

UNITED STATES NUCLEAR REGULATORY COMMISSION REGION II 101 MARIETTA ST., N.W., SUITE 2100 ATLANTA, GEORGIA 37303 AUG - 6 1990

Report Nos. 50-327/80-24, 50-328/80-15, 50-390/80-10, 50-391/30-14, 50-438/30-13, 50-439/80-13, 50-518/80-11, 50-519/80-11, 50-520/80-11, 50-521/80-11, 50-553/80-11, 50-554/80-10, 50-566/80-10 and 50-567/80-10

Licensee: Tennessee Valley Authority 500A Chestnut Street Chattanooga, TN 37401

Facility Names: Sequoyab, Watts Bar, Bellefonte, Hartsville, Phipps Bend and Yellow Creek

Docket Nos. 50-327, 50-328, 50-390, 50-391, 50-438, 50-439, 50-518, 50-519, 50-520, 50-521, 50-553, 50-554, 50-566 and 50-567

License Nos. DPR-77, CPPR-73, CPPR-91, CPPR-92, CPPR-122, CPPR-123, CPPR-150, CPPR-151, CPPR-152, CPPR-153, CPPR-162, CPPR-163, CPPR-172 and CPPR-173

Inspertion at Office of Engineering Design and Construction, Knozville, TN

Inspectors: MailtDistutt Date Signed Brownlee 8-6-30 Date Signed 8-4-80 Date Signed 8-6-80 Date Signed 08-06-80 Date Signed

Accompanying Personnel: T. E. Coulon D. G. Anderson, Principal Inspector, Program Evaluation Section, VIB

on, Section Chief, RC&ES Branch

8-6-90 Date Signed

SUMMARY

### Areas Inspected

This special, announced inspection involved 173 inspector-hours on site in the areas of design control, Part 21 and audits.

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### Results

Of the three areas inspected, no items of noncompliance or deviations were identified in one area; eight items of noncompliance were found in two areas (Infraction - Failure to properly identify and handle audit deficiencies, Paragraph 6.b.(4); Infraction - Audit frequencies incorrectly specified, Paragraph 6.b.(5); Deficiency - Failure to reference source information, Paragraph 6.a.(1)(d)1; Infraction - Inadequate civil drawing review, Paragraph 6.a.(2)(c); Deficiency - Improper storage of civil QA records, Paragraph 6.a.(2)(c); Infraction - Failure to implement QA program in the Georegic Services Group, Paragraph 6.a.(3)(c); D ficiency - Failure to identify safety-related drawing, Paragraph 6.a.(3)(c); Infraction - Contract service audits not performed, Paragraph 6.b.(6).

### DETAILS

### 1. Persons Contacted

### Licensee Employees

- G. H. Kimmons, Manager, Office of Engineering Dealer & Construction (OEDC)
- \*J. P. Knight, QA Manager, OEDC
- \*M. N. Sprouse, Manager, Engineering Design (EN DES)
- \*S. Duhan, Supervisor Quality Compliance, OEDC-QA
- \*R. M. Pierce, Asst. Manager, EN DES
- J. L. Farris, Branch Chief, Quality Eugineering Branch (QEB/EN DES)
- \*P. L. Duncan, Supervisor QA Section, QEB/EN DES
- \*J. F. Cox, Senior Nuclear Engineer-Licensing
- \*F. A. Stone, Civil Design Project Engineer, Hartsville, Phipps Bend
- \*R. D. Guthrie, Licensing Engineer, Civil Engineering Branch, (CEB)
- R. W. Allen, Supervisor, Geologic Services Group
- B. Cantrell, Mechanical Design Project Manager

Other licensee employees contacted included 15 OA personnel and 17 Engineers.

\*Attended exit interview

2. Exit Interview

The inspection scope and findings were summarized on July 11, 1980 with those persons indicated in Paragraph 1 above.

3. Licensee Action on Previous Inspection Findings

Not inspected.

4. Unresolved Items

Unresolved items are matters about which more information is required to determine whether they are acceptable or may involve noncompliance or deviations. New unresolved items identified during this inspection are discussed in paragraph 6.a.(1)(d)3 and 6.b.(7).

- 5. Independent Inspection offort
  - a. Singleton Materials Engineering Laboratory

The inspector performed a walk-thru inspection of the Singleton Materials Engineering Laboratory. The inspector examined the currentness of calibration of the laboratory equipment, and discussed the laboratory's QA program and materials testing procedures with the laboratory director and laboratory personnel.

No deviations or items of noncompliance were identified.

The identified inspector follow-up items are closed. TVA has revised EN-DES-EP 2.02 and evaluation worksheets to clearly; describe how the OEDC responsible officer is notified of reportable Part 21 matters; define the written report contents to include that information required by 10 CFR 21.21(b)(3); infor 1 the vendor supplying the component or portion of the facility for consideration of reporting generic implications.

- 6. Overall Review and Inspection of Engineering Design QA Program Implementation
  - a. Design Control
    - (1) Mechanical Engir vering Design Review
      - (a) Documents Examiner

TVA EN 2"S-EP 4.02 "Engineering Change Notices"

TVA EN DES-LP 4.63 "Field Change Requests

TVA EN DES-EP 4.04 "Handling of Squad Checks"

TVA EN DES-EP 4.25 "Design Review and Interface Coordination of Detailed Construction and Procurement Drawings"

TVA EN DES-EP 3.03 "Design Calculations"

Concrete Anchorages Civil Engineering Standard DS-C6.1

Alternate Criteria for Piping Analysis and Support CEB-76-11

Te dyne - Technical Report TR-2160-11

Westinghouse specification for Watts Bar, "Material Specification Pipe and Fittings, ASME III"

Typical support type TVA standard 3GB0053-00-series

Teledyne - Technical Report - Operating Modes Evaluation Decay Heat Removal and Core Flood Systems CEB-78-33

Bellefonte's BLP-EP 44.76, Nev. 1, Component Supports -Analyses, Design, Procurement, Fabrication and Installation

Dynamic Earthquake Analysis of the Interior Concrete Structure and Response Spectra for Actuched Equipment - (Bellefonte)

### (b) QA Program

TVA's QA program as described for each plant by its FSAR or PSAR (Section 17.1A) specifies the QA commitments for design control; procurement; document control; instruction, procedures, and drawings; control of purchased material, equipment and services. Various engineering procedures as listed above provide instructions to satisfy the above commitments by the Mechanical Engineering Branch (MEB). MEB has provided organizational charts for each plant inspected to assure control of activities and that commitments are being met.

(c) Implementation

The MEB is the lead branch in the Office of Engineering Design and Construction for activities related to development of the preliminary design for preparation and review of the PSAR. MEB is divided into separate piping system design groups. Discussions were held with various sections dealing in safety-related systems. These sections are responsible for the systems design and for the alternate criteria analysis required for stress analysis. Also, discussions were held with the Civil Engineering Branch (CEB) who has the responsibility for the rigerous computer stress analysis for all the safety-related systems. The following documents in both MEB and CEB were reviewed by the inspector for compliance with the commitments and procedures as Listed above.

1 Bellefonte Units 1 and 2

Design Criteria for "Decay Heat Removal System", Design Criteria No. N4-ND-D740, Rev. 0

Mechanical Decay Heat Removal System, Drawing No. SRW0/13-ND-03, Rev. 4

Design Criteria Diagram Decay Heat Removal System, Drawing No. 3BW0612-ND-01, Rev. 3

(Procurement Request Form) PRM-238 (Engineering Change Notice) ECN-342 ECN-599 ECN-202

B&W Document No. 15-4036000001, Rev. 5, Systems Discription for Decay Heat Removal System, Drawing No. 31124

Correspondence letters between TVA and B&W: TVA letter No. K-4083 B&W letter No. P-883 B&W letter No. K-5308

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National Valve and Manufacturing Co. (NAVCO) Drawing Nos. A8453; A8452

(Field Change Request) FCR-M630 FCR-M1773 FCR-M1267

Decay Heat Removal System - "Pipe Wall Calculations I.D." No. 3-MI-RRH-020175, Rev. 2

Piping Bill of Material Drawing Nos. 3RW0413-ND-Series 3RW0412-ND-Series

Design Criteria for "Design of Safety-Related Piping Supports and Supplemental Steel", Design Criteria No. N4-50-D717, Rev. 1

Alternate Criteria for Piping Analysis and Support Report No. PAD-76-116, Rev. 2 of Addendum 2

D sign Criteria Diagram Makeup and Purification System, Drawing No. 3BW0619-NV-04, Rev. 1

Mechanical Makeup and Purification System, Drawing No. 3BW0419-NJ-02, Rev. 4

EN DES Calculation Nos.: BLN-NV-D054-23, Rev. 0 3-M2-SCL-032780, Rev. 0

Design Calculations for 2-inch Diameter and Under Piping, Calculation No. 4BOX2-1

Alternate Criteria Problem No. BLN-SA-D054-3.1, Rev. 1

Hanger Selection and Load Summary Decay Heat Removal Piping for Reactor Coolant System Model N4-IND-E (NA-2ND-E)

DHR From Letdown to DHR Pump P1A thru Pentr. X70, Drawing No. 1RW04B-ND-E1, Rev. 1

RCS Displacements and Seismic Response Spectra, B&W Calculations No. 86-1100397-02

2 Watts Bar Units 1 and 2

Westinghouse Flow Diagram No. 113E791, Rev. 7 for kHRH, TVA Flow Diagram No. 47W810-1, Rev. 10 for RHRH

Mechanical Residual Heat Removal System Piping Drawing No. 47W432-1, Rev. 10 TVA FCR No. 1430 TVA FCR No. M-967

Design Criteria for "Analysis of Category I and I(L) Piping Systems", Design Criteria No. WB-DC-40-31.7, Nev. 3

RHR - Stress Problem N3-63-7A

Isometric - SIS, RHR and ACTS Piping for Static, Thermal, and Dynamic Analysis and Support Locations Stress Isometric Drawing No. 47W435-206, Rev. 3, System No. N3-63-7A

Seismic Analysis of the Auxiliary Control Building, dated 6/19/74

Reactor Building Dynamic Earthquake and Static Wind-Tornado Analysis of the Shield Building dated 3/10/75

3 Sequeryah Units 1 and 2

Mechanical Component Cooling System, Drawing No. 47W464-2, Rev. 18, Detail Support Drawing 47A464-2-148

Piping Analysis Spectra Data, CEB-HE1-79-24

2-Inch Diameter Pipe and less, Seismic Class 1 Support Calculations, 47A053 - 802 thru 850

TVA ECN No. 2419 TVA ECN No. 2192 TVA NCR CEB-79-19-R1

SNP "A" Size Print: 47A053-801-Series

Use of WBNP Alternate Criteria for Piping Analysis and Supports, Memo dated 9/7/76

### (d) Conclusions

The inspector concluded, with the exceptions listed below, that within the areas inspected, MEB and CEB have met the commitments of the FSAK and/or PSAR sections mentioned above and it appeared that the engineering staff has an effective organization.

1 Deficiency - Failure to Reference Source of Information

Calculations for Bellefonte typical supports used in the alternate criteria analysis for seismic supports did not reference the Grawings of the typical used in the supporting of the pipe. Sequoyah's typical supports used in the alternate criteria analysis did not reference the design parameters used in the calculations. These two examples do not meet the requirements of EN DES-EP 3.03 and would be identified as a Deficiency - Failure to reference source of information, 327/80-24-01; 328/80-15-01; 438/80-13-01; 439/80-13-01.

2 Inspector Follow-up Item - Program for Seismic Analysis of Small Bore Pipe

Discussions held with MEB on alternate criteria analysis for small bore piping revealed that no program was established that would identify that all small bore piping had been analyzed to the latest revision of the drawing for Bellefonte. The inspector concluded that the Sequoyah and Watts Bar projects have an informal program to provide assurance that the small bore piping has been analyzed. TVA design personnel committed to provide a method whereby it can assure that small bore pipe analyses will be complete for subsequent plants. This item is identified as an Inspector Follow-up Item; 438/80-13-02; 439/80-13-02; 519/80-11-03; 520/80-11-03; 521/80-11-03; 553/80-11-03; 554/80-10-03; 566/80-10-03; 567/80-10-03.

- 3 The following items for SQN-WBN plants have been identified as having potential safety concerns and are identified as Unresolved Items.
  - Essential sensing lines or conduits that were field routed were never evaluated for impact of internally generated missiles.
  - b No detail analysis and evaluations of internally generated missiles on essential equipment or containment has been conducted.
  - <u>c</u> Pipe rupture loads (longitudinal ruptures) have not been considered for the main steam and feedwater guard pipes.
  - d Breaks in the MS and FW lines have not been considered for the DBA analysis.
  - E DBA analysis of piping may not have considered the effect of internally generated missiles on containment.

- f Seismic qualifications of flex conduit and flex hoses were never validated. Report CEB-MET-77-12 never reached the field/construction (Ref. SND Spec. G-40). Some conduits are not designed for thermal movements.
- g CEB had asked SNP to provide identification of process pipe to simplify or to properly conduct field evaluations. SNP has refused to identify the process pipes with proper tags. Without proper identification it appears that the field evaluation can not be performed effectively.
- <u>h</u> During field evaluation interactions of sensing lines and conduits in local areas of essential equipment has to be checked. It is impossible for field evaluation teams to trace sensing lines and conduits after they leave a particular area. The field evaluation team relies heavily on the field construction personnel to route the lines as per separation criteria.
- i EDS performance as an AE for documentation preparation and document control has not been evaluated for effectiveness.

The above listed items are identified as Unresolved items 327/80-24-05; 328/80-15-05; 390/80-20-03; 391/80-14-03

## (2) Civil Engineering Design Review

(a) Documents Examined

EN DES EP 1.01, "Preparation and Processing of Division Level Engineering Procedures"

EN DES EP 1.02, "Preparation and Processing of Branch and Design Project - Level EPs

EN DES EP 1.14, "Engineering Records - Retention and Storage"

EN DES EP 1.16, "Quality Assurance Proficiency Improvement"

EN DES EP 1.26, "Nonconformances - Reporting and Handling by EN DES"

EN DES EP 1.28, "Control of Documents Affecting Quality"

EN DES EP 3.01, "Design Criteria Documents - Preparation, Review, and Approval" EN DES EP 3.02, "Seismic Design, Review, and Control"

EN DES EP 3.03, "Design Calculations"

EN DES EP 3.04, "EN DES Construction Specifications - Preparation, Review, and Approval"

EN DES EP 3.08, "Soil and Rock Investigations

EN DES EP 3.10, "Design Verification Methods and Performance of Design Verifications"

EN DES EP 3.14, "Production, Placing, and Quality Control of Concrete"

EN DES EP 3.23, "EN DES Computer Programs Requiring Quality Assurance, Verification, Documentation, and Revision"

EN DES EP 3.29, "Fill Quality Control Reports - Review by EN DES"

EN DES EP 4.02, "Engineering Change Notices - Handling"

EN DES EP 4.03, "Field Change Requests

EN DES EP 4.04, "Handling of Squadchecks"

EN DES EP 4.12, "EN DES Design Guides and Design Standards -Preparation, Review, Approval, Distribution, and Revision"

EN DES EP 4.18, "Design Change Requests (DCRs) - Processing, Reviewing, and Approving"

EN DES EP 4.25, "Design Review and Interface Coordination of Detailed Construction and Procurement Drawings"

ID QAP 3.1, "OEDC Site Investigation for Design Purpose"

(b) QA Program

The quality assurance program for all phases of design, construction, and operation of TvA's nuclear power plants is described in the Sequoyah and Watts Bar FSARs, in the Bellefonte, Hartsville, and Phipps Bend PSARs, and in TVA Topical Report TR75-1A. Sections 17.1A.3 and 17.1A.5 of the FSARs, PSARs, and Topical Report specify the QA requirements for design control and instructions, procedures, and drawings. The Bellefonte, Hartsville and Phipps Bend PSARs and the Topical Report commit to the requirements of NRC Regulatory Guide 1.64 and ANSI Standard N45.2.11-1974. The procedures listed in Paragraph 6.a.(2)(a) above, are the controlling procedures and documents for control of civil engineering design activities in accordance with the requirements of NRC, industry standards, and TVA QA commitments.

(c) Implementation

The inspector reviewed various civil design documents and held discussions with responsible engineers in the Civil Engineering Branch, in the Civil Engineering and Design Branch, in the Yellow Creek Design Project Group and in the Hartsville-Phipps Bend Design Project Group of the TVA Engineering Design Division to verify that civil design activities were being accomplished in accordance with the procedures listed above. Documents examined were as follows:

Hartsville Design Criteria N6-K2-D701, "Essential Service Water Pumping Station"

Hartsville General Design Criteria N6-50-D702

Hartsville Calculation Number HPP 790802507, "Essential Service Water Pumping Station"

Hartsville Drawing Numbers 4KE1406-K6-01 through 4KE1406-K6-07 and 4KE1407-K6-01 through 4KE1407-K6-13. These drawings show the essential service water pumping station concrete and reinforcement details.

Hartsville Calculation Number HPP790727516, "Diesel Generator 7-Day Fuel oil Tank Encasements"

Hartsville Drawing Numbers 4YE5422-Y7-01 through 4YE5422-Y7-07. These drawings show the diesel generator 7-day fuel oil tank encasement concrete and reinforcement details.

Hartsville and Phipps Bend ESW spray pond slope stability calculations

Hartsville Drawing Number 8YE0251-Y1-01, "General Grading Plan" and Drawing Number 8YE0252-Y1-01, "Spray Pond Grading and Details"

Phipps Bend Specification Number N7C-876, "Earth and Rock Foundation and Fills"

Yellow Creek - "General Design Criteria for Design of Civil Structures", Number N8-50-D702

Yellow Creek - Detailed Design Criteria for Reactor Building Structures", Number N8-9R-D701 Yellow Creek - "General Design Criteria for Dynamic Earthquake Analysis of Category 1 Structures and Earth Embankments", Number N8-50-D709

Yellow Creek - "Design Criteria for Application of Earthquake Forces for Design of Category I Structures", Number N8-50-710

Yellow Creek Calculation Number YCP-80-519-214, "Reactor Cavity Elevation 466.0 Slab"

Yellow Creek Calculation Number YCP-80-0519-215, "Reactor Cavity Brackets at Elevation 487.27"

Yellow Creek Calculation Number YCP-80-0519-216, "Reactor Cavity Elevation 470.55 to 497"

Yellow Creek Drawing Numbers 4REO 447-R3-1 through 4REO447-R3-6 and 4REO448-R3-1 through 4REO448-R3-10. These drawings show the concrete and reinforcement details for the reacor cavity.

Yellow Creek Calculation Number YCP-79-1217-204, "Reactor Building Enclosure Structural Concrete Design"

Yellow Creek Drawing Numbers 4RE0438-R7-1, 4RE0438-R7-2, and 4RE0439-R7-1 through 4RE0439-R7-4. These drawings show the concrete nd reinforcement details for the reactor building enclosure structure.

Yellow Creek Drawing Number IRE-0356-R6-01, "Containment Vessel Dish - Floating Procedure", and Drawing Number IRE-0356-R6-02, "Containment Vessel Dish - Grouting Procedure"

Yellow Creek Specification Number N8C-894, "Reactor Building Containment Vessel Dish Floating and Grouting"

Review of the above documents and discussions with responsible engineers disclosed the following noncompliances for failure to follow Engineering Design (EN DES) QA procedures.

EN DES Procedure Numbers 4.04 and 4.25 require that design drawings be checked to verify that all pertinent design information is included on the drawings. The design criteria for missile shielding for the Hartsville-Phipps Bend diesel generator 7-day fuel oil tank encasements require the concrete to have a minimum compressive strength of 4600 psi. This requirement was not noted on the design drawings (Hartsville Drawing Numbers 4YE5422-Y7-01 and Phipps Bend Drawing Number 4Y0422-Y7-01). This omission was not detected by the checker of the drawings and appears to be a result of inadequate review of the drawing by the checker. This was identified to the licensee as Infraction items 518, 519, 520, 521/ 80-11-04, 553/80-11-04 and 554/80-10-04, "Inadequate Civil Drawing Review".

EN DES Procedure Number EP 1.14 requires complete calculations to be microfilmed in order to meet the records storage requirements of ANSI N45.2.9 for quality records. The completed calculations for the stability analysis of the Hartsville and Phipps Bend ESW spray pond slopes have not been microfilmed. These records were stored on open shelves not meeting the requirements of the procedure or ANSI N45.2.9. This was identified to the licensee as Deficiency item 518, 519, 520, 521/80-11-05, 553/80-11-05, and 554/ 80-10-05, "Improper Storage of Civil Quality Records."

EN DES Procedure Number EP 1.02 requires Branch Engineering Procedures (EP) to be prepared to provide written instruction for QA related activities which are unique to that EN DES branch. EN DES Procedures EP 1.14, 1.16, 1.28, 3.03, 3.08, 4.04 and 4.25 provide, in part, measures for control of QA related activities in EN DES. Discussions with supervisory personnel in the Geologic Service Group in the EN DES Civil Engineering and Design Branch disclosed that no branch EPs had been prepared as required by EP 1.02 and that the Group had not implemented EN DES Procedures EP 1.14, 1.16, 1.26, 1.28, 3.03, 3.08, 4.04 and 4.25 in performance of safetyrelated activities within the Group. The Group supervisory personnel were not knowledgeable of TVA and NRC QA requirements. This was identified to the licensee as Infraction items 327/ 80-24-02, 328/80-15-02, 390/80-20-01, 391/80-14-01, 439/ 80-13-03, 518, 519, 520, 521/80-11-06, 553/80-11-06, 554/80-10-06 and 566, 567/80-10-04, "Failure to Implement QA Program in the Geologic Services Group".

### (d) Conclusions

The inspector concluded that Civil Design Engineering Procedures with the exception of those items identified in Paragraph (c) above meet the requirements of NRC, industry standards, and commitments in the Sequoyah and Watts Bar FSARs, in the Bellefonte, Hartsville, and Phipps Bend PSARs, and TVA Topical Report TR-75-1A. The procedures are an effective method of controlling civil design activities. However, the inspector expressed concern to Engineering Design management regarding the failure of the Geologic Service Group to implement the TVA QA program and the fact that the Geologic Services Group supervisory personnel were not knowledgeable of TVA and NRC QA requirements.

No deviations were identified.

# (3) Electrical Engineering Design Review

(a) Documents Examined

EN DES Engineering Procedures

EP 1.26, R2	Nonconformances-Reporting and Handling by EN DES
EP 1.28, R2	Control of Documents Affecting Quality
EP 3.01, R3	Design Criteria Documents-Preparation, Review and Approval
EP 3.02, R2	Seismic Design, Review and Control
EP 3.03, R4	Design Calculations
EP 3.04, R7	EN DES Construction Specifications - Preparation, Review, and Approval
EP 3.10, R4	Design Verification Methods and Performance of Design Verifications
EP 3.11, R1	Auxiliary Power System Studies - Responsi- bility and Preparation
EP 3.12, R1	Cable Trays - Design and Requisition Responsibilities
EP 3.21, RO	Auxiliary Power Load Information System - Development, Maintenance, and Use
EP 4.01, k4	Signatures/Initials for Preparation, Review, and Approval of EN DES Drawings
EP 4.02, R9	Engineering Change Notices - Hundling
EP 4.03, R3	Field Change Requests
EP 4.04, R5	Handling of Squadchecks
EP 4.11, R1	Combined - Design Drawings and Project Standard Drawings - Preparation and Use
EP 4.12, R4	EN DES Design Guides and Design Staudards - Preparation, Review, Approval, Distribution, and Revision
EP 4.14, R2	EN DES Typical Drawings and Standard Drawings - Preparation, Review, Approval, Distribution, and Revision

EP 4.15, R1	Project Layout Drawings
EF 4.18, RO	Design Change Requests (DCRs) - Processing, Reviewing, and Approving
EP 4.25, R2	Design Review and Interface Coordination of Detailed Construction and Procurement Drawings
EP 4.28, R2	Design and Layout Using a Physical Scale Model
EP 5.01, R9	Purchase Requisitions - Evaluation of Bids and Recommendation/Rejection of Contract Award - Revisions to Contracts
EP 5.02, R1	Distribution of EN DES Procurement Drawings
EP 5.11, R7	Vendor Documents - Handling and Disposition
EP 5.17, R1	Electrical Bills of Material and Master Bills of Material - Procedure for Drafting and Handling
EP 5.26, R4	Quality Requirements for Design Documents Furnished by Vendors
EP 5.30, R2	Standard Format for the Preparation of Procurement Specifications
EP 5.33, R2	Procurement Quality Assurance
Standard Spec	ification
SS-E14.1.01	EN DES Standard Specification for 600v thru 15kv Enclosed Honsegregated Phase

Bus System (All Projects) Design Guide

DG-E2.4.1, RO Auxiliary Power System Performance Criteria and Application Procedures

# (b) QA Program

With the exception of Yellow Creek Nuclear Plant (YCNP), the quality assurance program for all phases of design, construction, and operation of TVA's nuclear power plants is described in Chapter 17 of each plant's SAR. TVA's quality assurance

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program for YCNP is described in Topical Report TVA-TR-75-1A, "Quality Assurance Program Description for Design, Construction, and Operation of TVA Nuclear Plants". Quality assurance program description provided for Bellefonte, Hartsville, Phipps Bend and Yellow Creek Nuclear Plants require conformance to Regulatory Guide (RG) 1.64, R2, "Quality Assurance Requirements for the Design of Nuclear Power Flants" and RG 1.123, RI, "Quality Assurance Requirements for Control of Procurement of Items and Services for Nuclear Power Plants". RG 1.64 endorses the requirements of ANSI N45.2.11-1974 as modified by the RG 1.64, Section C regulatory position. RG 1.123 endorses the requirements of ANSI N45.2.12-1976 as modified by the RG 1.123, Section C regulatory position. The procedures . listed in 6.a. (3)(a) above were reviewed for creationce with the SAR and Topical Report TVA-TR-75-1A requirements for electrical engineering design and procurement activities.

### (c) Implementation

Selected design output documents for the Yellow Creek and Sequoyah Nuclear Plants were reviewed to assure compliance with the procedures and commitments identified in Paragraphs 6.a.(3)(a) and 6.a.(3)(b). The inspector discussed the preparation, verification and control of the selected documents with responsible personnel in the licensee's Electrical-Engineering Branch (EEB) Systems Engineering Layout Group, the EEB Equipment Requisition Group, and the Project Electrical Design Group. The EEB Systems Engineering Layout Group is responsible for the conceptual system design (includes establishment of design criteria and performance of initial layout and design) and design review (includes system studies, in-progress and final design reviews, relay coordination study and penetration protection, and review of protective relay settings). The EEB Equipment Requisition Group is responsible for equipment requisition (includes preparation of procurement specifications and requisitions). The Project Electrical Design Group is responsible for detailed design to plant requirements, design criteria and TVA standard practice. The design documents selected for review are listed below.

- 1 YNCP Design Criteria No. N8-RPD775, R1, "General Design Criteria for Class 1E AC Auxiliary Power System"
- 2 YCNP Design Criteria No. N8-50-D787, RO, "Design Criteria for Power, Control, and Signal Cables for Use in Category I Structures"
- 3 YCNP Design Criteria No. N8-50-D741, RO, "Design Criteria for Physical Separation"

- 4 YCNP EN DES Calculation No. 2GDS185RP, RO, "Medium Voltage Auxiliary Power System Study"
- 5 YCNP EN DES Calculation No. 2GDS186RP, RO, "Low Voltage Distribution System Study"
- 6 EN DES Calculation No. EN2-DS195RP, RO, "Plant Grid Interface Study" (Sequoyah)
- 7 EN DES Standard Specification No. SS-E14.1.01, "EN DES Standard Specification for 600v thru 15kv Enclosed Nonsegrated Phase Bus System (All Projects)"
- 8 Specification No. 3830, "Medium Voltage Metal-Clad Switchgear for Yellow Creek Nuclear Plant"
- Specification No. 4196, "480 Volt Switchgear and Transformers for Yellow Creek Nuclear Plant"
- 10 Specification No. 4179, "480 Volt Motor Control Centers for Yellow Creek Nuclear Plant"
- 11 General Construction Specification No. G-40, R2, "Installing Electrical Conduit Systems and Conduit Boxes"
- 12 YNCP Dwg. No. CCR0200-00-08, R2, "Control Building and Steam Valve Vault, Units 1 and 2, General Arrangement and Civil Features Plan"
- 13 YNCP Dwg. No. 9GE0200-X0-01, R0, "Switchyard, Electrical General Arrangement Plan"
- 14 YNCP Dwg. No. 5YE0802-RU-27, R1, "Electrical Features General Arrangement, Tunnels and Conduit Banks"
- 15 YNCP Dwg. No. 5YE0802-RU-03, R2, "Electrical Features General Arrangement, Tunnels and Conduit Banks"
- 16 YNCP Dwg. No. 5YE0802-RU-04. RO, "Electrical Features General Arrangement, Tunnels and Conduit Banks"
- 17 YNCP Dwg. No. 2TE0292-EA-01, R2, "Turbine Building and XFMR Yard, Units 1 and 2 Electrical Equipment, 6.9 and 13.8kv Station Service Buses, Schematic Diagram and Details"
- 18 YNCP Dwg. Nos. 5TE0860-RV-01 thru 07, R0, "Turbine Building, Units 1 and 2 Cable Trays, El. 520.5, Plan and Details"

- 19 YNCP Dwg. No. 5CE0761-EG-01, R1, "Control Building, Units 1 and 2 Single Line Diagram, 6900v Switchgear 1EG-EMVS-061-A"
- 20 YNCP Dwg. No. 5CE0772-EG-01, R1, "Control Building, Units 1 and 2 Single Line Diagram, 6900v Switchgear 1EG-EMVS-072-B"
- 21 Electrical Standard Drawing No. SD-E6.2.7-3, RO "Medium Voltage Switchgear, Normal Supply Breaker Schematic"
- 22 Electrical Standard Drawing No. SD-E-6.2.7-11, R0, "Medium Voltage Switchgear, Bus Auxiliary Relays Schematic"
- 23 Electrical Standard Drawing No. SD-E6.2.7-12, R0, "Medium Voltage Switchgear, Bus Undervoltage Schematic"
- 24 Electrical Standard Drawing No. SD-E6.2.7-15, RO, "Medium Voltage Switchgear, Low Voltage XFMR Feeder Schematic"
- 25 YCNP Dwg. No. 5CE0789-EI-01, R1, "Control Building, Units 1 and 2 Single Line Diagram, 480v Switchgear IEI-ELVS-089-A"
- 26 YCNP Dwg. No. 5CE0790-EI-01, R1, "Control Building, Units 1 and 2 Single Line Diagram, 480v Switchgear 1EI-ELVS-090-B"
- 27 YCNP Dwg. No. 2GE0720-RP-01, R4, "General, Plant A-C Auxiliary Power System Single Line - Units 1 and 2"
- 28 YCNP Dwg. No. 5AE1771-EI-01, R1, "Reactor Building -Auxiliary Arez Units 1 and 2, Single Line Diagram, 480v MCC 1EI-EMCC-0071-A and 2EI-EMCC-0071-A"
- 29 YCNP Dwg. Nos. 5RE0860-RV-01 and 02, RO, "Reactor Building -Auxiliary Area Units 1 and 2, Cable Trays, Elevation 445.0, AZ 0° - 180° Plan"
- 30 YCNP Dwg. Nos. 5RE0860-RV-03 and 04, R0, "Reactor Building - Auxiliary Area Units 1 and 2, Cable Trays, Elevation 458.0, AZ 0° - 180° Plan"
- 31 YCNP Dwg. Nos. 4RE0731-2R-1(R2), 2(R1), 3(R1), 4(R2), "Reactor Building - Auxiliary Structure Units 1 and 2, Cable Tray and HVAC Duct Supports, Elevation 445.0 to 458.0"

32 YCNP Dwg. No. 5RM0804-RU, RC, "Reactor Building -Auxiliary Area Units 1 and 2, Conduit and Grounding, Elevation 458.0, Electrical Bill of Material"

TVA EN DES Procedure EP 4.25, R3, requires that the originating organization of a drawing designate with the letter "Q" that some element of the depicted design must conform with 10 CFR 50, Appendix B, or other documented regulatory requirements. For Bellefonte and later nuclear plants, Procedure EP 4.25 requires that the "Q" designation be placed in the drawing title block. YCNP Drawing SRM0804-RU, R0, is the electrical bill of material applicable to Class IE embedded conduit installations in the reactor building auxiliary area (Class I structure). Drawing SRM0804-RU was issued without the required "Q" indication in the title block. This failure to follow Procedure EP 4.25 was identified to the licensee as deficiency 566/80-10-05 and 567/80-10-05, "Failure to identify safety-related drawing".

The licensee's final design review study number EN2-DS190RP for the Sequoyah Nuclear Plant's AC auxiliary power distribution system identified the following operating restrictions and potential problems which could result from voltage variations on the 161kv offsite supply.

- Underschage conditions for the Common Station Service Transformers.
- 2 Potential fault currents on the 6.9kv switchgear that would exceed breaker ratings. Main generator voltage aust be limited to 24.4kv when connected to the 6.9kv switchboards.
- Overload conditions on 480kv switchgear equipment requiring further evaluation for operating restrictions or design changes to eliminate. Prior to completion of the evaluation, on-site monitoring of switchboard loadings during actual operation is required.
- 4 Undervoltage conditions requiring tap settings of minus 5% for safety-related 480v transformers and field setting of other 480v transformers to ensure adequate voltage on 480v safety-related switchgear (nominal tap settings are not adequate to prevent motor operations outside steady-state voltage ratings).
- 5 The additional evaluation of the 480v switchgear will also determine if operating restrictions or design changes are required to limit fault currents to less than the breaker ratings.

TVA memorandum serial number 800116D0055 from EN DES to Power Engineering specified the following transformer tap settings.

- 1 CSST A&B: Minus 2.5% voltage tap setting to ensure adequate offsite power supply to the safety-related power systems for all expected 161kv grid conditions.
- 2 6900-480v transformers supplying 480v shutdown boards: Minus 5% voltage tap setting to pervent safety-related motors from being operated outside their steady-state voltage ratings.
- 3 6900-480v transformers supplying 480v unit boards: Minus 5% voltage tap setting.

TVA memorandum serial number 800123F0413 from EN DES to Power Engineering specified the following operating restrictions.

- 1 To prevent 6.9kv unit board circuit breakers from being subjected to fault currents greater than rated capability, Unit Station Service Transformers (USST) 1A, 1B, 2A and 2B must not exceed 7.1kv when connected to the unit board buses. (This corresponds to maximum generator output voltage of 24.4kv with USST voltage tap settings at plus 2.5%.)
- 2 Since significant overloads could occur on the nonsafetyrelated 480v service building main board, turbine building common board and auxiliary building common board if automatic transfers were allowed, the manualauto selector switch must be left in the manual position.

TVA memorandum serial number 800208F0452 from Power Engineering to EN DES identified the following concerns.

- 1 The restrictions that future additions to the plant will impose on the plant electrical systems as a result of the transformer tap settings specified in memorandum serial number 800116D0055.
- 2 The setting of the 480v main and common board auto-manual selector switches to manual could not only result in numerous unit trips over the life of the plant, but also could seriously encumber an operator during events that require total attention to nuclear safety.

Pending completion of the licensee's evaluation and corrective action for this matter, this was identified to the licensee as Inspector Followup Item 327/80-24-03 and 328/80-15-03, AC Auxiliary Power System. (d) With the exception of the deficiency discussed in Paragraph S.a.(3)c., it was felt that the licensee's electrical engineering design organization currently has an effective organization which meets the commitments discussed in Paragraph 6.a.(3)(b).

Within the areas inspected, there were no deviations identified.

b. Audits

- (1) Documents Examined:
  - (a) MO-QAP 3.1, Revision 1, Managers Office Quality Assurance Audit Program
  - (b) CEDC-QAM for NCM, Section 11.1, Revision 7, OEDC Audit Program
  - (c) ID-QAP 18.1, Revision 1, Qualification, Certification, and Recertification of Quality Assurance Audit Personnel
  - (d) ID-QAP 18.2, Revision 0, Joint Quality Assurance Audits
  - (e) EN DES-EP1.23, Revision 1, Internal EN DES Quality Assurance Audit Program
  - (f) EN DES-EP 5.34, Pevision 2, Vendor Quality Assurance Audit Program
  - (g) QEB-EP 24.67, Revision 0, Vendor QA Program Evaluation Index --- Maintenance and Handling
  - (b) OEDC Audit No. M78-6, Management Level Audit of GE, C. F. Braun and CBIN
  - (i) OEDC Audit No. M78-9, Quality Assurance Records All Nuclear Porjects Except Browns Ferry
  - (j) OEDC Audit To. M78-21, Management Level Audit of Interfaces Between T<sup>r</sup>A Organizations and GE/Braun/CBIN
  - (k) OEDC Audit No. M79-1, Pre-ASME Survey
  - OEDC Audit No. MR79-7, Yellow Creek Plant Management Review of Combustion Engineering QA Program
  - (m) OEDC Audit No. M79-12, EN DES, QEB QA Program
  - (n) OEDC Audit No. M80-6, Hartsville, PLipps Bend Nuclear Projects QA Programs - Implementation
  - (o) EN DES Audit No. 78-5, Hartsville/Phipps Bend Design Project

- (p) EN DES Audit No. 79-1, Civil Engineering Branch
- (q) EN DES Audit No. 79V-30, Bristol Steel and Iron Works, Bristol, VA
- (r) EN DES Audit No. 80V-2, Florida Steel Corporation, Charlotte, NC
- (s) EN DES Audit No. 80-4, QEE/QC
- (t) ANSI N45.2.12, Draft 3, Revision 4, 2/74, and 1977 Edition, Requirements for Auditing of QA Programs for Nuclear Power Plants
- (u) OEDC QA Program Requirements Manual for Design, Procurement, and Construction
- (v) SARs, Chapter 17, Section 17.1A.18, Audits
- (w) TVA Topical Report TR75-1A, QA Program Description for Design, Construction, and Operation of TVA Nuclear Power Plants Section 17.1A.18, Audits

(2) OA Program

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TVA's QA audit program consists of OEDC management audits, EN DES and construction internal audits, supplier and contractor audits. Since RII was evaluating TVA's Knoxville Offices primarily from an architect-engineer view point the construction audit program (which receives onsite review) was not examined during this inspection.

Section 17.1A.18 of pertinent TVA nuclear plant SARs and TVA's Topical Report along with the OEDC QA Program Requirements Manual (PRM) delineate respective nuclear plant site commitments and responsibilities for audits. Hartsville, Phipps Bend, Yellow Creek Nuclear Plants are committed to ANSI N45.2.12, Draft 3, Revision 4, February 1974. Bellefonte is committed to the NRC Gray Book (Guidance on Quality Assurance Requirements During Desigt and Procurement Phase of Nuclear Power Plants) June 7, 1973 which is essentially the same ANSI N45.2.12 - 1977 edition. No licensing commitments exist for Sequoyah or Watts Bar Nuclear Plants, however, TVA contends that both Sequoyah and Watts Bar Plants conforms fully to ANSI N45.2.12 - 1977 auditing requirements. Various OEDC QA program and EN DES Division procedures provide instructions for the proper implementation of audits.

### (3) Implementation

The inspector reviewed the referenced documents and held discussions with personnel in OEDC and EN DES Division responsible for audits. The inspector reviewed the twelve referenced audits to ensure audits are scheduled, prepared, and performed in accordance with established requirements. The inspector identified three items of noncompliance and one unresolved item relative to TVA's audit program which are discussed below in Paragraphs (4) through (6) and (7) respectively.

(4) Failure to Properly Identify and Handle Audit Deficiencies

Criterion V of 10 CFR 50, Appendix B as implemented by Quality Assurance Procedure MO-QAP No. 3.1, defines the method of reporting and documenting OEDC audit findings. By procedure audit deficiencies are to be recorded on Form TVA 22008 and reviewed for significant conditions adverse to quality per OEDC QAI-4. Audit findings for OEDC QA Audits M78-6, M78-21, and MR79-7 were reported/documented as conclusions and recommendations rather than as deficiencies and consequently not evaluated for significance. This item has been classified as Infraction 518-519-520-521/80-11-01, 553/80-11-01, 554/80-10-01, 556-567/80-10-01.

(5) Audit Frequencies Incorrectly Specified

As stated in Paragraph 6.b.(2) above, Hartsville, Phipps Bend and Yellow Creek are committed to ANSI N45.2 12, Draft 3, Revision 4 dated February 1974. Paragraph 3.4.2 of the subject standard requires that, "applicable elements of the quality assurance program shall be audited at least annually or at least once within the life of the activity, whichever is shorter." IE's position is that all elements within EN DES Division which perform quality related activities are to be audited against all applicable Appendix B criteria on an annual basis. An element is defined as any engineering branch (civil, electrical ..., etc.) or design project group. Contrary to the above, Engineering Design Procedure EP 1.29 for handling internal EN DES audits does not provide assurance that all elements of the EN DES organization be audited against applicable Appendix B criterion on an annual basis nor is there evidence that this commitment has been met. This item of noncompliance will be cited against the following units and classified as Infraction 518-519-520-521/ 80-11-02, 553/80-11-02, 554/80-10-02, 556-567/80-10-02.

(6) Contract Service Audits Not Performed

10 CFR 50, Appendix B, Criterion XVIII as implemented by Section 17.1A.18 of pertinent TVA nuclear plant SARs and Topical Report through Engineering Procedures EN DES-EP 5.34 and QEB-EP 24.67 states, "a comprehensive system of planned and periodic audits shall be carried out to verify compliance with all aspects of the quality assurance program and to determine the effectiveness of the program. Contrary to the above (iscussions with responsible QEB audit personnel and examination of wendor audits and evaluation indexes performed to date revealed that no preaward surveys, regularly scheduled audits nor evaluation indexes had been conducted by iVA on EDS and Teledyne contracted design services. Further discussions indicated there may be other procured services that TVA may not be auditing at this time. This item of noucompliance has been cited against all units and will be classified as afraction 327/80-24-04, 328/80-15-04, 390/80-20-02, 391/80-14-02, 438-439/ 80-13-04, 518-519-520-521/80-11-07, 553/80-11-07, 554/80-10-07, 566-567/80-10-06.

(7) OEDC Audit No. M79-12, Deficiency No. 6 - Lack of EN DES QA Organizational Freedom, Authority and Access to Management

During the review of findings for various audits conducted, the subject deficiency was uncovered. Due to the seriousness of the rinding, it prompted RII inspectors to interview approximately 17 OEDC QA and QEB personnel. The views, feelings and comments expressed by these individuals (be they imaginary or actual) were found to be consistent almost to the man. The views, feelings and comments expressed by these individuals were conveyed to TVA management prior to exiting with the names of the concerned individuals being withheld. RII will followup on this item during a management meeting to be conducted in Atlanta on July 25, 1980, with TVA in attendance and during subsequent IE inspections as deemed necessary. This item has been classified as unresolved item 327/80-24-06, 328/80-15-06, 390/80-20-04, 391/80-14-04, 438-439/80-13-05, 518-519-520-521/80-11-08, 553/80-11-08, 554/ 80-10-08, 566-567/8C-10-07.