed, therefore, it is impossible to identify microfilm of welder performance qualification records prepared and microfilmed specifically in Knoxville. The Code of Federal Regulation 41CFR101-11.506 allows for the destruction of original documents once the document has been placed on microfilm. Therefore, it is impossible to obtain original welder certification documentation previously

INVESTIGATION REPORTS PREPARED BY QUALITY TECHNOLOGY  
COMPANY AND NOT REVIEWED BY THE EMPLOYEE CONCERN TASK GROUP (ECTG)

ADDRESSES CONCERN NUMBERS:

WI-85-081-007.  
IN-85-057-001.  
IN-85-089-001.  
XY-85-088-X05.  
WI-85-053-004.  
WI-85-041-009.  
IN-86-305-004.  
IN-85-725-011.  
EX-85-061-003.  
EX-85-039-001.  
WI-85-041-012.  
PA-85-001-005.  
IN-85-244-001.  
XY-85-027-009.  
IN-85-393-004.  
IN-85-393-X06.  
IN-85-260-001.  
IN-85-260-002.  
IN-85-260-X05.

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ERT INVESTIGATION REPORT

PAGE 1 OF 3

CONCERN NO.\*XX-85-088-002

CONCERN: The "standard accepted" method of making corrections to quality records by Knoxville personnel is by use of correction fluid. This method is in conflict with methods specified as allowable by the applicable Nuclear Plant procedures. CI feels that consistent procedural requirements should be applied to the correction of quality records.

INVESTIGATION

PERFORMED BY: William R. Pickering

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DETAILS

PERSONNEL CONTACTED: (CONFIDENTIAL)

DOCUMENTS REVIEWED:

Administrative Instruction No. 7, Revision 36 "Records, Charts and Quality Records" (AI-7)

41CFR101-11.506 - Code of Federal Regulations

EnDes Calculations

Document Preparation Instructions 6/1/83

MEDS Documents Submittal Training

SUMMARY OF INVESTIGATION:

This concern is substantiated. The investigation encompassed a review of methods observed as standard operating procedure in preparation and microfilm photography of Quality Assurance Records. The investigation was conducted at the Documentation Preparation and Microfilming Department in Knoxville.

ERT FILE: IN-85-293  
CONCERN: -002 & -004

ATTACHMENT 1 OF 2  
SHEET 2 OF 2

ERT REVIEW OF CONSTRUCTION QA AUDIT/SURVEILLANCE ACTIVITIES

DOCUMENT NO.	QUALITY ASSURANCE ACTIVITY	ACTIVITY NUMBER/ SUBJECT	AFFECTED PROC.	DATE COND/ REPORTED	ERT REVIEW RESULTS AND/ OR REMARKS
C03-850404-200	Surveillance	QESP 7.7 Step 7. 4.4	N/A	4-4-85	Monthly Summary for Marcy 1985
C03-850502-200	Surveillance	QESP 7.7 Step 7. 4.4	N/A	5-2-85	Monthly Summary for April 1985
C03-850605-200	Surveillance	QESP 7.7 Step 7. 4.4	N/A	6-5-85	Monthly Summary for May 1985
C03-850702-200	Surveillance	QESP 7.7 Step 7. 4.4	N/A	7-2-85	Monthly Summary for June 1985
C03-850806-200	Surveillance	QESP 7.7 Step 7. 4.4	N/A	8-6-85	Monthly Summary for July 1985
C03-850903-200	Surveillance	QESP 7.7 Step 7. 4.4	N/A	9-3-85	Monthly Summary for August 1985
C03-851002-200	Surveillance	QESP 7.7 Step 7. 4.4	N/A	10-2-85	Monthly Summary for September 1985
C03-851101-200	Surveillance	QESP 7.7 Step 7. 4.4	N/A	11-1-85	Monthly Summary for October 1985
C03-851210-200	Surveillance	QESP 7.7 Step 7. 4.4	N/A	12-10-85	Monthly Summary for November 1985-Deviation #WB-S-86-019-D01
C03-860107-200	Surveillance	QESP 7.7 Step 7. 4.4	N/A	1-7-86	Monthly Summary for December 1985

ERT FILE: IN-85-293  
CONCERN: -002 & -004

ATTACHMENT 2 OF 2  
SHEET 1 OF 3

ERT WALKDOWN INSPECTION

<u>CONDUIT SUPPORT ID#</u>	<u>BLDG. I.D.</u>	<u>SUPPORT LOCATION</u>	<u>SUPPORT DWG/INSP. CRITERIA</u>	<u>ERT WALK DOWN RESULTS</u>	<u>REMARKS</u>
0-CSP-292-2535/9Z	Aux	E1 747 S Line 3' E of AB	47A056-55-R2 QCP 3.09 R2 WR 22386	Sat.	1) Acceptable IAW SVS E56-55-398 R1 2) RAP not updated 3) NCR 6417 (Open) 4) See Findings 1&2
0-CSP-292-2295/3Z	Aux	E1 747 S Line 2' E of AB	47A056-55-R2 QCP 3.09 R2 WR 22386	Sat.	1) Acceptable IAW SVS E56-55-376 R1 2) RAP not updated 3) NCR 6417 (Open) 4) See Findings 1&2
2-CSP-293-7102	RxB	E1 720 AZ 10 R 31'	47A056-55-R2 QCP 3.09 R2	Sat.	1) Acceptable IAW SVS E56-55-888 R1 2) NCR 6339 3) RAP not updated 4) IRN SC-78 5) See Finding 3
2-CSP-293-7103	RxB	E1 720 AZ 10 R 25'	47A056-55-R2 QCP 3.09 R2	Sat.	1) Acceptable IAW SVS E56-55-889 R1 2) NCR 6339 3) RAP not updated 4) IRN SC-79 5) See Finding 3
2-CSP-293-7104	RxB	E1 720 AZ 10 R 24'	47A056-48-R4 QCP 3.09 R2	Unsat.	1) Installation meets support dwg 47A056-50 R2 2) SVS E56-48-107 R1 & inspection document incor- rectly refs. support det. dwg 47A056-48-R4 3) NCR 6339 4) RAP not updated 5) SVS E56-48-107 R1 Final Appro- val by DE not indicated 6) IRN SC-80 7) See Finding 3

CONCERN NO. IN-86-068-001

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**DETAILS, continued****V. EVALUATIONS AND QUESTIONS:**

The following is based on a comparison of the Findings (Section IV) to the Concern aspects (Section III.D) identified in this Interim Report:

**A. Regarding the Design aspects:****1. The "float" aspect (III.D.1.b):****Evaluation:**

The baffles/support plates are subject to "float", i.e., displacement or movement, as a system, and have been subjected to misalignment individually. As shown on the Drawings, none of the baffles/support plates are directly attached to the shell of the CCSHX, and the system is only attached to the front end tubesheet by the tie-rods. The design does permit cantilever type bending and/or rotation of the system, and may allow movement of the individual members of the system. The Design Specification does not indicate attachment to the shell, but does indicate a "welded", "connected" system. The TEMA standards state that the system must "retain all transverse baffles and tube support plates securely in position", but do not indicate attachment to the shell. The TEMA standards provide for maximum clearance between the baffles/support plates and the shell, and the Drawings reflect these clearances, which indicates that the baffles/support plates are not intended to be attached to the shell, but are to have limited mobility. This lack of attachment to the shell may be necessary to permit thermal expansion and contraction of the tie-rod/spacer system, if such occurs during operation of the CCSHX, and if the tie-rods/spacers are "welded to tube sheets and baffles" as stated in the Design Specification. However, this "welded" connection of the system is not reflected in the Drawings. Also, the Drawings or other documents do not distinguish the "baffles" from the "support plates".

Refer to Section V.A.2, below, for related evaluation and questions.

CONCERN NO. IN-86-068-001

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**DETAILS, continued****V. EVALUATIONS AND QUESTIONS, continued****A. 1. continued****Questions:**

- a. Which of the details ("A", "B" and "C") shown on the Drawings are "baffles" and which are "support plates"?
- b. Since attachment of the baffles and/or support plates to the shell would provide a more secure positioning, and since it was necessary to use temporary attachments during the re-tubing activities, why isn't this part of the design and installation?

**2. The "warpage" aspect (III.D.1.c):****Evaluation:**

The baffle/support plates were subjected to "warpage" or misalignment during the re-tubing activity, particularly for CCSHX "C", and this condition could occur to some extent during operation of the CCSHX. The TVA Workplans and Memorandum for the re-tubing of the CCSHX show that the baffles/support plates had to be jacked and temporarily supported into position in order to install the new tubing. These documents show that the tie-rod/spacer system does not "retain all transverse baffles and tube support plates securely in position", as stated in the TEMA standards.

The Design Specification indicates that the tie-rods and/or spacers are to be welded to the baffles and/or support plates. The Drawings do not show such attachment. The Drawings show a system of tie-rods and spacers that should provide alignment of the baffles/support plates, if the rods, holes and spacers were properly sized and the nuts at the rear end of the rods are kept tightened. However, this system does not appear to meet the specific provisions in the Design Specification, and did result in misalignment during the re-tubing activities as indicated above.