ENCLOSURE 2

TVA

WATTS BAR NUCLEAR PLANT-UNIT 1

INDEPENDENT ENGINEERING & FIELD ASSESSMENT

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Contents

WATTS BAR NUCLEAR PLANT-UNIT 1
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I. GENERAL

A. PURPOSE

The purpose of this independent engineering and field assessment was to perform technical reviews of a broad cross-section of design output to confirm adequacy of design and installation with emphasis on electrical and instrumentation and control.

B. SCOPE/METHODOLOGY

The assessment was performed to identify the processes and requirements essential to the design, construction, licensing, and safe operation of WBN and to challenge the development and implementation of these processes and requirements to the degree necessary to ensure a high level of confidence that requirements and commitments have been met.

The assessment consisted of the following:

- RHR System Assessment
- Calculation Review: Mechanical, Electrical, Civil
- Electrical Engineering Specification Review
- Field Assessment: Specific Attributes, General
- Additional Assessments: Materials & Inspection, Mechanical Known Issues

The assessment included a cross section of engineering documents as well as implementing instructions, work plans and field installations. The assessment also included selected corrective action documents such as corrective action programs, condition adverse to quality documents, nuclear experience reviews and NRC bulletins. The assessment utilized document reviews, interviews and field verification with the intent of conducting the review independently of the site engineering personnel to the extent possible. Site engineering reviewed and addressed the problem statements and developed corrective actions.

B. SCOPE/METHODOLOGY (cont'd)

1. Conduct of the Assessment

- Team questions, observations or concerns generated during the assessment were transmitted as action items to the TVA site "owner" for response if the assessment team could not resolve the potential issues without line information. A two-part form was used to document the question, observation or concern (top) with appropriate attached back-up data (e.g. drawings or pictures) and to obtain a response and acceptance (bottom).

- Each action item was evaluated and placed in one of the following categories:

  - Deficiencies: errors, noncompliances, or violations of a specific licensing commitment, specification, procedure, code or regulation that are required to be documented via Problem Evaluation Report (PER) as defined in WBN corrective action program.

  - Observations: cases where it was considered appropriate to call attention to matters that are not deficiencies. They include items suggested for TVA consideration, but for which there is no specific regulatory or procedural requirement.

  - Anomalies: interim action items that were eventually dispositioned as deficiencies, observations or acceptable.

- To ensure that each question, observation or concern received the appropriate horizontal assessment, the following process was utilized:

  - All deficiencies were incorporated into PERs which, as part of TVA-WBN's corrective action program, will receive an extent-of-condition evaluation. Deficiencies applicable to PERs existing at the time of the assessment were not considered new deficiencies. In some cases deficiencies were rolled into existing Significant Corrective Action Reports (SCAR).

  - Observations were individually addressed with the intent of bounding the extent-of-condition. As a conservative measure all Action Category 1 and 2 observations (see below) have been documented in WBPER950123 to assess the collective impact of the individual observations. This step included field assessment anomalies identified for specific attributes. Disposition of all design-related observations has been made into the following action categories:

B. SCOPE/METHODOLOGY (cont'd)

1. To be completed prior to Unit 1 fuel load
2. Change or action to be implemented at opportune time consistent with site priorities (may be after Unit 1 fuel load)
3. Optional or Enhancement
4. Complete
5. No action to be taken

- For anomalies found as part of the general field assessment a three-step process was followed:

1. The anomalies deemed deficiencies using the definitions above were incorporated in a PER.
2. A review of individual anomalies determined to be observations was made to determine the likelihood of a broader impact prior to their individual disposition. Since most of these are to be repaired or reworked, work requests have been written; work requests are trended per the WBN corrective action program to identify potential adverse trends.
3. The remaining anomalies were determined to be acceptable, requiring no action or resolution.

- Responses requiring follow-up action (Action Categories 1 and 2) will be added to the Tracking and Reporting of Open Items (TROI) data base.

- It is noted that if an observation had already been identified by the line organization, it is not included in this summary; however these observations are contained in the detailed reports.

- The detailed reports and the original action item processing sheets, complete with dispositions, will be entered into RIMS for future retrieval and access.

2. Outline of the Reports

For each of the focused assessment areas or teams a detailed report was developed and is provided by reference herein. A summary of each of these detailed reports is included in Sections II through VI of this report.

Each summary (Sections II through VI) contains the following:

- An extract is taken from the detailed reports covering scope, results and conclusions

B. SCOPE/METHODOLOGY (cont'd)

- Deficiencies are listed in Table I-1; an explanation of each deficiency is found in the individual sections or in Attachment V-3 herein.

- Observations requiring follow-up action by TVA are tabulated in each section; a synopsis of the observation, the resolution by TVA and the disposition action category for each observation is included.

- Field assessment deficiencies and observations are discussed in Section V, Field Assessment. There is no separate detailed report for the field assessment.

C. RESULTS

To put the following results in perspective, more than 50 engineers and specialists spent over 20,000 man-hours reviewing hundreds of documents, field rooms/areas or participating in interviews and problem resolutions. Details of the scope and extent of the assessment are provided in the summary reports.

- Found sixteen (16) deficiencies - See Table I-1

- Observations reported in two areas: Specific and General Field

Specific	Number
- RHR System Assessment	57
- Electrical and I&C Calcs/Known Issues	44
- Mechanical Calcs	41
- Civil Calcs	5
- Electrical Specs	21
- Field Assessment for Specific Attributes	15
- Materials	11
Sub-total with Action Categories	194
- General Field Assessment (see Section V.C)	188
TOTAL	382

C. RESULTS (cont'd)

- Observations sorted by action category:

1.	To be completed prior to Unit 1 fuel load	47
2.	To be implemented at opportune time	57
3.	Optional or enhancement	20
4.	Complete	34
5.	No action to be taken	36
	TOTAL	194

D. EVALUATION

The assessment team, consisting of members with considerable experience in similar assessments, provided a large data base of comments, observations and questions; most of these were resolved during the assessment. To put this massive amount of information into context, the following is provided:

- There were well over 5000 opportunities[1] to identify problems.
- Sixteen (16) deficiencies were identified for formal corrective actions.
- With the exception of deficiency number 13 (cut cable) on Table I-1, the initial evaluation has shown that the specific deficiencies have minor or no safety significance and would not impact safe shutdown. The significance and extent of deficiency 13 are still under review.
- There was evidence that past corrective actions, initiated to address key issues, have been effective.
- The approximately 380 observations ranged over a wide spectrum (from typographical errors to minor discrepancies on some instrument setpoint calculations) of concerns and have been and are being thoroughly addressed by WBN personnel
- Actions to resolve observations will be monitored and tracked to completion
- None of these observations required significant changes; in many instances they reflect "good practice" and will be done consistent with plant priorities

[1]An order of magnitude number using estimates provided by team members which is based on commodities and commodity attributes (for example, 50 tray sections times 11 attributes per tray section would yield 550 opportunities).

E. OVERALL CONCLUSIONS

- There is reasonable assurance that the RHR System will perform its intended safety function; design of the RHR System is judged adequate and design attributes of the system were retrievable and verifiable. (see Section II)

- Installation of commodities to specific attributes is acceptable. (see Section V-A.1)

- Previous work sequence for room and area turnover was not optimum, therefore impacting room/area turnover and creating the need for some rework or additional work. (see Section V-A.2)

- Calculations were of acceptable quality and utilized correct and validated methodologies; although the calculations were well understood by the TVA staff, some could be enhanced with "roadmap" guidance for ease of use and review. (see Section III)

- Watts Bar engineering and design documents were complete and adequate. (see Sections II & III)

- There is good agreement between Electrical and I&C design specifications and implementing procedures. (see Section IV)

TABLE I-1
DEFICIENCIES

ITEM NO.	SYNOPSIS OF DEFICIENCY	RESOLUTION
1	RWST level channel setpoint discrepancy; the setpoint for lo-lo level alarm was found to be outside of the analytical limit	Subsequent design change revised lo-lo level alarm setpoint to be above the "upper" analytical limit which will cause the alarm to initiate prematurely. Operators utilize PAM RG1.97 indicators for action and the alarm is an operator aide. WBPER950006 has been initiated.
2	Inadequate Closure of Generic Letter 88-17 Commitments - Commitments regarding the generation of containment closure procedures were inappropriately closed out.	Action will be taken to ensure that closed GL 88-17 TROI items are appropriately closed and containment closure procedure will be developed prior to closure of GL 88-17. WBPER950119 has been initiated.
3	Operator Actions to reduce post-LOCA/MSLB heat loads have not been included in abnormal operating or emergency instructions-calculation identified requirement for operators to perform actions to reduce post-LOCA heat loads. Requirement not included in procedures.	The appropriate operator actions will be incorporated into the operating procedures prior to U1 fuel load. Engineering is performing a 100% review of the system description documents including the development of series 800 drawings where necessary to capture design based limitations on system operation. These actions are in support of the system SPOC turnover process. WBPER950118 has been initiated.
4	Calculation Review of Regular Undercut Anchor Bolts - A review of a sample of regular undercut anchor bolts for minimum edge distance requirements was deficient.	Additional assessment in accordance with site procedures will be performed for regular undercut anchors. CHPER950010 has been initiated.
5	RHR Heat Exchanger Seismic Lugs - "Worst-case" anchorage evaluation of RHR heat exchanger 1A and four other heat exchangers does not perform a check of the bolts which restrain the heat exchanger at its upper supports.	WBPER950063 has been issued. No impact on the installation. Calculation for bolt adequacy has been done and shown to be adequate.
6	Failure to comply with internal electrical separation criteria in 3 control room panels/boxes.	WBPER940119 has been issued. The required separation will be ensured as corrective action and extent of condition review of the PER.

TABLE I-1 (cont'd)
DEFICIENCIES

ITEM NO.	SYNOPSIS OF DEFICIENCY	RESOLUTION
7	Instrument drain line valves installed in wrong flow direction	WBPER950011 has been issued. Initial review indicates that valves would have performed their function as installed. All similar instrument panel drain valves will be reviewed for installed orientation and reversed as necessary.
8	Expansion anchors in high density concrete need to be evaluated for potential reduced capacity per engineering procedures; an engineering review was not requested (NRC first identified this issue)	Expansion anchors installed on high density concrete walls which have not been previously evaluated for the 15% reduction in allowable capacity, will be identified and evaluations performed. WBPER950095 has been issued.
9	Discrepancy between recorded heat number on weld data sheet and marked heat number in the field on 1/2" sch 80 pipe.	WBPER940771 has been issued. Further review has shown that both heat numbers are valid for 1/2" sch 80 pipe sections. Possible explanation is that welds were shop fabricated with exchange occurring during installation. QA record change has corrected this specific issue. Additional review of approximately 40 welds in same area yielded no anomalies.
10	NEMA-1 junction box not reviewed for seismic qualification per engineering procedure	WBPER940749 has been issued. Only one box has been found; however, junction boxes which have been affected by design changes following the completion of the Civil/Seismic walkdowns of NEMA-1 seismic qualified boxes will be reviewed for this potential nonconformance condition.
11	Two (2) cables installed on bottom of cable tray at fire seal	WBPER940740 has been issued. Condition is believed to be isolated based on the many visual opportunities during the field assessment; extent of condition will be addressed as part of corrective action for the PER. DCN 33747-A has been issued to add an attribute to specifically look for this condition to the cable tray walkdown.

TABLE I-1 (cont'd)
DEFICIENCIES

ITEM NO.	SYNOPSIS OF DEFICIENCY	RESOLUTION
12	Missed installation of electrical grounds: ground jumpers, bonding and grounding of miscellaneous steel	WBPER940748 has been issued. The missed electrical grounds are for personnel safety, not nuclear safety. Additional actions to enhance training and awareness for ongoing walkdowns are underway.
13	Cut cable in inboard containment penetration X27	WBPER950022 was written for cut cable found as part of general field assessment. This issue is being incorporated in WBSCA950002 which addresses damage to primary cable installation issues primarily with terminations and splices.
14	Misapplication of ASTM Deviation Table for Dry Film Thickness (DFT).	WBPER940727 initiated. Area within Zone of Influence (ZOI) reinspected. Unacceptable areas identified within the ZOI during reinspection will be repaired prior to fuel load.
15	Lack of support for cantilevered seal assemblies on solenoid valves	WBPER950099 has been issued. Appropriate EQ valves/assemblies will be evaluated for adequate supports.
16	Fillet weld on top of 1/2 inch straight stainless steel coupling to sense line, socket weld ends, is 1/8 inch vs. 3/16 inch minimum required	A work request has been issued to correct this condition. WBPER950028 was issued and extent of condition has been assessed, utilizing WBPER930097 and QAI-17.01, 17.02 resolutions and determined to be an isolated case.

II. RHR SYSTEM ASSESSMENT

An independent engineering assessment of the Watts Bar Nuclear Station (WBN) residual heat removal (RHR) system was conducted between November 1994 and January 1995, by Systems Research International (SRI).

The following factors were considered by TVA in selecting the RHR system over other safety related systems for this assessment:

-RHR closest to completion of SPOC/SPAE on project schedule

-RHR has both long and short term and safety and non-safety related modes of operation

-RHR has manual actions required by operations thus allowing for a wide scope of operating procedures

This report represents a summary of the assessment team's review and findings.

Resources

- approximately 3500 man-hours
- utilized personnel from field assessment team

A. PURPOSE

- perform independent functionality review of the adequacy and conformance to design basis and regulatory commitments; and

- assess adequacy of operating and testing procedures

B. SCOPE

- Capability to perform the safety functions

- Consistency of design basis requirements with the regulatory commitments

- Consistency of the as-built design and installation with the current design/licensing basis

- Adequacy of the operations, surveillance, and test documentation

B. SCOPE (cont'd)

Reviewed interfacing systems such as:

- Emergency AC and DC electrical systems including diesel load sequencer
- Interfaces with component cooling and essential raw cooling water systems
- Safety Injection System (e.g., RHR initiation logic)
- HVAC systems for RHR room cooling

C. METHODOLOGY

The assessment plan selected elements from:

- NRC Inspection Procedures for safety system functional inspections (IP 93801);
- System Based Instrumentation and Control Inspection (93807); and
- Electrical Distribution System Functional Inspection (TI 2515/107).

Reviewed a top-down vertical slice of documentation that included:

- upper tier design input documents (FSAR; licensing commitments; regulatory requirements; industry standards; TVA design criteria)

- design analyses (calculations, design evaluations, and qualification documents)

- design output documents (specifications, flow diagrams, control/logic diagrams, schematic diagrams, setpoint/scaling documents (SSDs), systems descriptions)

- plant operating documents

Review encompassed the following components:

- RHR train 1A-A
- Emergency Diesel Generator 1A-A
- Emergency AC electrical board 1A-A
- 161KV CSST B transformer
- 6.9 KV switchgear, 480 V switchgear, and MCCs associated with RHR train 1A-A
- Component cooling system train 1A
- Essential raw cooling water train A
- Corresponding battery and inverter sources

D. ELECTRICAL SYSTEMS DESIGN

1. Scope

a. Power Sources

- the offsite sources, and
- the emergency diesel generators.

Adequacy verified by comparing the expected voltage, currents, and frequencies against accepted margins

- ability to provide adequate voltage and frequency under normal and emergency operating conditions
- examined loading conditions
- evaluated steady state and transient state conditions
- adequacy of offsite source to provide adequate voltage regulation
- included transient and steady state stability, as well as reliability
- evaluated protective relaying, low voltage circuit breakers, and fuses

b. Power Distribution Equipment

- Sizing and installation of the transformers, switchgear, cables, bus ducts;
- Protection and coordination;
- Separation and independence; and
- Short circuit and voltage regulation analysis.

c. Power Utilization Equipment

- adequate sizing;
- E.Q. considerations;
- installation; and
- adequacy of the preoperational testing, maintenance, and surveillance testing.

D. ELECTRICAL SYSTEMS DESIGN (cont'd)

2. Results

- Found no deficiencies
- Noted 13 observations: See Items 1 through 13 in Table II-1

Noted strengths

- the monitoring system being implemented for the diesel generator testing;
- the general status of the calculations;
- clear and retrievable drawings, and
- the adequacy of the design guides.

3. Conclusions

- Based on the sample, there is reasonable assurance that electrical systems reviewed will adequately perform their safety functions

E. INSTRUMENTATION AND CONTROL SYSTEMS DESIGN

1. Scope

Attributes emphasized in the review included:
- automatic operation and interlocks
- alarms and indications important to safety, including post-accident monitoring (PAM) channels
- RHR leak detection instrumentation
- single failure criteria and circuit independence/isolation
- design requirements governing instrument installation
- provisions for safe shutdown outside the control room
- environmental and seismic qualification
- instrument accuracy and setpoints
- instrument selection and ratings
- I&C support power interface (120 Vac and 125 Vdc)

E. INSTRUMENTATION AND CONTROL SYSTEMS DESIGN (cont'd)

2. Results

- Found one deficiency (with safety significance considered to be minor): Item 1 in Table II-1, RWST level channel setpoint discrepancy.

- Noted 12 observations: see Items 14 through 25 in Table II-1

- No inconsistencies were identified for the areas reviewed between the plant configuration and design documents as a result of the supporting field assessment (results reported in field assessment, Section V.B.1)

3. Conclusions

- Based on the sample, there is reasonable assurance that the RHR instrumentation and control systems and equipment will adequately perform their safety functions.

F. MECHANICAL SYSTEMS

1. Scope

Focused on design features important to safety such as:

- heat exchanger performance
- system hydraulic performance including net positive suction head (NPSH), pump flows, system venting capability, relief valve operation, and containment sump performance
- ECCS requirements
- system design temperature and pressure
- refueling water storage tank parameters
- interfacing system capability
- motor-operated valves (MOV)
- room heat loads and HVAC capability
- containment isolation
- as-built system configuration

F. MECHANICAL SYSTEMS (cont'd)

2. Results

- Found two (2) deficiencies (with safety significance considered to be minor): Item 2 in Table II-1, closeout of NRC Generic Letter 88-17 commitments and Item 3 in Table II-1, inadequate impact review of design change.

- Noted twenty-six (26) observations: see Items 26 through 51 in Table II-1.

- One observation (Item 34 in Table II-1) consists of reconfirmation of ERCW design temperatures and flow rates upon completion of ERCW flow balancing test. This item will be resolved with this confirmation.

3. Conclusions

- Based on the sample, there is reasonable assurance that the RHR system and equipment will adequately perform safety functions

- Interfacing systems are capable of supporting RHR

G. MECHANICAL COMPONENTS

1. Scope

a. Piping Analysis

- piping from the containment sumps at penetration 1X-19A and -19B; and
- piping from the refueling water storage tank (RWST) to the RHR pump suction nozzle 1-AA and 1-BB.

The team verified that:

- the safety class used was in agreement with the safety class identified on the flow diagrams and in the FSAR;
- the operating and accident temperatures and pressures were in agreement with those contained in the system design criteria and operating mode diagrams; and
- proper seismic and DBA loadings were used.

G. MECHANICAL COMPONENTS (cont'd)

b. Pipe Supports

- Selected a sample of large-bore pipe supports

- Design attributes checked included:

  - Safety Class
  - Design Criteria
  - Comparison of support location, orientation and type shown on the piping isometric drawing and analyzed in the piping analysis with the support location
  - Comparison of the geometry and materials specified in the pipe support drawing bill of materials
  - Comparison of the pipe support loads and displacements computed in the piping analysis post-process run with the loads and displacements used in the pipe support calculation.
  - Review of the pipe support calculation to confirm that stress and load checks have been correctly performed

c. In-Line and Floor-Mounted Equipment

- Selected a sample of in-line and floor-mounted equipment

- Design attributes reviewed included:

  - Safety Class
  - Design Criteria
  - Design Specifications
  - Vendor Drawings
  - Vendor Seismic Qualification Reports
  - Anchorage Calculations and Drawings for Floor-Mounted Equipment
  - Piping Interface Limits

2. Results

- Found two (2) deficiencies (with initial evaluation indicating minor or no safety significance): Item 4 in Table II-1, field survey of regular undercut anchor bolts, and Item 5 in Table II-1, RHR heat exchanger seismic lugs.

- Noted six (6) observations: see Items 52 through 57 in Table II-1.

G. MECHANICAL COMPONENTS (cont'd)

3. Conclusions

- Design criteria for the analysis of piping and supports are detailed and complete
- Piping analysis and the pipe support calculations were of good quality and were generally performed in accordance with these criteria
- Design criteria for the design and analysis of valves, pumps and tanks are also detailed and complete
- Design criteria and calculations generally reflect "lessons learned" from past NRC reviews that have been conducted at TVA's Sequoyah Nuclear Plant and WBN

H. OVERALL CONCLUSIONS

- RHR system was found to be adequate and in conformance with design basis and regulatory commitments (with minor observations noted in Table II-1)

- Reconciliation of operations and testing documents with engineering requirements will be performed as noted in Table II-1

- There was no major programmatic weakness related to TVA's design process

- Field configuration is consistent with design for areas reviewed

Noted several strengths including:

- design standards/guides are detailed and extensive;
- calculations are generally well developed and complete;
- drawings are clearly detailed and retrievable;
- system descriptions and design criteria are complete and useful;
- a state-of-the-art, computerized data acquisition system enhances the ability to conduct diesel generator testing.

References: Engineering Assessment of the Residual Heat Removal System, Watts Bar Nuclear Station, TVA, by Systems Research International (SRI), February 1995.

TABLE II-1
RHR SYSTEM ASSESSMENT

DEFICIENCIES

Item No.	Report Section Item	Issue	Resolution
1	3.4-1	RWST Level Channel Setpoint Discrepancies - Lo-lo level alarm setpoint was found to be outside of the analytical limit.	Subsequent design change revised the lo-lo level alarm setpoint to be above the "upper" analytical limit which will cause the alarm to initiate prematurely. Operators utilize PAM RG1.97 indicators for action and the alarm is an operator aide. WBPER950006 has been initiated.
2	4.12.1-1	Inadequate Closure of Generic Letter 88-17 Commitments - Commitments regarding the generation of containment closure procedures were inappropriately closed out.	Action will be taken to ensure that closed GL 88-17 TROI items are appropriately closed and a containment closure procedure will be developed prior to closure of GL 88-17. WBPER950119 has been initiated.
3	4.14.2-1	Operator Actions to Reduce Post-LOCA/MSLB Heat Loads have not been Included in Abnormal Operating or Emergency Instructions - Calculation identified requirement for operators to perform actions to reduce post-LOCA heat loads. Requirement not included in procedures.	The appropriate operator actions will be incorporated into the operating procedures prior to U1 fuel load. Engineering is performing a 100% review of the system description documents including the development of series 800 drawings where necessary to capture design based limitations on system operation. These actions are taken in support of the system SPOC turnover process. WBPER950118 has been initiated.
4	5.2-2	Calculation Review of Regular Undercut Anchor Bolts - A review of a sample of regular undercut anchor bolts for minimum edge distance requirements was deficient.	Additional assessment in accordance with site procedures will be performed for regular undercut anchors. CHPER950010 has been initiated.
5	5.3-2	RHR Heat Exchanger Seismic Lugs - "Worst-case" anchorage evaluation of RHR heat exchanger 1A and four other heat exchangers does not perform a check of the bolts which restrain the heat exchanger at its upper supports.	WBPER950063 has been issued. No impact on the installation. Calculation for bolt adequacy has been done and shown to be adequate.

OBSERVATIONS

Item No.	Report Section Item	Observation	Resolution	Action*
1	2.2.1-1	6600V Safety Motors Protective Relay Settings - proper references to certified vendor data were not included.	All required input data is contained in the Calculation, but general clean-up of documentation is needed. Transmission Planning Group will revise the calculation with clean certified motor data sheets and correct other legibility problems.	2
2	2.3.1-1	Diesel Generator Loss of Field Relay - undervoltage permissive contact prevented action by the loss of field relay.	Existing design includes alarm function, which provides a degree of protection for most loss of field events based on operator action to abort testing. However, DCN F-34737 has been issued to bypass permissive contacts and allow tripping of DG breaker. This will provide improved protection.	4

*Action Categories: 1. To be completed prior to Unit 1 Fuel load
2. Change or action to be implemented at opportune time consistent with site priorities (may be after fuel load)
3. Optional or enhancement
4. Complete
5. No action to be taken

TABLE II-1 (cont'd)
RHR SYSTEM ASSESSMENT

Item No.	Report Section Item	Observation	Resolution	Action*
3	2.3.2-1	Diesel Generator Neutral Ground Protective Relay - relay not sufficiently sensitive to detect grounds in almost half of the generator winding.	TVA has determined that differential relay will adequately protect for ground faults in test mode. However, DCN W-33990 has been issued to install a more sensitive ground relay in order to provide better ground detection in emergency mode.	4
4	2.3.3-1	Diesel Generator Operation During Surveillance, Possibility of Overloading - operating procedure not consistent with design.	SOI-82.01 is presently on Administrative Hold pending incorporation of recent design changes. Revising the SOIs for outstanding DCNs will correct the identified issue.	1
5	2.3.3-2	Diesel Generator Operation During Surveillance, Possibility of Connection out of Synchronism - operating procedure not consistent with design.	SOI-82.01 is presently on Administrative Hold pending incorporation of recent design changes. Revising the SOIs for outstanding DCNs will correct the identified issue.	1
6	2.3.3-3	Diesel Generator Operation During Surveillance, DC Bus Voltage - operating procedure not consistent with design.	SOI-82.01 is presently on Administrative Hold pending incorporation of recent design changes. Revising the SOIs for outstanding DCNs will correct the identified issue.	1
7	2.3.3-4	Diesel Generator Operation, Protective Relay Action. - operating procedure not consistent with design.	SOI-82.01 is presently on Administrative Hold pending incorporation of recent design changes. Revising the SOIs for outstanding DCNs will correct the identified issue.	1
8	2.4.1-1	Protective Relaying for 6.9kV Board 1A-A Maintenance - auditability of documentation is difficult.	Documentation clean-up needed. Transmission Planning Group will revise the calculation to correct insufficient legibility and to re-draw time-current curves.	2
9	2.4.2-1	6.9kV Board 1A-A Feeder Protection for 6.9kV/440V Transformers - auditability of documentation is difficult.	Documentation clean-up needed. Transmission Planning Group will revise the calculation to show the correct instantaneous trip setting and remove reference to 57,500A trip. The time-current curves will be redrawn with short-circuit levels added.	2
10	2.4.4-1	Control Circuit Ground Fault Detection - control circuits are ungrounded and no ground fault detection scheme is provided.	TVA considers the existing design (ungrounded) a benefit which improves service continuity. TVA experience has shown this design to offer reliable operation without significant occurrences of ground-related failures. No corrective action is necessary.	5
11	2.4.5-1	480V System Ground Detection and Transient Overvoltages - system is ungrounded delta and ungrounded systems may give rise to undue transient overvoltages under ground fault conditions.	TVA considers the existing design (ungrounded) a benefit which improves service continuity. This design is commonly used in nuclear plant applications and is supported by industry. No corrective action is necessary.	5
12	2.4.6-1	Diesel Generator Voltage Transformer Secondary Fault - one set of voltage transformers does not have any protection in the secondary winding.	TVA considers the existing design acceptable. The DG vendor provided this design and supports its continued use. Secondary transformer protection was omitted purposely to increase reliability. No corrective action is necessary.	5
13	2.5.1-1	Integrity of the Offsite Sources Under Single Event Conditions - two offsite transformers were not separated by a fire wall.	TVA considers the transformer fire suppression design adequate, without having a fire wall between transformers. Experience has shown transformer explosions not likely and use of open head sprinklers on adjacent transformers will suppress heat generated by faulted transformer. No corrective action required.	5

*Action Categories: 1. To be completed prior to Unit 1 Fuel load
2. Change or action to be implemented at opportune time consistent with site priorities (may be after fuel load)
3. Optional or enhancement
4. Complete
5. No action to be taken

TABLE II-1 (cont'd)
RHR SYSTEM ASSESSMENT

Item No.	Report Section Item	Observation	Resolution	Action*
14	3.2-1	FSAR Document Discrepancies - minor inconsistencies regarding instrumentation descriptions.	FSAR change package will be submitted to resolve the minor issues noted (e.g. RHR valve regulated by a flow switch vice flow transmitter and reversed switch numbers for the interlocks for FCV-74-8 and 9).	1
15	3.2-2	Spurious Closure of CCS Surge Tank Vent Valves and Spurious Alarm Resulting from High Background Radiation During LOCA - this condition is not clearly addressed in training and response procedures.	Spurious closure of CCS vent valves was adequately addressed in a bounding analysis. Alarms from RG 1.45 rad monitors (not PAM) after a LOCA are expected by Operations and will be acknowledged, cleared and later investigated on a low priority basis without impact to the accident mitigation and recovery actions. No further action is required.	5
16	3.2-3	Weakness in Design Criteria/Standards for Instrumentation Isolation Devices - documents did not address isolation devices that do not use contacts.	Scope of calc addresses applicable devices and is adequate for the intended function of contact-to-contact and coil-to-contact isolation. Electronic isolators are purchased per TVA DSE.18.1.19, Class 1E Isolation. WBN will recommend that next revision to DS-E.18.1.19 address anticipated surge and peak voltage.	2
17	3.2-4	Discrepancy in Identification of ECN Implementing Corrective Action Resulting from Appendix R Reevaluation. - wrong ECN referenced.	ECN 5317 referenced in Appendix R calc WBPEVAR8904059 will be corrected to ECN 5340 as required, other references will be verified correct and implementation of other Appendix R corrective actions addressed in the analysis will be verified.	2
18	3.3-1	Document Discrepancy in EQ Binder - data sheet not updated to reflect item closure.	The subject EQ binder open items section was updated to correct this administrative discrepancy.	4
19	3.3-2	Clarification of FSAR Commitments Regarding Seismic Qualification of Electrical Equipment - the FSAR should be updated to clarify TVA's current licensing basis regarding the ESQ CAP program with respect to certain electrical components.	The FSAR will be updated to clarify TVA's current licensing basis during the next amendment which is currently being developed.	1
20	3.4-2	Auditability/Maintainability of Documents Supporting Setpoints - the Eagle 21 demonstrated accuracy calculation and interfacing documents contain minor discrepancies.	The minor issues noted (e.g. footnote references, typos) will be corrected in future revision to calculations. In addition, an Eagle 21 calculation(s) "Roadmap" will be developed to aide in the auditability and maintainability of these calculations.	2
21	3.4-3	Diesel Generator Sequence Timing Relay Documentation - associated documentation should be clarified.	Rev.3 of the subject calc provided the basis for the existing SSD. Rev. 5 of the calc revised the Av values. The Av value was set below the calculated allowable. No safety concern exists since adequate margin is available. The calculation will be revised to support issued SSD.	1

*Action Categories: 1. To be completed prior to Unit 1 Fuel load
2. Change or action to be implemented at opportune time consistent with site priorities (may be after fuel load)
3. Optional or enhancement
4. Complete
5. No action to be taken

TABLE II-1 (cont'd)
RHR SYSTEM ASSESSMENT

Item No.	Report Section Item	Observation	Resolution	Action*
22	3.6-1	Use of Unshielded Transformer for Maintenance Power to Safety Related Instruments - unshielded transformer is available for use as a 120 VAC power source during maintenance.	TVA considers the existing design acceptable. This equipment has been surge tested to the same requirements as the RPS/Eagle 21 system found in Standard Specification E18.14.01. This subjects the equipment to surge-withstand testing in excess of 2.5 KV-peak and to rejection of conducted RF energy of 300V pk-pk/100 to 500 KHz and 5V pk-pk/0.5 to 100 MHz. Such level of surges has been shown to be representative of typical industrial low voltage distribution sources by IEC 801-4. Also, SQN has used similar equipment successfully including operation on the maintenance source about once every refueling outage. The vital control bus is inoperable whenever this maintenance supply is used.	5
23	3.6-2	Design/Qualification Basis for Power Quality in 120 VAC Vital Power System - no program to monitor and evaluate effects of non-linear loads on the 120 VAC instrument buses.	TVA will consider power quality/harmonic content monitoring of the 120VAC vital power system as an enhancement to reliability. Such monitoring could be useful as part of a trending program. This may be considered for implementation after initial fuel loading.	3
24	3.6-3	Lack of Analytical Basis for DC Ground Detection System Setpoints and Lack of Specific/Quantitative Procedural Requirements for Clearing and Managing DC Grounds - the ground detection setpoints for the vital 125 VDC system should have a formal basis; procedures should address specific actions in response to grounds.	The alarm setting is based on TVA design standard which provides a sound basis for the setpoint. Maintenance checks the ground detection meter once per shift and action to locate and clear any grounds is initiated when the meter exceeds 1.5ma. This is sufficient sensitivity to identify grounds that may result in spurious actions. The ground detection system alarm also results in control room annunciation. Prompt location and removal of grounds will be appropriately addressed in the Annunciation Response Instruction (ARI) when it is issued.	1
25	3.6-4	125 VDC Voltage Study did not Quantify Margin Allowed for Contact Resistance	Conservatisms in the calculation include use of cable cut lengths vs. installed lengths (5% to 10%) and cable resistance at 90°C vs. 60°C or less (10%). This available margin is more than adequate to compensate for the negligible contact resistance. No action required.	5
26	4.2-1	RHR Heat Exchanger Performance Test Evaluation - formal calculations were not developed to analyze test results.	This special case was handled via Q-DCN and the engineering evaluation of the test data was captured as a QA record in that format; as an enhancement, after HFT2 when additional data is available, a formal calculation will be developed.	2
27	4.3.2-1	RHR Pump Curve Discrepancy - two curves were interchanged; typographical error.	RHR pump curve data table titles will be revised to correct this typographical/administrative error prior to U1 fuel load	1
28	4.3.2-2	Maximum RHR Pump Flow - FSAR and system description contain misleading values for max pump flow.	The system description was revised and FSAR change package issued to clarify RHR maximum flow valves.	4

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3. Optional or enhancement
4. Complete
5. No action to be taken

TABLE II-1 (cont'd)
RHR SYSTEM ASSESSMENT

Item No.	Report Section Item	Observation	Resolution	Action*
29	4.3.3-1	RHR System Venting - system configuration may lead to venting problems; should test system after lined-up in standby for 30 days.	Engineering will confirm via memorandum that Tech Support will conduct a one-time, RHR venting special test prior to U1 fuel load and after the system has been lined-up in standby mode for 30 days to provide additional assurance that the current RHR venting procedure is adequate.	1
30	4.3.4-1	Modes of Operation and Temperatures not Fully Justified - calculation does not provide adequate basis for temperature values.	The RHR Op Modes calc will be revised to provide additional bases for temperature conditions and a "Roadmap" design document will be prepared to clarify the Op Mode generic methodology applied for WBN.	1
31	4.3.5.1-1	Relief Valve Dynamic Loading - calculation should be updated to include new parametric study performed in response to a team question.	The subject relief valve dynamic load calc will be revised to incorporate the slug length parametric study performed in response to the RHR Team question.	2
32	4.3.5.3-1	Statements in RHR Relief Valve Calculation are unclear - the calculation should be revised to clarify its purpose and use of the term backpressure.	The purpose of the calculation is clearly stated. The calculation may be enhanced to clarify the use of the term "backpressure" in the Abstract section.	3
33	4.3.7-1	Leaking Flow Control Valves - leaking valves may present a problem during controlled cooldown; condition should be monitored for increases in leakage.	Engineering will coordinate with Tech Support to develop a methodology for future testing to assure that excessive leakage past FCVs 74-16, 28 and 32 has not developed; this methodology will be developed prior to U1 fuel load.	1
34	4.6.1.1-1	ERCW Design Temperatures and Flow Rates - it was unclear that desired flow rates could be achieved.	A flow balance test will be performed on the ERCW system to demonstrate that the desired flow rates can be achieved as part of system pre-op testing	1
35	4.6.1.2-1	ERCW Maximum Inlet Temperatures - reliable and accurate temperature measurement should be established.	The accuracy of the associated ERCW maximum inlet temperature Tech Spec compliance instrumentation will be reviewed and verified to be consistent with the engineering design requirements.	1
36	4.8.1-1	Flood Mode not fully justified for Stress Analysis of RHR Piping - piping/temperature configurations do not address flood mode operation analysis.	This mode was excluded on the basis that the simultaneous occurrence of the probable maximum flood (PMF) and low river temperature conditions is not a credible scenario. Calculation WBN-RAG3-014 estimates the probability of the PMF alone to be in the range of 4E-7 to 1E-9 which is well below the 1E-6 threshold for credible events. No further action required.	5
37	4.8.2-1	Exclusion of RHR Piping in MELB Flooding Study - the MELB study for RHR does not reference or include RHR piping in auxiliary building which is covered in separate analysis.	The MELB flood study calculation will be revised to reference the results in the HELB analysis for RHR piping in the auxiliary building	2
38	4.8.2-2	Method Used for Calculating Thru Wall Crack Area - the calculation should reference basis for crack size.	The MELB calculation currently references the pipe break design criteria document which references the ANSI/ANS standard that specifies use of pipe inside diameter for crack area determination. No change is required to the MELB calc.	5

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3. Optional or enhancement
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5. No action to be taken

TABLE II-1 (cont'd)
RHR SYSTEM ASSESSMENT

Item No.	Report Section Item	Observation	Resolution	Action*
39	4.9-1	Absence of RHR Check Valves in SOER 86-03 Check Valve Program Design Review - the design review portion of the program does not address RHR check valves.	The WBN SOER 86-03 program includes a design review calculation for valves inside containment and performance monitoring activity for valves outside containment. The subject RHR valves are located outside containment and are included in the monitoring program. This is consistent with the WBN level of commitment addressing SOER 86-03. No further action required.	5
40	4.10-1	Actuator Maximum Thrust Capability Versus Valve Allowable Thrust - MOV calculations do not address maximum actuator thrust capability versus valve thrust limits.	The recommended evaluation is not required and the observation applies to "beyond design basis" conditions. Therefore, TVA will not backfit this evaluation but may address the concern for MOVs procured/installed in future DCNs	3
41	4.11.1-1	Final Verification of RHR Pump NPSH Data from Preop - a DCN which evaluated results of preop test data did not address recirculation and inaccurately computed NPSH for injection mode.	The WBN FSAR clearly indicates that sump recirculation NPSH is verified by analysis not test. DCN S-34554-A was implemented to address the observation relative to the injection mode NPSH calculation which did not consider the combined flow loss in the CSS and RHR common suction line. NPSH margin was demonstrated in all cases. No further action is required.	4
42	4.11.2-1	Inconsistencies Between Surveillance Instruction Setpoint Valves and the Calculations - limits stated in mechanical calculation regarding RWST level are incorrectly stated in existing surveillance procedures.	The noted inconsistencies will be resolved by the final revisions of the surveillance instructions which are in progress as part of the SPOC system turnover process.	1
43	4.12.1-2	Generic Letter 88-17 commitment on Core Exit Temperature Monitoring - a change to a commitment regarding the need to have alarming (audible and visual) core exit temperature monitoring was not clearly stated.	Engineering will clarify and revise the commitment if necessary prior to closure of GL 88-17.	1
44	4.13.1-1	Auxiliary Building HVAC Performance; ERCW Flow Rates to ESF Equipment Coolers - environmental temperatures should be re-visited following ERCW flow balancing.	The Auxiliary Building environmental temperature calculations will be reviewed for any impacts that may result from the ERCW flow balance testing to ensure that the calculations reflect achievable ERCW flow conditions.	1
45	4.13.2-1	Insulation Thermal Conductivity Input to Heat Gain Calculations in the Auxiliary Building - calculation included an assumption for thermal conductivity that appeared to be inconsistent with the ASTM thermal conductivity value for the insulation used.	Conservative assumptions used in calculating piping heat loads compensate for the minor difference in the "typical" ASHRAE value of 0.41 Btu-in./hr-ft^2-°F and the "max" ASTM value of 0.45 Btu-in./hr.-ft^2-°F. Based on the above and the fact that piping loads calculated using the ASHRAE value represent less than 20% of the total heat load, no calculation revisions are required.	5
46	4.14.1-1	Reconciliation of SOIs and Engineering Requirements - problems were found with existing SOIs but these documents are being re-written for system turnover.	The system descriptions are being revised and series 800 drawings are being created to capture design based operating limitations. These are being reflected as necessary in the SOIs for system turnover and Engineering will perform an off-line review of the resulting SOIs.	1

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3. Optional or enhancement
4. Complete
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TABLE II-1 (cont'd)
RHR SYSTEM ASSESSMENT

Item No.	Report Section Item	Observation	Resolution	Action*
47	4.15.2-1	Clarification of Exception to Containment Leak Tightness Design Criteria - the criteria should reference the design basis events design criteria.	Design criteria WB-DC-40-66 will be revised to clarify paragraph 3.2.1 to refer to the subject exception and exception 7.2 will be further clarified to indicate that containment penetration integrity is not required for design basis accidents outside of containment.	2
48	4.16.1-1	Design Basis Event Design Criteria did not Provide Analysis of Two Events.	DCN S-33991-A was initiated in response to this observation to remove the word "later" and provide the missing information; no other "later" status items were found in the Design Criteria.	1
49	4.16.1-2	Drawing Discrepancy - two minor drawing discrepancies were noted.	The minor discrepancies on drawing 47W812-1 are being corrected by an administrative change.	1
50	4.16.1-3	Watts Bar and Westinghouse Terminology - a comprehensive cross reference listing for components other than valves does not exist.	The existing Westinghouse cross reference lists will be obtained and placed in DCRM for reference, a memo will publicize this action to site design engineering and this information may be considered for addition to EMS as an enhancement.	3
51	4.16.2.1-1	Justification for Exception to G-37 (HVAC) - the exception should address a minor clarification in wording.	The recommended enhancement may be incorporated into G-37 and the subject exception deleted.	3
52	5.1-1	MOV Valve and Operator Weights Reversed When Input into Pipe Stress Calculation - for rigid valves where the center of gravity is clearly identified the calculation should model the valve such that the total valve plus operator weight be lumped at the center of gravity.	Calculation N3-63-07A R15 is being revised to address this concern. This will result in lower pipe stresses.	2
53	5.1-2	Removal of Two Rigid Restraints Without Proper Justification in the Calculation - the basis for removing two pipe supports was questioned since Attachment P did not contain sufficient rigor to enable evaluation; support should be included in the next run of the model.	The basis for removal of the two supports was given in Att P of calculation N3-63-07A. A confirmatory TPIPE computer run was made and supports the hand calculation approach used in Attachment P. DCN P04667 and F29121 were issued to delete these supports. Per existing site procedures, the next computer run will incorporate the removal of these supports. No further action is planned.	4
54	5.1-3	Disposition of Bellows Movements - calculation contained no reference to explanation for apparent excessive bellows movements and no evaluation of the effects of additional restraint provided by the over-deflected bellows.	The bellows movement was acceptable per an attachment to the design document. The next calculation revision will provide a reference to Attachment G and include a discussion of the restraining effect of the over-deflected bellows.	2
55	5.2-1	Pipe Support Friction Loads - the interpretation of friction requirements is not clear.	WB-DC-40-31.9 will be revised to make the direction of movement, as it applies to friction loads clear.	2
56	5.3-1	Valve Design Pressure (document discrepancy) - system description and vendor specification sheet were inconsistent.	Calculation WCG ACQ-0542 was issued to revise valve pressure rating from 22 to 33 psig.	4
57	5.3-3	Evaluation of "Worst-Case" Tank Anchorages - does not explicitly address each safety-related component.	ESQ CAP closure report will clarify the selection process.	1

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3. Optional or enhancement
4. Complete
5. No action to be taken

III. CALCULATION REVIEW

A. ELECTRICAL AND I & C

1. SCOPE

The scope of the Electrical and I&C Calculations review was to examine:

a. Calculations and analyses applied to design input or output to gain a high level of confidence that electrical systems or components meet design requirements and support operation and maintenance. A total of eight (8) Electrical Baseline and seven (7) I&C Demonstrated Accuracy Calculations were reviewed (see Table III.A-1).

b. Calculations and commitments associated with Electrical/Cable CAP issues categorized as Priority 1 or 2 as defined in the detailed report to assure that they have been satisfactorily resolved. A total of 22 Electrical and Cable CAP Calculations were reviewed (See Table III.A-2).

c. Design Criteria Exception Requests to determine whether the exception justification is clear and technically adequate. Exception Requests associated with four (4) WBN Electrical Design Criteria were reviewed (See Table III.A-3).

The methodology used in reviewing the Electrical Baseline and I&C Demonstrated Accuracy Calculations, the Cable CAP Calculations, and the Design Criteria Exception Requests is outlined in Table III.A-4.

2. RESULTS

The results of the Independent Design Review are as follows:

a. Deficiencies

Failure to comply with the internal electrical separation criteria in some Control Room panels/boxes. Further detail is discussed in Section V, Attachment V-3.

b. Observations

General:

An indexing and overall application document for calculations is needed to supplement the existing procedural requirement to use the TVA calculation checklist.

Most of the recommendations and observations are enhancements and clarifications to the subject documents, with little or no impact to the calculation conclusions.

Electrical Calculations:

A total of 22 observations were written against the eight (8) electrical calculations reviewed, and are summarized in Table III.A-5.

I&C Demonstrated Accuracy Calculations:

A total of twelve (12) observations were written against the seven (7) I&C demonstrated accuracy calculations reviewed, and are summarized in Table III.A-6.

Electrical/Cable CAPs Calculations:

A total of seven (7) observations were written against the 22 electrical & cable CAP calculations reviewed, and are summarized in Table III.A-7.

Design Criteria Exception Requests:

A total of three (3) observations were written against the exception requests associated with the four (4) design criteria reviewed, and are summarized in Table III.A-8.

3. CONCLUSIONS

Review of the calculations and criteria concluded:

a. The electrical calculations are acceptable.
b. The electrical calculations are prepared in accordance with industry practice.
c. A strength of the program is that the electrical calculations are comprehensive and in some cases innovative approaches have been taken for problem solution.
d. The electrical staff was well versed in the calculations.

4. REFERENCES

Brown, M. T. , Gaffney, P. W. , and Weronick, R. , Watts Bar Nuclear Plant - Independent Design Review - Electrical and I&C Calculation Review, February 2, 1995.

ELECTRICAL AND I&C CALCULATIONS REVIEW

TABLE III.A-1
SCOPE OF REVIEW
ELECTRICAL BASELINE/I&C DEMONSTRATED ACCURACY CALCULATIONS

The baseline Electrical calculations reviewed are as follows:

Calculation Number	Title	Revision
WBNEEBMSTI060010	Auxiliary Power System Analysis	37
WBNEEBMSTI060029	Degraded Voltage Analysis	12
WBNEEBMSTI030012	Diesel Generator Loading Analysis	28
WBNEEBMSTI060013	Diesel Generator Voltage Analysis	18
WBNEEBMSTI110003	125VDC Vital Battery and Charger Capacity Evaluation	39
WBPEVAR8909010	Cable Ampacity NV4 and NV5 Cables in Class 1E Raceways	28
WBPE0892906002	Diesel Generator Underground Duct Bank Analyses	4
WBNEEBMSTI120016	120VAC Vital Inverter Loading	52

The I&C Demonstrated Accuracy calculations reviewed are as follows:

Calculation Number	Title	Revision
1-FT-3-147A	AFW System	8
1-FT-3-142	AFW System	3
1-PS-68-63A	RCS System	1
1-PT-68-70	RCS System	7
1-FE-74-12	RHR System	0
WBPE0748903115	RHR System	0
WBPEVAR9211003	RHR System	1

ELECTRICAL AND I&C CALCULATIONS REVIEW

TABLE III.A-2
SCOPE OF REVIEW
ELECTRICAL/CABLE CAPs SPECIAL PROGRAM CALCULATIONS

The Electrical/Cable CAPs Special Program Calculations reviewed are as follows:

1. Cable Support in Vertical Conduit and Tray Runs Calculations

Calculation Number	Title	Revision
WBPEVAR8905049	Evaluates Silicone Rubber Cable in Vertical Conduit	3
WBPEVAR8907010	Vertical Cable Tray Analysis	2
WBPEVAR8912010	Screening and Evaluation of Cables in Vertical Conduit	2
WBPEVAR90005001	Analysis of the Effects of Cable Vertical Drop	6
WBPEVA9007011	Disposition and Evaluation of Conduits for Vertical Drop	3

2. Computerized Cable Routing System (CCRS) Calculations

Calculation Number	Title	Revision
WBPEVAR8806006	Appendix R Cable Route	1
WBPEVAR8810018	CCRS Data Base (EQ and Appendix R)	1
WBPEVAR8810017	Silicone Rubber Insulated Cable	0
WBPEVAR8811001	Cable Raceway/Fill and Weight	1
WBPEVAR8901001	Parallel Tray Segments	2
WBPEVAR8902003	Tray CSA and Cable Weight (Depth)	6
WBPEVAR8902015	CCRS Conversion	0

TABLE III.A-2 (cont'd)
SCOPE OF REVIEW
ELECTRICAL/CABLE CAPs SPECIAL PROGRAM CALCULATIONS

3. Hot Pipe-Related Electrical Calculations

Calculation Number	Title	Revision
WBPEVAR9006005	Conduits Within Close Proximity to Hot Pipes-Data Tabulation and Heat Generation	1
WBPEVAR9109006	Evaluation of V1, V2, and V3 Class 1E Cables with Qualification Temperature Less than 90°C	0
WBPEVAR9109007	Effects on Ampacity of 135°F Pipes	0

4. Electrical Separation Calculation

Calculation Number	Title	Revision
WBPEVAR9001002	Enclosures Containing Multiple Divisional Cables	1

5. Cable Bend Calculations

Calculation Number	Title	Revision
WBPEVAR8904018	Adequacy of QC Procedures-Bend Radius	0
WBPEVAR9004013	Electrical Cable Bend Radius-Lower Bound	2
WBPEVAR9006007	Determination of Remaining Life Due to Lowered Bend Radius Installation	1
WBPEVAR9006015	Electrical Cable Bend Radius-Lower Bound	1
WBPEVAR9007015	Disposition of Class 1E Cables	12

6. Class 1E Splice List

Calculation Number	Title	Revision
WBPEVAR8904055	Class 1E Splice List- Unit 1, Common and Unit 2	8

ELECTRICAL AND I&C CALCULATIONS REVIEW

TABLE III.A-3
SCOPE OF REVIEW
DESIGN CRITERIA EXCEPTION REQUESTS

The Design Criteria Exception Requests associated with the following Design Criteria were reviewed:

Design Criteria Number	Title
WB-DC-30-4	Separation/Isolation
WB-DC-30-5	Power, Control, and Signal Cables for Use in Category 1 Structures
WB-DC-30-22	Electrical Raceways
WB-DC-30-27	AC and DC Power Systems

ELECTRICAL AND I&C CALCULATIONS REVIEW

TABLE III.A-4
METHODOLOGY OF REVIEW

REVIEW ELEMENT	REVIEW QUESTIONS/ISSUES
Electrical Baseline Calculations Review	Review the revisions of calculations performed since the 1991 NRC IDI
	Review the 1991 NRC IDI follow-up activities and known EDSFI issues to ensure commitments and industry issues have been effectively addressed.
	Is the calculation assembled in a clear and logical package?
	Have the revised portions of the calculation been documented?
	Has the source of calculational input been documented?
	Has the revision been verified?
	Have there been modifications to the system since this revision that are not incorporated in the calculation?
	Are the output results reasonable based on the revised input?
	Does the revision require a field modification? If so, have the results been appropriately included in a DCN and work package?
	Have the results been appropriately reflected in the field installation?
Electrical/Cable CAPs and Special Program Calculation Review	A review methodology particular to the resolution of the respective issue was prepared which also considered items such as:
	-Validity of input
	-Analytical method utilized
	-Design output and work plan for field installation
	-Field walkdown

ELECTRICAL AND I&C CALCULATIONS REVIEW

TABLE III.A-4 (cont'd)
METHODOLOGY OF REVIEW

Design Criteria Exception Requests	Clarity: Are the problem and justification presented in a clear and logical fashion?
	Inputs: Are there input data required to establish validity of the justification?
	Documentation: Are the required inputs documented?
	Trends: Does the exception reflect any trends in the design process that the preparer may not be aware of?
	Technical Adequacy: Does the justification reflect sound engineering judgement?

ELECTRICAL AND I&C CALCULATIONS REVIEW

TABLE III.A-5
SUMMARY OF OBSERVATIONS
ELECTRICAL BASELINE CALCULATIONS

Item No.	Calculation	Observation	Final Resolution	Action*
1	WBNEEBMSTI060010	Testing of four fan motors to determine acceleration time is not referenced in the calculation.	The calc will be revised to reference the test requirements in SDD N3-30CB-4002.	2
2	WBNEEBMSTI06002	The aggregate effect of 19 revisions is not addressed.	The aggregate effects are evaluated but not documented at each revision.	3
3	WBNEEBMSTI060010	The acceleration time calculation for the auxiliary feedwater pump motor does not show the derivation of the starting time constant used.	The time constant used is correct and the calc may be clarified in a future revision.	3
4	WBNEEBMSTI060010	It was suggested to consider alternate software which can analyze down to the load level both statically and dynamically.	Existing calcs are technically correct as is, but may be converted to Electrical Transient Analysis Program (ETAP) after fuel load.	3
5	WBNEEBMSTI060029	The voltage and time delay setting for the loss of voltage relay appears to be high, and requires analysis.	Previously identified. Ongoing work to be complete prior to fuel load.	1
6	WBNEEBMSTI060029	The input data for motor (1-MTR-082-AOPB2-B) is in error.	Verification of the data will be discussed with the vendor prior to fuel load.	1
7	WBNEEBMSTI030012	It was suggested to calculate cable losses for comparison with transformer full load losses to verify that assumptions made are conservative.	The QA software DGAP has been verified to be conservative in the methodology of how transformer and cable losses are addressed and is contained in the calculation. No further action is required.	5

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3. Optional or Enhancement
4. Complete
5. No action to be taken

ELECTRICAL AND I&C CALCULATIONS REVIEW

TABLE III.A-5 (cont'd)
SUMMARY OF OBSERVATIONS
ELECTRICAL BASELINE CALCULATIONS

Item No.	Calculation	Observation	Final Resolution	Action*
8	WBNEEBMSTI030012	The calculation contains reference to obsolete sources.	The proper references are included. The calc will be revised to delete obsolete references.	2
9	WBNEEBMSTI030012 WBNEEBMSTI060013	The calculation requires revision to compare the contract guaranteed data used to actual test data obtained for transient voltage drop on downstream equipment.	The calculation will address the use of test data in a future revision.	2
10	WBNEEBMSTI060013	A review the application of electronic timing relays for any inconsistent use of tolerances is suggested.	TVA will revise the calc to reflect the installed relays or to remove references to these relays.	2
11	WBNEEBMSTI060013	Appropriate documents should clarify the starting sequence and logic for the containment spray pump.	The reference to the 187 second starting time for the containment spray pump is for the Unit 2 motor. The calc will be revised to delete the reference.	2
12	WBNEEBMSTI060013	Reference to the automatic load shedding as well as the single failure design criteria due to the current limiting reactors should be addressed.	The calc will be revised to identify the design implemented and to indicate that the load shedding is automatic.	1
13	WBNEEBMSTI060013	The basis of the short circuit assumptions should be clarified.	The calc will be revised to delete the basis for the short circuit assumptions.	2
14	WBNEEBMSTI110003	The calculation should include clarification for the use of single failure criteria in the FSAR. FSAR and calc do not contain the same criteria.	A future calculation revision will explain application of single failure criteria used in the calculation.	2

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5. No action to be taken

ELECTRICAL AND I&C CALCULATIONS REVIEW

TABLE III.A-5 (cont'd)
SUMMARY OF OBSERVATIONS
ELECTRICAL BASELINE CALCULATIONS

Item No.	Calculation	Observation	Final Resolution	Action*
15	WBNEEBMSTI110003	Partial incorporation of load changes in margin assessment portion for battery charger was incomplete.	The minor change will be corrected in a future revision to provide additional margin.	2
16	WBPEVAR8909010 WBPE0892906002	A statement is missing that trays were reviewed against the room hot spot locations.	The calc was prepared in accordance with the requirements of Electrical DS-E12.6.3 and references the site EQ drawings which identifies all hot spot locations. No further action required.	5
17	WBPEVAR8909010 WBPE0892906002	Field walkdowns indicated cases where field installation was not consistent with respect to calculation.	Ampacity of cable is acceptable but the associated technical justification will be clarified. Also included in field assessment.	2
18	WBPEVAR8909010 WBPE0892906002	A non-conservative method was used regarding use of an "equivalent cable" to represent several individual cables in a duct.	The methodology of UCTEMP was properly followed and the use of a conservative equivalent cable versus individual conductors was evaluated in the Appendices of the calc. No further action required.	5
19	WBPEVAR8909010 WBPE0892906002	Final locations of tray covers and the impact on ampacity are not known at this time.	Location criteria for tray covers are on design output drawing; locations will be verified as part of the cable tray walkdown. Ampacity will be verified as part of ongoing work after the cable tray walkdown is complete. No additional work is required.	5

*Action Categories: 1. To be completed prior to Unit 1 fuel load
2. Change or action to be implemented at opportune time consistent with site priorities (may be after fuel load)
3. Optional or Enhancement
4. Complete
5. No action to be taken

ELECTRICAL AND I&C CALCULATIONS REVIEW

TABLE III.A-5 (cont'd)
SUMMARY OF OBSERVATIONS
ELECTRICAL BASELINE CALCULATIONS

Item No.	Calculation	Observation	Final Resolution	Action*
20	WBPEVAR8909010 WBPE0892906002	The results indicate little or no margin primarily due to the limitations of the model used in UCTEMP software. Alternate program model demonstrates significant margin.	Current results are acceptable and conservative. WBN will retain existing program.	5
21	WPBEVAR8909010 WBPE0892906002	Assumptions made about the duct bank depth, spacing between individual conductors, and time to reach steady-state temperature could not be field verified. Alternate program model demonstrated significant margin.	Current results are acceptable and conservative. WBN will retain existing program. Design drawings provide required information. No further action required.	5
22	WBNEEBMSTI120016	Recommendations are made for (1) configuration management plan to monitor load changes, (2) estimate effects of load inrush currents on inverter voltage, (3) evaluate effects of faults on circuits protected by slow acting breakers, (4) evaluate effects of faults on inverter voltage, (5) consider effect of load induced harmonics.	A future calc revision will address effects of inrush currents on inverter voltage (2). Effects of load harmonics (5) is addressed in response to RHR Assessment Item 23. No further action is required for items (1), (3) and (4): Load growth is monitored as part of the design change process; faults on circuits with slow acting breakers fall within single failure criterion; faults at levels sufficient to drive inverter into current limit are cleared instantaneously.	2

*Action Categories: 1. To be completed prior to Unit 1 fuel load
2. Change or action to be implemented at opportune time consistent with site priorities (may be after fuel load)
3. Optional or Enhancement
4. Complete
5. No action to be taken

WATTS BAR NUCLEAR PLANT-UNIT-1
INDEPENDENT ENGINEERING & FIELD ASSESSMENT

ELECTRICAL AND I&C CALCULATIONS REVIEW

TABLE III.A-6
SUMMARY OF OBSERVATIONS
I&C DEMONSTRATED ACCURACY CALCULATIONS

Item No.	Calculation/Other Documents	Observation	Resolution	Action*
1	1-FT-3-147A, 1-FT-3-142, 1-PS-68-63A, 1-PT-68-70, 1-FE-74-12, WBPE0748903115, WBPEVAR9211003	FSAR requires revision to include the correct versions of Figures 5.1-1 sheet 8 and 7.6.7 sheet	The FSAR is periodically updated and the use of the latest CCD drawing will be utilized per procedures. A note will be added to 1-47W610-68-7 to reference the correct FSAR figure.	1
2	**	Revise System Description N3-3B-4002 to state that Table 7 is limited to the safety-related instruments with a control function.	The system description will be revised to address the editorial comment.	1
3	**	Surveillance Instruction 1-SI-3-42 has a discrepancy in step 5.2, page 10.	The discrepancies will be corrected via an administrative change	1
4	**	A revision to SI-4 and TI-49 is required to reflect the current design and licensing format.	SI-4 will be revised. TI-49 has been revised and references the new procedure.	1
5	**	DCN M-18200 requires revision to correct minor discrepancy in SSD Table 1 for a-FT-147A.	The SSD will be corrected in a future revision to correct the minor discrepancy.	2
6	**	Plant SSD 1-LPF-3-147A-S requires revision to correct a typo on page 12	The plant SSD typo will be corrected at the next revision.	2
7	**	The SSD contained in DCN P-3373-B does not reference Technical Specification TS3.3.4	An administrative change will be included to add the Tech Spec reference.	2
8	**	SOI-68-01 and SOI-74.01 require revision to reflect the latest design pressure for RHR operation	The SOIs will be reviewed when the work completion statement for DCN W-28758 and System 68 and 74 are turned over.	1

*Action Categories: 1. To be completed prior to Unit 1 fuel load
2. Change or action to be implemented at opportune time consistent with site priorities (may be after fuel load)
3. Optional or Enhancement
4. Complete
5. No action to be taken

**Same as Item 1

ELECTRICAL AND I&C CALCULATIONS REVIEW

TABLE III.A-6 (cont'd)
SUMMARY OF OBSERVATIONS
I&C DEMONSTRATED ACCURACY CALCULATIONS

Item No.	Calculation/Other Documents	Observation	Resolution	Action*
9	**	System Description N3-74-4001 has a typo in Table 7 and Table 8 note, is incomplete	DCN S-33810 has been issued to correct the System Description.	4
10	**	Site engineering SSD 1-T-74-29-S require revision to show the correct tolerance. The differences found differ by ~1%.	The SSD's will be revised if the plant has trouble meeting the more conservative value during calibration.	3
11	CALCULATION 1-FT-3-142	Page 108 has omitted the "A" from tag number 1-FM-3-142A	The calc will be corrected in a future revision to correct minor typo.	2
12	CALCULATION 1-FT-3-147A	Various minor discrepancies and inconsistencies in transference of data require corrections	The minor discrepancies have been noted and will be corrected in a future revision.	2

*Action Categories: 1. To be completed prior to Unit 1 fuel load
2. Change or action to be implemented at opportune time consistent with site priorities (may be after fuel load)
3. Optional or Enhancement
4. Complete
5. No action to be taken

**Same as Item 1

WATTS BAR NUCLEAR PLANT-UNIT-1
INDEPENDENT ENGINEERING & FIELD ASSESSMENT

ELECTRICAL AND I&C CALCULATIONS REVIEW

TABLE III.A-7
SUMMARY OF OBSERVATIONS
ELECTRICAL/CABLE CAP'S SPECIAL PROGRAM CALCULATIONS

Item No.	Calculation	Observation	Final Resolution	Action*
1	Computerized Cable Routing System Calculations	An anomaly was noted on tray 5A2061/2062. One cable (3C) tagged as spare/abandoned was not loaded in CCRS (This item also discussed in field assessment report).	Ongoing work would have detected, but CCRS will be revised to correct the discrepancy.	1
2	WBPEVAR906005	The latest revision of DS-E12.6.3 was not used	Review of the differences in revision level determined that no calc impact exists, however, the calc will be superseded by WBN-OSG4-138.	1
3	WBPEVAR9109006	A computation error was made in sections 6.2 and 6.3	Conclusions are unaffected. This calc will be superseded by WBN-OSG4-138.	1
4	WBPEVAR9109007	Formulas used are not readily understood nor are contained in the references	The calc will be superseded by WBN-OSG4-138 prior to fuel load.	1
5	WBPEVAR9004013	Data in tables are not correct, they are listed as ratios given in percentages versus delta percent from 100%.	This administrative correction may be made in a future revision. Conclusions are unaffected.	3
6	WBPEVAR9006007	The assumption used regarding 0% retained elongation being an acceptable end of life for cables in a mild environment needs additional justification	Information contained is adequate and results are unaffected.	5
7	WBPEVAR9007015	Calculation contains various minor "attention to detail" discrepancies	Conclusions are unaffected, however, corrections will be made in a future revision.	2

*Action Categories: 1. To be completed prior to Unit 1 fuel load
2. Change or action to be implemented at opportune time consistent with site priorities (may be after fuel load)
3. Optional or Enhancement
4. Complete
5. No action to be taken

TABLE III. A-8
SUMMARY OF OBSERVATIONS
DESIGN CRITERIA EXCEPTION REQUESTS

Item No.	Exception Number	Observation	Final Resolution	Action*
1	EX-WB-DC-30-4-18	The justification is complex and difficult to follow and should be revised to clarify	The revision of the exception to address the clarity of the technical writing is considered an enhancement	3
2	EX-WB-DC-30-4-19	NRC acceptances of the RPS design at SQN and the applicability of those acceptances at WBN lack documentation	The RPS design is a generic Westinghouse design which has been reviewed and accepted by the NRC. Additional information will be added to the exception to further explain the Westinghouse test.	1
3	EX-WB-DC-30-22-2	A comparison of conduit loading with the maximum limit of conduit supports is required	Evaluation shows conduit supports are not overloaded	4

*Action Categories: 1. To be completed prior to Unit 1 fuel load
2. Change or action to be implemented at opportune time consistent with site priorities (may be after fuel load)
3. Optional or Enhancement
4. Complete
5. No action to be taken

III. CALCULATION REVIEW

B. MECHANICAL

1.0 SCOPE

a. Mechanical Calculations

The scope of the Mechanical Calculation Assessment was to verify that recent corrective actions applied to the Mechanical/Nuclear essential calculations for WBN, have been effective and complete. Specifically, this review was focused on the following four areas:

1. Radiation Dose Assessment

   - TI-RPS-197 Rev. 6, "Off-Site Doses Due to a Regulatory Guide 1.4 Loss of Coolant Accident."
   - TI-RPS-198 Rev. 7, "Dose to Control Room Personnel Due to a Regulatory Guide 1.4 Loss of Coolant Accident."
   - WBNAPS3-082 Rev. 0, "Mission Dose to Connect a Spool Piece Between the CCS Surge Tanks and ERCW System After a LOCA."
   - WBNNAL3-031 Rev. 4, "100-Day Loss of Coolant Accident Dose to Electrical Equipment in the EGTS Filter Train Room."

2. System Operating Modes

   - EPM-JKJ-022988 Rev. 5, "Component Cooling System Operating Modes."

3. System Analytical Limits/Required Accuracy Calculations

   - WBN-OSG4-071 Rev. 5, "RWST and Containment RHR Sump Safety Limits, Analytical Limits, and Setpoints."

4. Safe Shutdown Calculations

   - WBN-OSG4-183 Rev. 5, "Functional Requirements of Mechanical Components in Systems 2, 3, 61, 68, 72, and 74."

1.0 SCOPE (cont'd)

The technical adequacy of the calculations was addressed by validating the following attributes:

- Design Inputs - current, valid, and referenced to appropriate sources.
- Methodology - correct and consistent with industry standards.
- Assumptions - necessary, appropriate, and adequately justified.
- Results/Conclusions - reasonable and address the objectives.
- Inputs/Outputs - consistent with plant configuration and design basis documents.
- CCRIS and Procedures - Calculation Cross Reference Information System (CCRIS) data is correct and procedures have been followed.

b. Mechanical Known Issues

The scope and purpose of the Mechanical Known Issues Assessment was to perform an independent assessment of the adequacy, consistency and conformance to design requirements of specific known issues identified at the other TVA nuclear sites. The twelve areas selected for review were:

1. Specification Improvement Program
2. Unit 1/Unit 2 Interface
3. NUREG 0612, Control of Heavy Loads
4. System Overpressure Design/Relief Valve Capacity
5. Freeze Protection
6. Service/Instrument Air Issues
7. Heater Drain System Issues
8. Generic Letter 89-10, Motor Operated Valve Program
9. Generic Letter 89-13, Heat Exchanger Monitoring Program
10. Hot Pipes
11. SQN Operational Issues
12. 10CFR50, Appendix J

1.0 SCOPE (cont'd)

A cross section of documents were reviewed, including:

- corrective action documents
- work implementing instructions
- work orders
- calculations
- operating procedures
- specifications
- drawings
- vendor instructions
- exception requests to design criteria and general construction specifications

Field installations were inspected as appropriate for specific issues.

The Mechanical known issues were evaluated in accordance with the following factors:

- Technical Adequacy
  - compliance and/or consistency with code, regulatory requirements and industry practices
  - valid design input
  - technical quality
- Accuracy
  - reasonable results
  - satisfaction of primary objectives
  - appropriate design output documentation
- Completeness
  - appropriate scope
  - satisfaction of commitments
  - existence of recurrence controls

2.0 RESULTS

a. Calculations

- Found no deficiencies.
- Reported 38 observations, see items 1 through 38 in Table III.B-1.

2.0 RESULTS (cont'd)

b. Known Issues

For each of the Known Issues, the Team completed a Known Issues Assessment report which provided the following information as a minimum:

- Description
- Assessment Methodology
- Field Inspection Requirements/Results
- Assessment Summary/Conclusions
- Documents Reviewed

The results of the Mechanical Known Issues Assessment are summarized as follows:

- Found no deficiencies.

- Reported 3 observations, see items 39 through 41 in Table III.B-1.

3.0 CONCLUSIONS

a. Calculations

Based on the focused sample review described herein, it is concluded that the corrective actions applied to the Mechanical/Nuclear calculation program subsequent to the 1991 NRC Integrated Design Inspection have been effective. In the four calculation review areas the following specific conclusions were drawn:

1. Radiation dose calculations - acceptable quality and applied correct and validated methodologies. Additional confirmation/technical justification was provided for some assumptions.

2. System operating mode calculation - results acceptable but methodology was not well documented (addressed by roadmap commitment).

3. System analytical limits/required accuracy calculation - acceptable quality and well documented.

3.0 CONCLUSIONS (cont'd)

4. Safe shutdown calculation - acceptable quality and well documented.

b. Known Issues

1. Issues have been adequately addressed.

2. Programs conform to standards and requirements.

3. Programs are consistent with Licensing commitments.

4. Site follow-up on observations can provide improvements.

4.0 REFERENCES

4.1 Watts Bar Nuclear Plant - Unit 1, Independent Design Review, Mechanical Calculation Assessment, February, 1995

4.2 Watts Bar Nuclear Plant - Unit 1, Independent Design Review, Mechanical Known Issues Assessment, February, 1995

TABLE III. B-1
MECHANICAL CALCULATIONS & KNOWN ISSUES SUMMARY

ITEM	ISSUE	OBSERVATION	RESOLUTION	ACTION *
1	DOSE	TI-RPS-197 REFERENCE FOR PRIMARY CONTAINMENT LEAKAGE RATE REQUIRES REVISION TO AGREE WITH TECH SPEC	UPDATED REFERENCE TO LATEST TECH SPEC NUMBER IN CALC TI-RPS-197 REV 7	4
2	DOSE	APPROPRIATE REFERENCE FOR PRIMARY CONTAINMENT LEAKAGE SPLIT NEEDS TO BE IDENTIFIED IN TI-RPS-197	ADMINISTRATIVE CHANGE, WB-DC-40-34 WAS ADDED AS REFERENCE IN CALC TI-RPS-197 REV 7.	4
3	DOSE	NO REFERENCES PROVIDED TO SHOW THAT CHARCOAL FILTERS MEET RG 1.52 REQUIREMENTS (TI-RPS-197)	EFFICIENCIES USED IN CALC. ARE CORRECT, REFERENCE TO APPLICABLE SD ADDED IN CALC TI-RPS-197 REV 7	4
4	DOSE	WESTINGHOUSE ICE CONDENSER IODINE REMOVAL COEFFICIENTS DEVELOPED FOR ELEMENTAL IODINE WERE INCORRECTLY APPLIED IN TI-RPS-197 TO PARTICULATE AS WELL AS ELEMENTAL IODINE	CALC TI-RPS-197 WAS REVISED (REV 7) TO ADD WESTINGHOUSE EVALUATION AS JUSTIFICATION FOR PARTICULATE IODINE REMOVAL EFFICIENCY	4
5	DOSE	ICE CONDENSER IODINE REMOVAL AT FULL AIR RETURN FAN FLOW IS ASSUMED BEFORE AIR RETURN FAN FLOW IS ESTABLISHED (TI-RPS-197)	CALC TI-RPS-197 REV 7 ADDED TECHNICAL JUSTIFICATION SHOWING BLOWDOWN FLOW EXCEEDS FAN FLOW IN TIME PERIOD BEFORE FANS START	4
6	DOSE	ABGTS START TIME DELAY IN TI-RPS-197 IS NOT CLEARLY JUSTIFIED BY REFERENCES	4 MIN DELAY IS THE TIME TO DRAW VACUUM, AS DESCRIBED IN SYSTEM DESCRIPTION WHICH WAS ADDED AS A REFERENCE TO TI-RPS-197 REV 7	4
7	DOSE	CALCULATION TI-RPS-197 USES NONCONSERVATIVE EGTS RECIRC FLOW RATES	CALC. TI-RPS-197, REV 7 UTILIZED LOWER FLOW RATES, THIS CHANGE DID NOT AFFECT ORIGINAL CONCLUSIONS	4
8	DOSE	EGTS START TIME DELAY ASSUMPTION HAS NOT BEEN JUSTIFIED IN TI-RPS-197	30 SEC DELAY IS CORRECT; CALC TI-RPS-197 WILL BE REVISED TO PROVIDE ADDITIONAL CLARIFICATION	2
9	DOSE	CALC TI-RPS-197 DOES NOT CONTAIN "COMPUTER INPUT FILE STORAGE INFO. SHEET" REQUIRED BY NEP-3.1	FORM WAS INCLUDED IN REV 7 OF CALCULATION TI-RPS-197	4
10	DOSE	FENCDOSE USER MANUAL LISTS RG 1.4 BREATHING RATES IN UNITS OF M^3/HR INSTEAD OF M^3/SEC; INCONSISTENT WITH RG 1.4	CONFIRMED AS TYPO IN MANUAL; AN ENGINEERING SOFTWARE PROBLEM/ERROR REPORT HAS BEEN GENERATED TO CORRECT THIS	4
11	DOSE	TI-RPS-198 USES NOMINAL CREV RECIRC FLOW RATE INSTEAD OF MORE CONSERVATIVE TECH SPEC MINIMUM FLOW RATE	CALC TI-RPS-198 REV 8 UTILIZED MINIMUM FLOW RATE OF 3275 CFM, THIS CHANGE DID NOT AFFECT ORIGINAL CONCLUSIONS	4

* Action Categories: 1. To be completed prior to Unit 1 Fuel Load.
2. Change or action to be implemented at opportune time consistent with site priorities (may be completed after Fuel Load)
3. Optional or enhancement.
4. Complete.
5. No action to be taken.

TABLE III.B-1 (cont'd)
MECHANICAL CALCULATIONS & KNOWN ISSUES SUMMARY

ITEM	ISSUE	OBSERVATION	RESOLUTION	ACTION *
12	DOSE	TI-RPS-198 ASSUMED FILTER EFFICIENCIES BASED ON RG 1.52 & RG1.140 SHOULD BE BASED ON INSTALLED FILTER PERFORMANCE	CONSERVATIVE TO APPLY RG EFFICIENCIES; INSTALLED FILTER EFFICIENCIES EXCEED RG SPECIFIED MAXIMUMS; EFFICIENCIES ARE JUSTIFIED IN SYSTEM DESCRIPTION WHICH MAY BE REFERENCED IN NEXT TI-RPS-198 REVISION AS AN ENHANCEMENT	3
13	DOSE	IT WAS SUGGESTED THAT UNFILTERED IN-LEAKAGE OF 51 CFM BE ADMINISTRATIVELY CONTROLLED TO SUPPORT TI-RPS-198 CALC ASSUMPTION	CCRIS FOR TI-RPS-198 WILL BE REVISED TO ADD CALC EPM-MAJ-060989 WHICH IS SOURCE OF IN-LEAKAGE DATA AS PREDECESSOR PRIOR TO U1 FUEL LOAD	1
14	DOSE	BETA DOSE ANALYSIS APPEARS TO BE VERY CONSERVATIVE (TI-RPS-198)	BETA SKIN DOSE REDUCTION FACTORS MAY BE EVALUATED AS A POTENTIAL METHOD FOR DOSE MARGIN IMPROVEMENT; NO ACTION PLANNED AT THIS TIME.	5
15	DOSE	FSAR TABLE 15.5-14 DISPERSION FACTORS FOR PERIOD AFTER 8 HRS POST-LOCA NOT CONSISTENT WITH TI-RPS-198 CALC VALUES	AN FSAR CHANGE PACKAGE WILL BE INITIATED TO REVISE THE FSAR TO AGREE WITH CALCULATION VALUES	1
16	DOSE	A "DISPOSITION OF RESULTS" SECTION ADDED TO CALC TI-RPS-198 WOULD ENHANCE UNDERSTANDING OF LIMITATIONS BY END-USERS	THE CONCLUSION SECTION MAY BE ENHANCED IN THE NEXT REQUIRED REVISION TO ADDRESS THIS ADMINISTRATIVE ENHANCEMENT	3
17	DOSE	CALC TI-RPS-198 DOES NOT CONTAIN COMPUTER FILE STORAGE SHEET REQD BY NEP-3.1	THIS ADMINISTRATIVE FORM WAS INCLUDED IN REVISION 8 OF CALCULATION TI-RPS-198	4
18	DOSE	CALC WBN-APS3-082 IS A SUCCESSOR TO CALC TI-RPS-198 AND REQUIRES UPDATING TO REFLECT REV 7 OF TI-RPS-198	TI-RPS-198 REV 7 IMPACT ON WBN-APS3-082 WAS EVALUATED IN RESPONSE TO CCRIS NOTIFICATION OF CHANGE; IT WAS DETERMINED NOT TO IMPACT WBN-APS3-082 RESULTS	5
19	DOSE	CALC WBN-APS3-082 DOES NOT DESCRIBE "SPECIAL REQUIREMENTS" OR ASSOCIATED IMPLEMENTING AND DESIGN OUTPUT DOCUMENTS IN RESULTS SECTION OF CALC.	SPECIAL REQUIREMENTS ARE DISCUSSED IN THE CALC ABSTRACT AND ASSUMPTIONS SECTIONS; CONCLUSION SECTION OF CALC WILL BE REVISED TO HIGHLIGHT SPECIAL RQMTS/LIMITING CONDITIONS AT NEXT REQUIRED REVISION	2
20	DOSE	CCRIS SUCCESSORS SECTION OF CALC TI-RPS-197 REQUIRES UPDATING TO INCLUDE WBN-NAL3-002	UPDATING IS NOT REQUIRED; WBN-NAL3-002 LISTS TI-RPS-197 AS A PREDECESSOR IN CCRIS	5
21	DOSE	EGTS FILTER SOURCE TERMS IN NAL3-002 ARE NOT CURRENT, DUE TO REVISIONS TO CALC TI-RPS-197	REVISIONS TO TI-RPS-197 WERE REVIEWED PER CCRIS AND DETERMINED NOT TO IMPACT WBN-NAL3-002	5

* Action Categories:
1. To be completed prior to Unit 1 Fuel Load.
2. Change or action to be implemented at opportune time consistent with site priorities (may be completed after Fuel Load)
3. Optional or enhancement.
4. Complete.
5. No action to be taken.

TABLE III.B-1 (cont'd)
MECHANICAL CALCULATIONS & KNOWN ISSUES SUMMARY

ITEM	ISSUE	OBSERVATION	RESOLUTION	ACTION *
22	DOSE	THE PROPER BASIS FOR CALC WBN-NAL3-031 DESIGN INPUT FOR HEPA FILTERS IS THE INSTALLED EQUIPMENT PERFORMANCE	DATA WAS VERIFIED CORRECT; REFERENCES MAY BE UPDATED AS AN ENHANCEMENT IN A FUTURE CALC REVISION TO REFER TO EGTS SD AND CONTRACT DWGS FOR INSTALLED EQUIPMENT PERFORMANCE.	3
23	DOSE	CALC WBN-NAL3-031 APPEARS TO USE NON- CONSERVATIVE THICKNESS FOR FILTER PANELS FROM SUPPORTING CALC WBNNAL3-030	DATA WAS VERIFIED CORRECT; TYPO FOUND IN SUPPORTING CALC TO BE CORRECTED IN NEXT REVISION OF CALC WBNNAL3-030	2
24	DOSE	NON-QA SOFTWARE USED IN WBN-NAL3-031 WAS NOT RE-VERIFIED IN LATER REVISIONS OF THE CALC	RESULTS WERE CHECKED AND VERIFIED; CALC WILL BE REVISED TO PROVIDE VERIFICATION OF NON-QA SOFTWARE	2
25	SAFE SHUT-DOWN	CALC WBN-OSG4-183 ASSUMPTION 4.1 ESTABLISHING ENVIRONMENTAL CONDITIONS REQUIRES REVISION FOR CLARITY	ASSUMPTION 4.1 WILL BE CLARIFIED IN THE NEXT REVISION TO WBN-OSG4-183	2
26	OP MODES	CALC EPM-JKJ-022988 PROVIDES NO DOCUMENTATION FOR SELECTION OF BOUNDING OP MODES	CALC WAS VERIFIED CORRECT; OBSERVATION IS APPLICABLE TO FAMILY OF CALCS; TVA WILL CREATE A ROADMAP DESIGN DOCUMENT TO CLARIFY THE APPLICABLE METHODOLOGY	2
27	OP MODES	CALC EPM-JKJ-022988 DOES NOT IDENTIFY SINGLE FAILURES USED TO ESTABLISH OP MODES	CALC WAS VERIFIED CORRECT; OBSERVATION IS APPLICABLE TO FAMILY OF CALCS; TVA WILL CREATE A ROADMAP DESIGN DOCUMENT TO CLARIFY THE APPLICABLE METHODOLOGY	2
28	OP MODES	REVISIONS OF SUPPORTING CALCS APPARENTLY HAVE NOT BEEN CONSIDERED IN EPM-JKJ-022988	LATEST REVISIONS OF ALL INPUT DOCUMENTS WILL BE REVIEWED AND EPM-JKJ-022988 WILL BE REVISED TO DOCUMENT THIS REVIEW	2
29	OP MODES	THE JUSTIFICATION FOR REMOVAL OF UNVERIFIED ASSUMPTION 4.2.3 IN CALC EPM-JKJ-022988 APPEARS TO BE INAPPROPRIATE	JUSTIFICATION FOR REMOVAL OF THIS ASSUMPTION WILL BE CLARIFIED IN A FUTURE REVISION OF EPM-JKJ-022988 ; NO IMPACT ON RESULTS	2
30	OP MODES	THE HEADER ON TABLE 6 OF CALC EPM-JKJ-022988 SHOULD READ "COMPONENT COOLING HEAT LOADS" NOT ".....WATER FLOWS"	HEADER INFORMATION FOR TABLE 6 WILL BE CORRECTED IN A FUTURE REVISION OF CALC EPM-JKJ-022988	2

* Action Categories:
1. To be completed prior to Unit 1 Fuel Load.
2. Change or action to be implemented at opportune time consistent with site priorities (may be completed after Fuel Load)
3. Optional or enhancement.
4. Complete.
5. No action to be taken.

TABLE III.B-1 (cont'd)
MECHANICAL CALCULATIONS & KNOWN ISSUES SUMMARY

ITEM	ISSUE	OBSERVATION	RESOLUTION	ACTION *
31	OP MODES	DELETION OF LOSS OF ERCW AS AN OPERATING MODE FROM CALC. EPM-JKJ-022988 REQUIRES AN EVALUATION FOR EFFECTS ON CCS EQUIPMENT BE PERFORMED PRIOR TO RESUMING PLANT OPERATION SHOULD A LOST TRAIN OF ERCW OCCUR	THIS LIMITATION TO OPERATION WILL BE INCLUDED IN SECTION 4.0 OF THE CCS SD PRIOR TO FUEL LOAD	1
32	OP MODES	CCS OP MODES CALC. EPM-JKJ-022988 METHODOLOGY IS DIFFICULT TO FOLLOW	CALC WAS CORRECT; OBSERVATION IS APPLICABLE TO FAMILY OF CALCS; TVA WILL CREATE A ROADMAP DESIGN DOCUMENT TO CLARIFY THE APPLICABLE METHODOLOGY	2
33	OP MODES	CCS OP MODES CALC. EPM-JKJ-022988 DOES NOT PROVIDE DOCUMENTATION FOR MODES SELECTION	CALC WAS CORRECT; OBSERVATION IS APPLICABLE TO FAMILY OF CALCS; TVA WILL CREATE A ROADMAP DESIGN DOCUMENT TO CLARIFY THE APPLICABLE METHODOLOGY	2
34	OP MODES	CCS OP MODES CALC. EPM-JKJ-022988 CONTAINS TWO PAGES NUMBER 16	EPM-JKJ-022988 WILL BE REVISED TO CORRECT ADMIN ERROR	2
35	OP MODES	CCS OP MODES CALC. EPM-JKJ-022988 PROVIDES NO JUSTIFICATION FOR OPERATING PRESSURES	CALC WAS CORRECT; OBSERVATION IS APPLICABLE TO FAMILY OF CALCS; TVA WILL CREATE A ROADMAP DESIGN DOCUMENT TO CLARIFY THE APPLICABLE METHODOLOGY	2
36	OP MODES	CCS OP MODES CALC. EPM-JKJ-022988 DOES NOT CLEARLY DESCRIBE THE BASIS FOR THE HEAT LOADS APPLIED	CALC WAS CORRECT; OBSERVATION IS APPLICABLE TO FAMILY OF CALCS; TVA WILL CREATE A ROADMAP DESIGN DOCUMENT TO CLARIFY THE APPLICABLE METHODOLOGY	2
37	ANALYTICAL LIMITS	THE ASSUMPTION APPEARS OPTIMISTIC THAT THE OPERATOR TRIPS THE CONTAINMENT SPRAY PUMPS WITHIN 10 SEC AFTER THE LO-LO RWST ALARM.	ASSUMPTION IS JUSTIFIED ON THE BASIS OF SIMULATOR TESTING AT SQN WHICH DEMONSTRATED THAT THIS ACTION STEP IS ACCOMPLISHED IN LESS THAN 5 SEC.	5
38	ANALYTICAL LIMITS	RWST/RHR LIMITS/SETPOINTS CALC WBN-OSG4-071 DOES NOT REFERENCE OR ADDRESS VORTEX LIMITS FROM NUREG/CR-2772.	VORTEX TEST REFERENCED IN THE CALC IS DIRECTLY APPLICABLE TO WBN AS WELL AS SQN SO NO VORTEX ANALYSIS NECESSARY. THE SQN CALC SQS2-0045 MAY BE ADDED AS A REFERENCE IN A FUTURE REVISION OF CALC WBN-OSG4-071	3
39	SERVICE/ INSTRUMENT AIR	SUGGEST INSPECTION OF AIR RECEIVER TANK FOR CORROSION	THE SUGGESTED INSPECTION PROGRAM IS IN PLACE. PREVENTATIVE MAINTENANCE IDENTIFIERS 0-RCVR-032-001, 0-RCVR-032-002 AND 0-RCVR-032-003 REQUIRE VISUAL INSPECTION EVERY 3 YEARS.	5

* Action Categories: 1. To be completed prior to Unit 1 Fuel Load.
2. Change or action to be implemented at opportune time consistent with site priorities (may be completed after Fuel Load)
3. Optional or enhancement.
4. Complete.
5. No action to be taken.

TABLE III.B-1 (cont'd)
MECHANICAL CALCULATIONS & KNOWN ISSUES SUMMARY

ITEM	ISSUE	OBSERVATION	RESOLUTION	ACTION *
40	HEATER DRAINS	SUGGEST MIN WALL CALCULATIONS BE DEVELOPED	SUBJECT MAIN RUN PIPING CONFIRMED TO BE INCLUDED IN THE FLOW ACCELERATED CORROSION (FAC) PROGRAM FOR WALL THICKNESS MONITORING IN RESPONSE TO INPO SOER 87-003. MIN WALL CALCULATIONS TO BE DEVELOPED PRIOR TO FIRST REFUELING OUTAGE INSPECTION	2
41	HEAT EXCHANGER MONITORING	THE WBN STATUS AND COMMITMENTS RELATIVE TO THE GL 89-13 HEAT EXCHANGER MONITORING PROGRAM WERE NOT CLEAR TO THE REVIEWER	WBN COMPLETED PRELIMINARY TESTING ON 12/23/94 & THE COMMITMENT TO THE NRC IS TO IMPLEMENT THE FULL TEST PROGRAM PRIOR TO STARTUP AFTER THE FIRST REFUELING	2

* Action Categories: 1. To be completed prior to Unit 1 Fuel Load.
2. Change or action to be implemented at opportune time consistent with site priorities (may be completed after Fuel Load)
3. Optional or enhancement.
4. Compiete.
5. No action to be taken.

III. CALCULATION REVIEW

C. CIVIL

1.0 SCOPE

The objective of this assessment was to verify technical adequacy, accuracy and completeness of civil engineering activities. Assessment scope included selected aspects of:

- Corrective Action Programs (CAPs)
- Post-CAP Emergent Work
- Technical Issues

Field implementation of civil designs was primarily covered by a separate assessment that focused on implementation activities for the engineering disciplines.

The approach applied for the civil assessment involved four separate teams that focused reviews on distinct civil engineering work areas. Each team was led by an independent industry participant with acknowledged expertise within the assigned area of review. Due to extensive previous calculation audits that have not revealed generic technical issues, the review focused on programmatic documentation. Adequacy was judged in accordance with the following factors:

- Technical Adequacy
  - compliance and/or consistency with regulatory requirements and industry practices
  - valid design input
  - technical quality
- Completeness
  - appropriate scope
  - satisfaction of CAP commitments
  - existence of recurrence controls
  - existence of controlled interfaces

1.0 SCOPE (cont'd)

- Accuracy

  - reasonable results
  - satisfaction of objectives
  - appropriate design output documentation

2.0 RESULTS

The scope, results and conclusions from each team are summarized below.

2.1 TEAM 1 - Civil/Structural Issues and Programs (Reference 4.1)

SCOPE

- Technical Topics:

  - NRC request for additional information on NSSS structural modeling
  - floor loads
  - seismic instrumentation
  - HVAC CAP
  - Conduit CAP
  - Cable Tray CAP
  - platforms and structural steel
  - concrete design
  - baseplates, embedments and anchors
  - tornado missiles
  - doors and hatches
  - Thermo-Lag program
  - building structural qualification
  - containment and NSSS
  - pipe rupture
  - emerging issues
  - communication (i.e., interfaces) among engineering, operations and maintenance

2.1 TEAM 1 - Civil/Structural Issues and Programs (Reference 4.1) (cont'd)

SCOPE (cont'd)

- Selected Document Reviews Included:
  - closure reports
  - procedures
  - inspection reports
  - memoranda
  - calculations
  - regulatory guides
  - FSAR
- Interviews with Cognizant Engineers
- Field Observation

RESULTS

- Found no deficiencies
- Documented two (2) observations: see Items 1 & 2 in Table III.C-1
  - Two (2) additional field implementation observations generated and documented in Field Assessment Report, Section V and Attachment V-5.

2.2 TEAM 2 - Hanger and Analysis Upgrade Program and Equipment Seismic Qualification Program (References 4.2 and 4.3)

SCOPE

- Technical Topics:
  - large and small bore piping
  - pipe supports
  - pipe rupture evaluation
  - ESQ CAP
  - Emergent ESQ Work
  - internal and external interfaces

2.2 TEAM 2 - Hanger and Analysis Upgrade Program and Equipment Seismic Qualification Program (References 4.2 and 4.3) (cont'd)

SCOPE (cont'd)

- Selected Document Reviews Included:
  - corrective action plans
  - closure reports
  - design criteria
  - specifications
  - procedures
- Interviews with Cognizant Engineers
- Field Observation

RESULTS

- Found no deficiencies
- Documented two (2) observations: see Items 3 and 4 in Table III.C-1

2.3 TEAM 3 - Civil Field Related Issues (Reference 4.4)

SCOPE

- Technical Topics:
  - damaged, loose or missing hardware
  - temporary plant configurations requiring seismic II/I evaluation
  - general engineering specification compliance
  - commodity clearance requirements
- Selected Document Reviews Included:
  - general engineering specifications
  - site procedures
  - site instructions
  - site practices
  - site work implementing documents

2.3 TEAM 3 - Civil Field Related Issues (Reference 4.4) (cont'd)

SCOPE (cont'd)

- Field Observation

RESULTS

- Found no deficiencies and reported one (1) observation documented in Field Assessment Report, Section V, Attachment V-5.

2.4 TEAM 4 - General Engineering Specification (G-Spec) and Design Criteria Exceptions (Reference 4.5)

SCOPE

- Exceptions to Civil Engineering Related G-Specs and Design Criteria
  - technical adequacy
  - proper application
- Document Reviews Included:
  - G-Specs (G-32, G-51 and G-90)
  - specification revision notices (SRNs)
  - pertinent regulatory documents
  - design change notices (DCNs)
  - work plans
  - quality information requests/releases (QIRs)
- Interviews with Cognizant Engineers

RESULTS

- Found no deficiencies
- Documented one (1) Observation: see Item 5 in Table III.C-1

TABLE III.C-1
CIVIL/STRUCTURAL CALCULATION REVIEW
SUMMARY OF OBSERVATIONS

ITEM	OBSERVATION	RESOLUTION	ACTION*
1	NEED TO CONFIRM ENGINEERING REQUIREMENTS FOR ABNORMAL OPERATING INSTRUCTION AOI-9 INCLUDING RESOLUTION OF APPARENT DISCREPANCY WITH FSAR CONCERNING INSTRUMENT LABELS AND CLARIFICATION OF CONFUSING PROCEDURE IN APPENDIX B	THE ADEQUACY OF EXISTING ENGINEERING REQUIREMENTS RELEVANT TO AOI-9 INCLUDING INSTRUMENT LABELLING AND REQUIRED PROCEDURES WILL BE ENSURED THROUGH 47W800 DRAWING SERIES REVIEW AND UPDATE PRIOR TO FUEL LOAD.	1
2	NEED TO CONFIRM APPLICABLE SPECTRA FOR SEISMIC INSTRUMENTATION SET POINTS	"SET A" IS THE APPLICABLE SPECTRA FOR SEISMIC INSTRUMENTATION. WILL CONFIRM ADEQUACY OF TRIAXIAL RESPONSE SPECTRUM INSTRUMENT SETTING AND CONFIRM ENGINEERING REQUIREMENTS REGARDING SEISMIC INSTRUMENTATION IN THE PLANT TECHNICAL SPECIFICATIONS.	1
3	RIGOROUS ANALYSIS HANDBOOK COULD BE INTERPRETED TO ALLOW USE OF DESIGN PRESSURE IN LIEU OF MAXIMUM OPERATING PRESSURE FOR DETERMINATION OF AXIAL FORCES FOR THE DESIGN OF UNTIED BELLOWS (HAAUP)	REVIEW OF WBN INSTALLATIONS INDICATES ALL UNTIED BELLOWS CONSIDERED MAXIMUM OPERATING PRESSURE FOR DETERMINATION OF AXIAL FORCE. WILL REVISE WBN RIGOROUS ANALYSIS HANDBOOK TO CLEARLY SPECIFY MAXIMUM OPERATING PRESSURE REQUIRED AS AN ENHANCEMENT.	2
4	NEED TO ENTER WAREHOUSED REPLACEMENT ITEM DATA INTO EMS (ESQ)	MAY UPGRADE EMS TO ALLOW INPUT OF DATA BASED ON CONTRACT NUMBER AND REVISE DATA ENTRY INSTRUCTIONS TO REQUIRE RECORDING OF BOTH CONTRACT AND TIIC NUMBERS FOR QUALIFIED REPLACEMENT ITEMS WHEN INSTALLED.	3
5	G-32; TORQUE VALUE FOR 5/8" WEDGE BOLT NOTED IN APPENDIX Q (70 FT-LB) FOR CAQR WBP880518 IS NOT CONSISTENT WITH TABLE 3.3B IN MAIN BODY (110 FT-LB)	WILL REVISE G-32 TO ADMINISTRATIVELY CLARIFY THAT THE 70 FT-LB VALUE WAS ASSOCIATED WITH A PREVIOUS VERSION OF TABLE 3.3B WHICH WAS APPLICABLE FOR HILTI KWIK-BOLTS AS AN ENHANCEMENT.	1

*Action Categories:
1. To be completed prior to Unit 1 fuel load
2. Change or action to be implemented at opportune time consistent with site priorities (may be after fuel load)
3. Optional or enhancement
4. Complete
5. No action to be taken

3.0 CONCLUSIONS

- There is reasonable assurance of the technical adequacy, accuracy and completeness of civil engineering activities.
- No technical deficiencies (other than the NRC-identified issue on anchors in high density concrete discussed in Section V.) were identified.
- Criteria, procedures, work products, and the knowledge of the engineering staff were judged to be of acceptable quality.
- Explicit procedures and design criteria should contribute to preventing recurrence of the deficiencies that led to the need to implement the CAPs.
- Implementation of remaining identified civil work should result in readiness for Unit 1 operation.

4.0 REFERENCES

4.1 Chen, Chang, Civil Discipline - Team 1 Report, Watts Bar Unit 1 Start-up Review, January 12, 1995

4.2 Landers, Donald F., Civil Engineering Assessment - Hanger and Analysis Upgrade Program Corrective Action Program and Related Emerging Issues, Watts Bar Nuclear Plant - Unit 1, January 18, 1995 (Team 2)

4.3 Landers, Donald F., Civil Engineering Assessment - Equipment Seismic Qualification (ESQ) Corrective Action Program (CAP) and Related Issues, Watts Bar Nuclear Plant - Unit 1, January 18, 1995 (Team 2)

4.4 du Bouchet, A. V., Start-up Review Program - Team 3 Summary Report, Watts Bar Nuclear Plant - Unit 1, January 26, 1995

4.5 Smith, Ronald J., Civil Discipline Review of the General Engineering Specifications and Design Criteria Exceptions, Watts Bar Nuclear Plant, January 24, 1995 (Team 4)

IV. ELECTRICAL ENGINEERING SPECIFICATION REVIEW

A. SCOPE

The scope of this assessment was to review the Electrical General Engineering Specifications (G-Specs) and site implementing procedures (MAIs, MIs) to ensure that cable and electrical installations meet engineering requirements and are being used effectively to implement these requirements. The review was performed in four parts as follows:

1. Review of General Engineering Specification G-38 to industry standard IEEE 690 - 1984.

   - Review of IEEE 690-1984 to determine that applicable requirements were included in G-38
   - Identification of requirements that may not be included

2. Comparison review of G-38 and G-40 to site implementing instructions

   - Review of the engineering specifications and selected key attributes for cable pulling, cable terminations, cable splices and conduit installations
   - Review of Modification/Addition Instructions (MAI) and Maintenance Instructions (MI) for incorporation of selected attributes
   - Review of selected attributes from Modification/Addition Instructions for comparison to engineering specifications
   - Review of 9 MAIs and MIs and 2 specifications

3. Review of select work implementing documents (WID) to validate adequate documentation of work performed in the field

   - Review for adequate documentation within the WID for key work activities associated with cable, terminations, and splice installations

A. SCOPE (cont'd)

4. Review of G-38 and G-40 variances for technical adequacy

- Review of G-38 and G-40 variances to determine technical adequacy
- Review of variances to determine if any should be listed as input to a base DCN

B. RESULTS

1. Review of General Engineering Specification G-38 to industry standard IEEE 690 - 1984.

- There is clear delineation of the IEEE requirements to the G-specification requirements
- No deficiencies or observations identified
- Specification contained the installation requirements listed in the standard
- Table IV-1 provides a cross reference between G-38 and IEEE 690 provisions

2. Comparison review of G-38 and G-40 to site implementing instructions

- Table IV-2 identifies the documents reviewed
- Identified 21 observations contained in Table IV-3

3. Review of Work Implementing Documents for Adequate Documentation

- Reviewed ten (10) work plans from five (5) DCNs contained in Table IV-4 involving cable removal and cable installation, cable terminations, and cable splices

B. RESULTS (cont'd)

- Documentation of the specific applicable attribute is retrievable within the WID
- Identified no deficiencies or observations

4. Review of G-38 and G-40 variances for technical adequacy

- Reviewed forty two (42) variances for G-38 and twenty four (24) for G-40
- Identified no deficiencies or observations
- Results contained in Tables IV-5 and IV-6

C. CONCLUSIONS

1. Review of General Engineering Specification G-38 to industry standard IEEE 690 - 1984.

- G-38 incorporates all the requirements of IEEE 690 except the fire protection requirements, which are incorporated in other design documents

2. Comparison review of G-38 and G-40 to site implementing instructions

- Engineering Specifications G-38 and G-40 accomplish established requirements
- Some "how to" information is in G-38 and G-40 and belongs more appropriately in a procedure-type document, such as MAIs and MIs.

C. CONCLUSIONS (cont'd)

- A move to site specific specifications in lieu of the general specifications would simplify the revision process and facilitate the needs of the individual plants, while maintaining the necessary engineering requirements.

- The MAIs are a basic restatement of G-specs with data sheets

- The MIs are step by step detailed implementing procedures with appropriate signoffs for each step

- Of the 21 observations identified, 11 revision changes will be made to the specifications and implementing instructions to either clarify the requirements to lessen the risk of error or to correct a minor error.

- One of the 11 is currently being addressed by WBSCA940063.

3. Review of Work Implementing Documents for Adequate Documentation

   - Completion of work is adequately documented in the work plans

4. Review of G-38 and G-40 Variances

   - Approved variances for G-38 and G-40 are technically adequate

   - No additional variances were identified that should have been listed as input to a base DCN

D. REFERENCES

- Collins, J.D. & Spore, D. Electrical Engineering Specification Review, Watts Bar Nuclear Plant - Unit 1, February 1995.

TABLE IV-1
ELECTRICAL ENGINEERING SPECIFICATION REVIEW

SECTION & NAME	IEEE 690 REQUIREMENTS	TVA G-38 SPECIFICATION REQUIREMENTS
1. General	a. Scope of the standard is to provide direction for the design and installation of safety related electrical cable systems, including associated circuits, in nuclear power generating stations. b. Purpose of the standard is to identify existing standards and to establish requirements pertaining to safety related cable systems in nuclear power generating stations.	a. & b. The specification describes materials and procedures for receiving, storage, and handling, installation, modification, and maintenance, including terminating, splicing, and marking field installed cables rated up to 15,000 volts. It also applies to modification or maintenance of vendor wired equipment that is required by design drawings. The specification is supplemented by instructions on site engineering drawings.
2. References	NA	NA
3. Cable, Field Splices, and Connection Qualification	a. Shall have a qualified life for all service conditions b. Shall be qualified in accordance with IEEE 323-1983 and IEEE 383-1974 c. Cables in trays shall pass the vertical tray flame test of IEEE 383-1974	a. Acceptable materials are covered in 2.2 and 3.4.1. Installation is covered in 3.4.1.4 and 3.4.2.3. b. & c. Design criteria WB-DC-30-5 governs the cable qualification. Cable is qualified to IEEE 383-1974.
4. Conductor Sizing	a. Cables shall be sized to carry load current b. Size shall carry normal, emergency overload, and short circuit current w/o exceeding rated temperature of the insulation.	a. Conductor sizing is governed by WB-DC-30-5 and DS-E12.6.3. b. Type and size are required to be installed as specified on design output in 3.2.1.1.
5. Electrical Segregation	a. Segregated to voltage level, signal level, and vulnerability to electrical noise. b. Medium voltage, low voltage, control, instrumentation	a. & b. Voltage level segregation is governed by WB-DC-30-5 and design output drawings.
6. Separation and Identification	a. Shall meet the requirements if IEEE 384-1981	a. Physical separation is governed by WB-DC-30-4. Identification requirements are contained in sections 3.6 and 3.2.1.11.
7. Shielding and Shield grounding	Medium voltage: a. Cables rated above 5kV shall be shielded. b. Shielded cables shall be terminated with qualified terminations. c. Shields shall be solidly grounded. d. Compensation for the heating effect of the induced circulating current shall be considered when calculating the cable ampacity. Instrumentation: e. Shields shall be electrically continuous f. The shield of each cable shall be isolated. g. The shield shall not be used as an electrical conductor. h. The shielding criteria shall be in accordance with the system design and manufacturer's instructions.	a., b., c., & d. Types of shielded cable is governed by WB-DC-30-5. Requirements for terminations of the shield, grounding, and compensation for the heating effect are contained in sections 3.4.1, 3.4.2.2.a, and 3.4.2.2. e., f., g., & h. Section 3.4.1.1.S contains requirements for protecting shield during splicing.

TABLE IV-1 (cont'd)
ELECTRICAL ENGINEERING SPECIFICATION REVIEW

SECTION & NAME	IEEE 690 REQUIREMENTS	TVA G-38 SPECIFICATION REQUIREMENTS
8. Cable Penetration Fire Stops, Fire Breaks, and System Enclosures	a. Material is governed by environmental conditions and design basis events. b. Fire stops shall be provided wherever the cable system penetrates a rated fire resistive barrier. c. Cable tray fire breaks shall be installed in cable tray systems as deemed necessary by the fire hazard analysis. d. Cocoons to permit less separation distances than required by IEEE 384-1981 shall be in compliance to IEEE 384-1981.	ALL REQUIREMENTS ARE IN ACCORDANCE WITH TVA's FIRE PROTECTION R CAP.
9. Fire Detection Systems	a. Automatic fire detection systems shall be installed in accordance with NFPA 72D-1979 and NFPA 72E-1982. b. Fire detection systems shall be electrically supervised to comply with requirements of NFPA 70-1984 Art 760 and NFPA 72D-1979.	ALL REQUIREMENTS ARE IN ACCORDANCE WITH TVA's FIRE PROTECTION R CAP.
10. Fire Extinguishing Systems	a. A fire hazard analysis shall be conducted to determine if fixed automatic fire extinguishing systems are necessary. b. Automatic water spray systems shall be in accordance with NFPA 13-1983 or NFPA 15-1982. c. Sensitive equipment shall be protected from spray and sealed against potential damage due to water traveling along the cable system. d. System testing shall be in accordance with NFPA standards. e. System shall alert the control room operators of system operation or abnormal condition f. Ventilation shall be shut down when required to prevent spread of smoke, gas to other areas. g. Dampers shall be closed prior to fire protection discharge. h. Portable extinguishers shall be located throughout the plant in accordance with NFPA 10-1981. i. Water shall not be used on fires involving energized cables. j. Standpipe and hose stations shall be located throughout the plant in accordance with NFPA 14-1983.	ALL REQUIREMENTS ARE IN ACCORDANCE WITH TVA's FIRE PROTECTION R CAP.

TABLE IV-1 (cont'd)
ELECTRICAL ENGINEERING SPECIFICATION REVIEW

SECTION & NAME	IEEE 690 REQUIREMENTS	TVA G-38 SPECIFICATION REQUIREMENTS
11. Handling and Installation	a. Installation and inspection shall meet IEEE 336-1980.	a. IEEE 336-1980 requires that procedures be prepared and documented for installation and that verification occur for pre-installation, during installation, and post installation. Installation requirements are contained throughout the body of the specification. Verification requirements are contained in 4.1.
	b. Cables shall be installed in raceway systems that are qualified for the design basis events.	b. Type of raceways is governed by WB-DC-30-5 and DS-E13.1 and DS-13.2.
	c. Cables shall be installed to meet separation in accordance with IEEE 384-1981.	c. Separation requirements are governed by WB-DC-30-4 and the design output drawings.
	d. The raceway system shall be permanently identified prior to installing cables.	d. Requirement contained in section 3.2.1.1.M.
	e. Cable field splices shall be recorded and filed.	e. Requirement contained in section 3.4.1.1.
	f. The ends of cable shall be sealed during storage.	f. Requirement contained in section 2.3.
	g. Cable reels shall be stored and handled in accordance with manufacturer's recommendations.	g. Requirement contained in section 2.3.
	h. Cables shall be installed in raceways that have suitable pull points so pull tension and sidewall bearing pressure are not exceeded	h. Requirement contained in section 3.2.1.1.
	i. Cables shall be installed in raceways that have adequately sized bends, boxes and fittings so that cable bend radius is not exceeded.	i. Requirement contained in section 2.2.6 for cable bending equipment, section 3.2.1.1.B. for pull points, and section 3.2.1.3. for bend radius.
	j. In steel raceway all phases of an AC circuit shall be installed in the same raceway.	j. Requirement governed by WB-DC-30-5 and design output drawings.
	k. Cables shall be installed to compensate for movement of mechanical equipment.	k. Requirement for movement in penetration is contained in section 3.2.1.10. Other movement is covered by installation of the raceway system in GES G-40 sections 3.2.6 and 3.4.9.
	l. Cables shall not be installed in raceways that are utilized to carry or support equipment, piping, inst tubing unless the design is specific and if protection is provided for the cables.	l. The raceway design is governed by design output drawings.
	m. For cable pulling the manufacturer's instructions shall be followed.	m. Cable pulling requirements are contained in section 3.2.
	n. Cables shall not be pulled around sharp corners or obstructions.	n. Requirement contained in section 3.2.1.1.C.
	o. Cables shall not be pulled at temperatures below manufacturer's recommendation.	o. Requirement to not pull cable when temperatures are below 15°F is contained in section 3.2.1.1.F.
	p. Cable pulling lubricants shall be compatible with the cable jackets.	p. Requirement contained in section 2.2.7.
	q. Bare wire rope shall not be used to pull cables in conduits.	q. Requirement for the type of rope to use during installation is contained in section 3.2.1.1. and 3.2.1.2.
	r. Medium voltage cables shall be properly sealed during and after installation. Other cables shall be sealed during and after installation in wet locations.	r. After cables are pulled, a length of undamaged cable is cut off and the cables are sealed (3.2.1.11.A).
	s. The cable end within a pulling device shall be removed prior to terminating the cable.	s. Requirement contained in section 3.2.1.1.
	t. The manufacturer's recommended bend radius shall be followed for the permanent training.	t. Requirement contained in section 3.2.1.3.
	u. Protection of the cables shall be provided on trays at floor levels and at locations where there is likelihood of damage.	u. The location of tray covers is governed by WB-DC-30-5 and design output drawings.

TABLE IV-1 (cont'd)
ELECTRICAL ENGINEERING SPECIFICATION REVIEW

SECTION & NAME	IEEE 690 REQUIREMENTS	TVA G-38 SPECIFICATION REQUIREMENTS
11. Handling and Installation (continued)	w. (cont'd) further cables unless an inspection or analysis indicates additional cables can be installed. x. An analysis shall determine the weight of the cable loading and this value shall be used for the seismic analysis of the support system. y. Conduit fill shall be in accordance with NFPA 70-1984. z. Cable terminals shall not be subjected to excessive tensions resulting from vertical runs. aa. Vertical cable runs shall be secured by support devices within the raceway system. ab. In vertical trays cables shall be secured to keep all cables within the trays.	w. (cont'd) requires a design evaluation and justification. Section 3.2.1.10E requires notification to engineering when slots or sleeves are full. x. Raceway weight is governed by WB-DC-20-21.1 and WB-DC-40-31.10. y. Conduit fill is governed by design output drawings using DS-E13.1.3 and E13.1.4 and WB-DC-30-22.. z. Vertical cable support requirements are contained in section 3.2.1.9. aa. Vertical cable support requirements are contained in section 3.2.1.8 and 3.2.1.9. ab. Requirements for installing cables in trays are contained in section 3.2.1.8.
12. Acceptance Testing of Installed Cables	a. Testing of installed cables shall meet the requirements of IEEE 336-1980. b. Medium voltage cable shall be DC high potential tested prior to connection to equipment. c. Low voltage cables shall be insulation resistance tested prior to connection to equipment or functionally tested at equipment operation voltage. d. Test results shall be recorded and filed.	a. IEEE 336-1980 requires that procedures be prepared and documented for installation and that verification occur for pre-installation, during installation, and post installation. Installation requirements are contained throughout the body of the specification. Verification requirements are contained in 5.1. b. Requirement contained in section 5.1.3.2. c. Requirement contained in section 5.1.2 d. Requirement contained in section 4.1.3.2.L.
13. Documentation	a. Documents shall be prepared as the work is accomplished to provide evidence of the quality of the items and activities performed.	a. Requirement contained in section 4.2.

TABLE IV-2
ELECTRICAL ENGINEERING SPECIFICATION REVIEW

DOCUMENT NUMBER	DOCUMENT TITLE
G-38	Installation, Modification, and Maintenance of Insulated cables rated Up to 15,000 Volts
G-40	Installation, Modification, and Maintenance of Electrical Conduit, Cable Trays, Boxes Containment Electrical Penetrations,Electrical Conductor Seal Assemblies, Lighting and Miscellaneous Systems
MAI-3.1	Installation of Electrical Conduit Systems and Conduit Boxes
MAI-3.2	Cable Pulling for Insulated Cables Rated Up to 15,000 Volts
MAI-3.3	Cable Terminating, Splicing, and Testing for Cables Rated Up to 15,000 Volts
MI-57.015	Taping of Electrical Terminations and Splices
MI-57.102	Electrical Terminations
MI-57.103	Torque Value for Electrical Terminations
MI-57.106	Repairing Damaged Cable
MI-57.107	Application of Raychem Material
MI-57.113	Cable Bend Radius

WATTS BAR NUCLEAR PLANT-UNIT 1
INDEPENDENT ENGINEERING & FIELD ASSESSMENT

TABLE IV-3
ELECTRICAL ENGINEERING SPECIFICATION REVIEW
SUMMARY OF OBSERVATIONS

NO.	CATEGORY OF OBSERVATION	OBSERVATION	RESOLUTION	ACTION*
1	Implementing instruction more conservative than specification	MI-57.102, Paragraph 6.1.E.5 does not provide any information or a reference for selecting 3M taping applications.	No action required. Instructions for selection are provided in other sections.	5
2	Implementing instruction more conservative than specification	MAI-3.3, Paragraph 6.3.9.d limits self-insulated terminals and splices to Kynar whereas, G-38 permits Tefzel or Kynar.	No action required, since the Tefzel is not specified in the procedure.	5
3	Implementing instruction more conservative than specification	MAI-3.2, Appendix H, Table H-1 has an upper boundary of < 2.0" for the MTR column > 1.0" whereas, DS-E12.1.5, Table 1 does not have this upper boundary.	No action required, since the procedure limits are conservative.	5
4	Specification references made to superseded documents	MAI-3.3 rev. 12, Appendix A, Paragraph A3.1 refers to Standard Drawings SD-E12.5.5-1 & SD-12.5.5-2; however, a check of these drawings revealed that SD-E12.5.5-1 rev. 7 & SD-E12.5.5-2 rev. 8 incorporated all valid requirements in General Engineering Specification G-38. G-38 was revised by SRN-150 to incorporate the Standard Drawing requirements. CN-4 to MAI-3.3 incorporated some requirements from SRN-G-38-150 but apparently missed the references to these drawings in Appendix A.	No impact. The contents of the superseded documents had been adequately reflected in the specification.	4
5	Specification references made to superseded documents	A situation similar to the observation above exists in MAI-3.3 rev. 12, Appendix A, Paragraph A3.2 for SD-E12.5.3. In addition, G-38 paragraph 2.2.2.2 refers to 3M Company splice kits based on SD-E12.5.3.	No impact. The contents of the superseded documents had been adequately reflected in the specification.	4
6	Clarification of requirements	MI-57.102, Paragraph 8.0 refers to data package handling per Document Control and Records Management Program for documenting Class 1E splices. G-38, paragraph 3.4.1.1 requires that Class 1E splices be documented in a QA record and the 10CFR50.49 splices be documented in EQ binders.	No action required. The splices are documented as a QA record as dictated by the work implementing document and will be incorporated into the EQ binders prior to fuel loading.	5
7	Clarification of requirements	MAI-3.2, Paragraph 6.2.9.b does not consider replacement of flex conduit as a cable pull. No exemption from cable pull or pullback requirements could be found in G-38. However, Paragraphs were identified in G-38 that permit pullbacks and pushes into flex conduit.	No action required. Cables removed or installed by sliding the flexible conduit over them is not considered a cable pull.	5

*Action Categories:
1. To be completed prior to Unit 1 fuel load
2. Change or action to be implemented at opportune time consistent with site priorities (may be after fuel load)
3. Optional or enhancement
4. Complete
5. No action to be taken

TABLE IV-3 (cont'd)
ELECTRICAL ENGINEERING SPECIFICATION REVIEW

NO.	CATEGORY OF OBSERVATION	OBSERVATION	RESOLUTION	ACTION*
8	Clarification of requirements	The G-40 requirement to not cut structural steel or reinforcing bars was not found in MAI-3.1.	These requirements are captured in other specifications and procedures. No action required.	5
9	Clarification of requirements	For silicone rubber cables, Paragraph 3.4.3.1.C of G-38 allows the use of pre-insulated terminals or butt splices for #10 and smaller wire sizes when the temperature of the conductor does not exceed 150°C within the primary containment. Paragraph 2.2.3.1 of G-38 prohibits pre-insulated terminals for Class 1E applications inside containment and in high energy line break areas unless approved by engineering or located in an environmentally sealed enclosure. These requirements appear to conflict with Paragraph 2.2.1.3 which allows only uninsulated terminals and splices under Raychem materials.	Paragraph 2.2 refers to the type of terminal lugs allowed for applications and Paragraph 3.4 refers to the type of splice installation material to be used. Installations are performed using these requirements and detailed design output under QC controlled work processes. Therefore, the two sections are not in conflict and no action is required.	5
10	Beneficial improvements	MAI-3.3, Paragraph 6.2.7 permits bending of Amp and T&B terminal lugs but is silent on bending Burndy terminal lugs.	Changes will be made in a future revision to include Burndy.	2
11	Beneficial improvements	MI-57.015, Paragraph 6.5.2 refers to Specification G-38 instructions for selecting material. Reference back to the higher tier document is not appropriate for this type of document.	Present instructions are adequate, but procedure revisions may be performed as enhancements.	3
12	Beneficial improvements	MI-57.102, Paragraph 6.1.G does not provide sufficient information to ensure correct application of pre-insulated terminals and splices. MI-57.102, Paragraph 6.1.G.3 refers to "non-quality" applications. The term "non-quality" is not appropriate.	Changes to the procedure will be performed at the next revision as enhancements.	2
13	Beneficial improvements	Since the type of insulation permitted on self insulated lugs and splices is dependent on the application and/or area, MI-57.102, Table C-2 should show type insulation for RC terminal series as was done for T&B RA and RB series.	Changes to the procedure may be performed at the next revision as enhancements.	3
14	Beneficial improvements	MAI-3.1, Paragraph 6.2.15.a does not include the requirement for engineering approval for a reduction in conduit size when not specified on design drawings.	Procedure clarifications will be provided at the next revision to preclude any misunderstandings.	2

*Action Categories:
1. To be completed prior to Unit 1 fuel load
2. Change or action to be implemented at opportune time consistent with site priorities (may be after fuel load)
3. Optional or enhancement
4. Complete
5. No action to be taken

TABLE IV-3 (cont'd)
ELECTRICAL ENGINEERING SPECIFICATION REVIEW

NO.	CATEGORY OF OBSERVATION	OBSERVATION	RESOLUTION	ACTION*
15	Conflict between engineering documents or incorrect terminology	G-38, Paragraph 3.4.1.9 allows adhesive backed cable supports (ABCSM) only if mounted with bolting hardware; however, SD-E15.3.2, Note 11 permits adhesive backed cable supports without bolting.	Acceptable since the apparent conflict has no impact on analysis or hardware because the SD contains requirements for installed conditions and future installations. Engineering inspections as part of the Electrical Issues CAP have determined where ABCSM's must be mechanically fastened.	5
16	Conflict between engineering documents or incorrect terminology	G-40, Paragraph 3.2.2.4 refers to "nonseismic Category I" structures; however, Category I structures are seismic structures. MAI-3.1, Paragraph 6.1.2.e refers to a nonseismic structure.	Acceptable since the apparent conflict has no impact on analysis or hardware, however, specification changes will be performed for clarification.	2
17	Implementing instruction not correct	Specification G-38 requires maximum allowable cable pulling tension calculations for cable pulling in raceways. MAI-3.2 refers to maximum allowable pulling tension calculations for conduit raceways only, which is not in complete agreement with the G-38 requirement. Additionally, limiting maximum allowable cable pulling tension to cable conductor strength for non 1E cables appears contradictory to G-38 requirements.	Procedure changes will be made at a future revision. Other sections within the MAI place restrictions on cable pulling in cable trays, therefore, no physical work has been performed incorrectly and there is no physical non compliance to installation requirements. Proper maximum allowable cable pulling calculations for non 1E cables are performed by site engineering using approved software, CBLPUL.	2
18	Implementing instruction not correct	MI-57.102, Paragraph 6.1.H.2 requirements for self-insulated terminals and splices for #8 or larger wire sizes are not correct and contradict Paragraph 6.1.H.1.	Procedure changes will be made in a future revision. The lists of acceptable terminals and splices contained in Appendix C does not include self-insulated material for #8 and larger wire sizes, therefore, no physical work had been performed incorrectly and there is no physical non compliance to installation requirements.	2

*Action Categories:
1. To be completed prior to Unit 1 fuel load
2. Change or action to be implemented at opportune time consistent with site priorities (may be after fuel load)
3. Optional or enhancement
4. Complete
5. No action to be taken

TABLE IV-3 (cont'd)
ELECTRICAL ENGINEERING SPECIFICATION REVIEW

NO.	CATEGORY OF OBSERVATION	OBSERVATION	RESOLUTION	ACTION*
19	Implementing instruction not correct	Although MI-57.102, Paragraph 6.1.E.10 refers to insulating shield drain wires, this G-38 requirement is not adequately conveyed in MI-57.102.	Procedure changes will be made at a future revision. This requirement was recently added to the specification as an enhancement in anticipation of increased industry awareness of potential degradation of aluminum mylar shields by borated water during a LOCA. This requirement affects new installations only and any maintenance performed would require replacements as found. No rework on these particular type installations have been required since the specification was changed; therefore, no physical work had been performed incorrectly and there is no physical non compliance to installation requirements..	2
20	Implementing instruction not correct	MAI-3.3, Attachment 1, Table 4 lists butt splices which are not identified in G-38.	This item involves butt splices for connecting wires of different sizes and has been captured in the corrective action program by WBSCA940063.	4
21	Implementing instruction not correct	Splice sketch in MI-57.107 does not agree with Raychem splice kit instructions.	Procedure requires revision to agree with kit instruction. No physical work was performed incorrectly since work is performed in accordance to kit instructions as required by G-38.	1

*Action Categories:
1. To be completed prior to Unit 1 fuel load
2. Change or action to be implemented at opportune time consistent with site priorities (may be after fuel load)
3. Optional or enhancement
4. Complete
5. No action to be taken

TABLE IV-4
ELECTRICAL ENGINEERING SPECIFICATION REVIEW

DCN NUMBER	DESCRIPTION
M7959	Replaced cables for the cable pullby issue in conduits VC758A, VC728A, VC759A, 1PLC3249A, and VC720A. (WP's D-07959-01 &-04)
P7265	Replaced cables for the cable pullby issue in conduits MC882A, MC879A, MC880B, MC923A, MC869B, and MC868A. (WP's D-07265-02 &-05)
P2992	Replaced cable which was removed for the silicone rubber testing. (WP's D-02992-02 & -03)
M14241	Replaced cable which was calculated to have exceeded the maximum allowable sidewall bearing pressure (SWBP). (WP's D-14241-02 & -03)
M11050	Replaced Diesel Generator feeder cables due to ampacity calculation failure. (WP's D-11050-05 & -58)

TABLE IV-5
ELECTRICAL ENGINEERING SPECIFICATION REVIEW (G-38)

CATEGORY OF VARIANCE	VARIANCE NO.'S	TECHNICAL JUSTIFICATION	REVIEW RESULTS
Variance no longer applicable	1	NA	NA
Cable pullbacks	2, 4, 6, 9	Variances 2, 4, and 6 were approved based on adequate lubricant, the pull would be a hand pull or a monitored pull, and the cables would be inspected for damage after the pull. Variance 9 was approved to allow the use of a mechanical pulling device with the tension limited to a specific calculated value.	The variances were approved based on sound engineering principles and are technically adequate.
Motor lead repairs	3, 7	Variance 3 was approved based on a letter from the vendor, Raychem. Variance 7 was approved based on qualification testing.	The variances were approved based on sound engineering principles and are technically adequate.
Cable repair	5, 10, 28, 29, 33, 38, 40, 43	Variances 5, 10, 28, 38, and 38 were approved based on the repair being made in a flexible conduit in a suitable location. Variance 33 was approved based on the repair having no adverse impact on the cable performance. Variance 40 was approved based on the cable being non Class 1E jacket repair, with no insulation damage, and the repair being located in a mild environment. Variance 43 was approved based on the shield not being totally torn and jacket repair performed with tape.	The variances were approved based on sound engineering principles and are technically adequate.
Voltage level mix	8	Approved based on a cable tray cover being placed on a V3 cable tray and the V4 cable resting on the cover.	The variance was approved based on sound engineering and is technically adequate.
Cable bend radius	12, 18, 22, 31	Variance 12 was approved based on the function of the non safety circuit. Variance 18 was approved based on vendor qualification. Variance 22 was approved based on a vendor report. Variance 31 was approved based on application and location.	The variances were approved based on sound engineering principles and are technically adequate.
Cable vertical drop	11, 15	Both approved based on engineering calculation.	The variances were approved based on sound engineering principles and are technically adequate.
Cable oversleeves	13	Approved based on adequate material and protection	The variance was approved based on sound engineering and is technically adequate.
Random lay of medium voltage cable in cable tray	14	Approved based on engineering ampacity calculations.	The variance was approved based on sound engineering and is technically adequate.

TABLE IV-5 (cont'd)
ELECTRICAL ENGINEERING SPECIFICATION REVIEW (G-38)

CATEGORY OF VARIANCE	VARIANCE NO.'S	TECHNICAL JUSTIFICATION	REVIEW RESULTS
Lugs and screws	16, 17, 30	Variance 16 was approved based on contact area of lug to terminal block. Variance 17 was approved based on circular mil area of barrel and the two conductors. Variance 30 was approved based on pull tests.	The variances were approved based on sound engineering principles and are technically adequate.
Computer software CBLPUL ver 3.2	19	Use of the software was acceptable since the requirement in question was below the allowable limit.	The variance was approved based on sound engineering and is technically adequate.
Cable splices in trays	20, 21	Variance 20 was approved based on failure analysis and splicing to be performed in accordance to SD E12.5.9 (ref DCN M11050). Variance 21 was approved based on an approved instruction from the vendor, Raychem.	The variances were approved based on sound engineering principles and are technically adequate.
Hardware used for bolted connections on motor center taps	23	Variance approved based on tightness of connector and insulating material.	The variance was approved based on sound engineering and is technically adequate.
End caps for spare conductors	24	Variance approved based on cables being located in enclosures and in a mild environment.	The variance was approved based on sound engineering and is technically adequate.
Rollers excluded from cable pull calculation	25	Variance approved based on expected pull tension calculation.	The variance was approved based on sound engineering and is technically adequate.
Pulling cable within critical jam ratio	32	Approved based on engineering placing requirements and limitations on the field installation.	The variance was approved based on sound engineering and is technically adequate.
Installation of MFR85 which is not in On-Mark	27	Variance approved based on the use of vendor data used in the pull tension calculation which showed the installation to be adequate.	The variance was approved based on sound engineering and is technically adequate.
Trimming of terminal lug to allow landing on a 1/2" wide terminal block	34	Variance approved based on trimmed lug being adequate size for a comparable sized lug.	The variance was approved based on sound engineering and is technically adequate.
Bolting hardware for splices	35	Variance approved based on size of lock washer and torquing of bolts.	The variance was approved based on sound engineering and is technically adequate.
Installation of fiber optic cable and copper cable in conduit without dedicated inter duct	37	Variance approved based on limitations placed on installation.	The variance was approved based on sound engineering and is technically adequate.
Use of solder to splice conductors to 26 AWG pigtails for electric door hinges	39	Variance approved based on function and use of standard industry requirements.	The variance was approved based on sound engineering and is technically adequate.

TABLE IV-5 (cont'd)
ELECTRICAL ENGINEERING SPECIFICATION REVIEW (G-38)

CATEGORY OF VARIANCE	VARIANCE NO.'S	TECHNICAL JUSTIFICATION	REVIEW RESULTS
AMP PIDG lugs with conductor strands extending equal to or beyond the end of the compression area	41	Variance approved based on vendor data.	The variance was approved based on sound engineering and is technically adequate.
Acceptance of 600V splice connectors and terminals used in 6.9KV applications	42	Variance approved based on vendor data.	The variance was approved based on sound engineering and is technically adequate.
Cable bend radius and terminal lugs	36	Variance to bend radius approved based on load cycle and load tests and variance for terminal lugs approved based on vendor data.	The variance was approved based on sound engineering and is technically adequate.

TABLE IV-6
ELECTRICAL ENGINEERING SPECIFICATION REVIEW (G-40)

CATEGORY OF VARIANCE	VARIANCE NO.'S	TECHNICAL JUSTIFICATION	REVIEW RESULTS
Repair of flexible conduits 1PP2668A and 2PP2320A	1	Variance approved based on the use of half lapped layers of 3M Scotch 22 electrical tape and location of conduit in a mild environment.	The variance was approved based on sound engineering and is technically adequate.
Flexible conduit length	2, 5, 6, 7, 15	All variances were approved based on civil engineering calculations.	The variances were approved based on sound engineering and are technically adequate.
Use of Service Air flexible conduit rather than American Boa	3, 8, 19	Variance 3 approved based on civil engineering calculation, pull tension calculations, and conduit fill. Variance 8 approved based on tested configuration. Variance 19 approved based on tested configuration and as installed configuration.	The variances were approved based on sound engineering and are technically adequate.
Use of T & B flexible conduit connectors without torquing	4	Variance approved based on the conduits not being required to be watertight, adequate electrical continuity, and pullout based on seismic testing.	The variance was approved based on sound engineering and is technically adequate.
Conduit separation from hot pipes	9, 10, 11, 12, 13, 14, 17, 18	Variances approved based on cable application, cable temperature rating, and pipe temperature.	The variances were approved based on sound engineering and are technically adequate.
Variance no longer required	16	DCN M6128 modified the condition, thereby, negating the need for the variance.	NA
Conduits inside containment routed below the maximum LOCA flood levels	20	Variance approved based on the conduits being characterized into three cases and accepted based on the specific evaluations for each case as follows: Case 1 - Acceptable because the conduits would not be submerged prior to completing their safety function as long they remain routed above the minimum elevations identified. Case 2 - Qualified for submergence based on the conduit construction or installation. Case 3 - Cables in these conduits are not required to function after an event that would cause them to be submerged.	The variance was approved based on sound engineering and is technically adequate.
Flexible conduit bend radius violations	21, 22, 24	Variance 21 approved based on engineering analysis of actual movements. Variance 22 approved based on flexible conduit lengths with negligible movements. Variance 24 approved based on actual conduit lengths and the allowable bend radius of the cables within the conduit.	The variances were approved based on sound engineering and are technically adequate.
Use of Anaconda "Sealtite 23 type EF" liqiutite flexible conduit	23	Approved based on bend radius, grounding and location.	The variance was approved based on sound engineering and is technically adequate.

V. FIELD ASSESSMENT

A. SCOPE/APPROACH

The Field Assessment Team performed an independent assessment of the adequacy, consistency and conformance to design output of installations to ensure a high degree of confidence that requirements and commitments have been met. Specific areas of scope were:

- Field assessment of specific attributes requested by the RHR System Assessment Team.
- Field assessment of specific attributes from the Calculation Review Teams (Civil, Mechanical & Materials and Electrical).
- Field assessment of a limited sample of attributes selected by the Electrical Specification Review Team.
- Independent general assessment of electrical and I&C field installations.

The effort to assess workmanship against the G-Specs and the general assessment of electrical and I&C installations were combined into a sampling review based on inspection of observable attributes.

The field assessment was grouped into two major activities:

1. SELECTED ATTRIBUTES

   a. RHR System Assessment Team

   b. Calculation Review Teams

      - Civil Calculation Review Team
      - Mechanical Calculation/Known Issues & Materials Review Teams
      - Electrical/I&C Calculation Review Team

A. SCOPE/APPROACH (cont'd)

2. GENERAL FIELD ASSESSMENT

a. Electrical Specifications Review Team [G-38 & G-40]

(1.) Reviewed general attributes - see Attachment V-1

NOTE: Attachment V-1 is a synopsis of selected G-Spec 38 and 40 attributes and additional experience based attributes.

(2.) Combined these attributes into general assessment of electrical and I&C installations

b. General Field Assessment of Electrical and I&C

(1.) Focused on the "most-complete" rooms and areas
(2.) Scope addressed in 2.a.(1) above
(3.) A general comparison review of similar and adjacent components or attributes was included as part of the assessment where practical

B. RESULTS OF SELECTED ATTRIBUTES ASSESSMENT

1. RHR SYSTEM ASSESSMENT TEAM

a. Over 400 component-specific attributes were requested for field assessment. Due to inaccessibility about 300 specific attributes were assessed. These attributes are summarized in Attachment V-2.

b. Found one deficiency: instrument drain valve installed backwards (WBPER950011); see Attachment V-3.

c. Four (4) other observations were made as discussed in Attachment V-4.

Conclusion: Installation of RHR System components against specific attributes is acceptable.

2. CIVIL CALCULATIONS REVIEW TEAM

a. Reviewed three (3) G-Spec attributes and seven (7) DCN's totaling more than 100 specific attributes

b. Found one (1) deficiency and noted three (3) observations:

- One deficiency regarding expansion anchors in high density concrete is covered by WBPER950095 (first identified by NRC) previously initiated (See Attachment V-3)
- Two (2) observations were evaluated to be acceptable as installed
- One (1) observation required an administrative calculation revision

Additional information for these observations is contained in Attachment V-5

Conclusion: All areas reviewed (with the exception of the PER) yielded acceptable results.

3. MECHANICAL CALCULATIONS AND KNOWN ISSUES & MATERIALS REVIEW TEAMS

a. Mechanical

(1.) Selected portions of four (4) topical areas were assessed:

- Design baseline verification program
- Unit 1/Unit 2 interface
- As-designed vs. As-constructed
- Tagging and identification

3. MECHANICAL CALCULATIONS AND KNOWN ISSUES & MATERIALS REVIEW TEAMS (Cont'd)

These topical areas are specified in Attachment V-6 and represent over 300 component-specific attributes.

(2.) Found no deficiencies

(3.) There were eight (8) observations; each was evaluated and required actions as noted on Attachment V-7

Conclusion: All areas reviewed yielded acceptable results.

b. Materials

(1.) Three (3) G-29 attributes were selected for field assessment (64 welds were reviewed):

- weld data sheet retrieval
- weld location in accordance with weld map
- required base metals used

One general attribute was also selected: observable MIC damage.

(2.) Found one (1) deficiency involving heat code traceability resulting in WBPER940771 (see Attachment V-3)

(3.) Found one (1) other observation involving a discrepancy between the weld data sheet and the installed component which had been previously found by the site N-5 group and dispositioned (see Table VI-2, item 2); there was no observable MIC damage

Conclusion: with the exception of the one identified deficiency all areas reviewed yielded acceptable results

4. ELECTRICAL CALCULATION REVIEW TEAM

a. In addition to the general field assessment discussed in Section V.C, over 150 selected electrical attributes were assessed as follows:

4. ELECTRICAL CALCULATION REVIEW TEAM (cont'd)

- Cable separation using Design Criteria 30-4, "Separation/Isolation"
- Three (3) aspects of ampacity calculations
  - -cable tray cover installation
  - -conduit grouping factor
  - -reduced tray fill
- Vertical cable supports in conduits (of those reworked from previous PER resolution)
- Computer Cable Routing System (CCRS) verification

b. Found separation deficiencies in three (3) panels/boxes out of 13 reviewed; WBPER940119 has been revised to incorporate these. Attachments V-3 and V-8 provide more information regarding these deficiencies.

c. Results of the review of field data related to ampacity showed that some ampacity derating factors used in calculations did not reflect field conditions. Engineering evaluation determined that the ampacities are acceptable based on available margins. The evaluation incorporating the field assessment is provided in the detailed report. Attachment V-8 provides a summary of the specific field data collected for ampacity assessment.

d. Found no deficiencies or observations in vertical cable supports in conduits, as discussed in Attachment V-8.

e. Five (5) requests for CCRS verification were submitted. Evaluation of each request resulted in either no change or minor revisions to CCRS to reflect more detail regarding the actual field condition. The specific attributes requested and the results of the assessment are contained in Attachment V-8.

Conclusion: With the exception of the separation deficiencies (Item 4.b above), the field installation adequately reflects as-designed conditions.

C. RESULTS OF GENERAL FIELD ASSESSMENT

The following summarizes the results of the general field assessment. Attachment V-9 discusses the approach and methodology of this assessment.

- Over 800 man-hours spent in plant gathering data/over 1000 man-hours total field
- An estimated 4000 opportunities[1] to identify problems resulted from the general field assessment

  - No. of field "observations"[2]: 348
  - No. of field "observations" requiring no response from TVA 160
  - Action items resulting in deficiencies or observations: 188

  - Resolution of the 188 deficiencies or observations is as follows:
    - Evaluated to be "Acceptable as is" 50
    - Instances of Deficiencies (grouped into 7 deficiencies discussed in Attachment V-3.B) 26
    - Field completed 18
    - Repair/Rework Planned (WR's written) 65
    - Document- only change 4
    - Scheduled for future action 25

Conclusions: Many of the items requiring correction involved housekeeping and previous workmanship (for example loose fittings, dirty panel internals, missing electrical grounds, etc.). Most of these are addressed by the current MAI 1.9 walkdown program. However, improvements are needed in the current program and approach in the following areas:

- Current walkdown programs do not clearly address interfaces between commodities, e.g. cable tray walkdowns do not look at cable drop to conduits.

- Sequencing of work has led to incomplete and inconsistent status of rooms/areas:

  - sequencing resulted in instances of rework
  - walkdowns conducted prior to all work being completed in particular rooms/areas resulting in identifying work which had not yet been completed.

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[1] See footnote on page 5

[2] The term "observation" here is used in a generic sense, not necessarily per the definition on page 2 Section I. When quotation marks are used with "observation" the generic sense is implied.

C. RESULTS OF GENERAL FIELD ASSESSMENT (cont'd)

- Current MAI 1.9 walkdown completed for room/areas did not identify deficiencies found by the field assessment team.

- MAI 1.9 walkdown procedure does not include additional attributes considered to be "key attributes" by the assessment team, e.g. check valve interference with sense lines.

In response to these conclusions TVA is revising both the specific content of ongoing walkdowns and the sequencing of work activities to increase the progress toward successful completion.

D. OVERALL FIELD ASSESSMENT CONCLUSIONS

- Installation of commodities to specific attributes is acceptable.

- Previous work sequence for room and area turnover was not optimum, therefore impacting room/area turnover and creating the need for some rework or additional work.

ATTACHMENT V-1
GENERAL FIELD ASSESSMENT ATTRIBUTE MATRIX

COMPONENTS/ ATTRIBUTES	CONDUIT	TRAY	JUNCTION BOXES & PANELS	TERMINATIONS	MISC. EQUIP (Switches, relays, MOVs, etc.)
Tagging	X	X	X	X	
Separation	X	X	X		
Size/Type/Material	X	X	X	X	
Span, Conc. Loads, Cantilever	X	X			
Flex:					
- Material	X		X		
- Length	X				
- Connectors	X				
- Condition	X		X		
Degree Bends	X				
Bend Radius	X	X			
Vertical Drop	X	X			
Grounding	X	X	X	X (Shield)	X
Seals, Moisture, Pressure, Fire	X	X	X		X
Suitability For Pulling	X	X			

ATTACHMENT V-1 (Cont'd)
GENERAL FIELD ASSESSMENT ATTRIBUTE MATRIX

COMPONENTS/ ATTRIBUTES	CONDUIT	TRAY	JUNCTION BOXES & PANELS	TERMINATIONS	MISC. EQUIP (Switches, relays, MOVs, etc.)
Hardware			X		
- Locknuts	X				
- Fittings	X				
- Bushings	X				
No Split Couplings	X				
Enlarger/Reducers @ Knockouts	X				
Spare Sleeves Sealed/Plugged	X				
Threaded Connection or flex below flood level	X				
Aluminum inside RX. Bldg or near BA Spray	X				
Covers, Length Markers		X			
Fire Stops		X			
Side Rail Attach.		X			

ATTACHMENT V-1 (Cont'd)
GENERAL FIELD ASSESSMENT ATTRIBUTE MATRIX

COMPONENTS/ ATTRIBUTES	CONDUIT	TRAY	JUNCTION BOXES & PANELS	TERMINATIONS	MISC. EQUIP (Switches, relays, MOVs, etc.)
Housekeeping/Layout Tie Wraps	X		X		
Cable Spacing	X				
Air Drop	X				
Construction/Condition			X	X	X
Terminations-Splices & blocks			X	X	X
Wireways/Panduit			X		
Cable mount/wire bundles			X		
Lugs, bent lugs				X	
Raychem, Tape				X	
Wired per Connection Diagram				X	
Joint Configuration				X	
T/C legs lashed together				X	

ATTACHMENT V-1(Cont'd)
GENERAL FIELD ASSESSMENT ATTRIBUTE MATRIX

COMPONENTS/ ATTRIBUTES	CONDUIT	TRAY	JUNCTION BOXES & PANELS	TERMINATIONS	MISC. EQUIP (Switches, relays, MOVs, etc.)
Clamp down				X	
For silicon rubber cable - self-insulated terminals or butt splices				X	
Repairs documented				X	
Mounting & Attachments					X
Alignment					X

I & C GENERAL ATTRIBUTES:

- separation
- slope
- high-point vents
- damage
- valve orientation
- N-Stamps
- fittings
- grounding
- tubing/capillary supports
- capillary/process flexibility
- accessibility

ATTACHMENT V-2
RHR SYSTEM ASSESSMENT FIELD SUPPORT
SUMMARY MATRIX

NUMBER COMPONENT	NO. REQUESTED	ACCESSIBLE NO. INSPECTED	NO. OF ATTRIBUTES PER DEVICE INSPECTED - TYPICAL
Hand Switches	21	17	9
Transfer Switches	3	3	4
Flow Elements	1	1	10
Flow Indicating Switch	1	1	13
FCV	3	1	2
Thermowells	2	2	1 (insulation details)
Temperature Elements	2	2	2
Temperature Indicator	2	1	1
Temperature Recorder	1	1	1
Temperature Switches	4	4	4
Pressure Transmitters	4	4	11
Pressure Switches	2	2	11
Level Transmitter	8	6	13

ATTACHMENT V-2 (Cont'd)
RHR SYSTEM ASSESSMENT FIELD SUPPORT
SUMMARY MATRIX

LIST OF ATTRIBUTES - TYPICAL

- Separation (free air, barriers, metallic braid config., etc.)
- Tagging/Identification
- Nameplate data
- Workmanship/Condition: terminations, instrument, connections
- Proximity to high energy lines, other potential hazards
- Upstream/downstream approach conditions
- Slope
- Bend radius (impulse lines)
- Vents/drains
- Conform to drawings
- Location/mounting details/accessibility
- Insulation details
- Some instrument - unique attributes

ATTACHMENT V-3
DEFICIENCIES

A. DEFICIENCIES FROM FIELD ASSESSMENT FOR SPECIFIC ATTRIBUTES

- Instrument drain line valves installed in wrong flow direction. (1 instance for RHR, 5 instances for general field assessment, some involving more than one valve; 10 valves total found)

  The assessment team provided a general overview of the installed instrumentation. Several panels were assessed where the instrument drain valves were found to be installed backwards. The assessment was expanded to include additional panels. Approximately fifty (50) panels containing an average of six (6) drain valves were looked at specifically for valve flow orientation.

  Approximately 300 instrument drain valves were checked for flow orientation. Ten instrument drain valves were found to be installed backwards within the local instrument panels in the field. Per MAI 1.9 Section 6.1 the system walkdowns which were to support system release for testing were to have verified attributes listed in Appendix B of the MAI. Appendix B specifically lists the flow orientation for valves as an attribute for the system walkdown. Several of these were found in an additional walkthrough by modifications personnel. Seven of the valves were installed in safety related systems: 62-CVCS, 67-ERCW, 68-RCS, 70-CCS.

  WBPER950011 was issued to track and evaluate the deficiency. Initial review of the deficiency indicates that the valves would have performed their function in the reverse position and that plant safety would not have been compromised. Per discussion with the valve manufacturer (Dragon Valves, Inc.), the valve will function and seal in the reverse flow position. The only drawback is that, when in the closed position, the system pressure will be on the packing section of the valve. Over a period of time the packing could leak requiring tightening or replacing.

  All similar instrument paneldrain valves will be reviewed for installation orientation and reversed as necessary.

- Anchors installed in high density concrete without engineering approval.

  G-32, section 3.1.1.2 requires engineering review of expansion anchors installed in high density concrete. As a part of the civil calculation review, a request was made for the engineering reviews of selected expansion anchors for specific conduit supports. Prior to site engineering's response to this request, NRC made similar inquires, resulting in the issue of WBPER950095. It is characterized herein as an NRC-identified deficiency.

  The requirement for evaluation is based on WBN tests of expansion anchors in high density concrete which indicate reduced capacity for expansion anchors in high density concrete. TVA Design Standard DS-C1.7.1 prescribes a 15% reduction.

ATTACHMENT V-3 (cont'd)
DEFICIENCIES

WBN MAI 5.18 and issued concrete drawings contain the requirement for evaluation of expansion anchors in high density concrete. Additionally, signs installed on the high density concrete walls state: "CAUTION-DO NOT ATTACH TO THIS WALL WITHOUT NE-CIVIL APPROVED DESIGN OUTPUT DOCUMENT".

Expansion anchors installed on high density concrete walls which have not been previously evaluated for the 15% reduction in allowable capacity will be identified and evaluations performed.

- Heat code traceability: the M&I review team found a discrepancy between a recorded heat # on a weld data sheet and the marked heat # in the field.

  Weld #1-067G-T160-02 cut 1 repair 0, which is included in the N-5 supplement package for system 67, lists heat #'s as existing. The data sheet for original installation, 1-067G-T160-02 cut 0 repair 0, lists heat number for 1/2" pipe as 445478. Field verification showed this heat # as 455379. WBPER940771 has been initiated to track this finding.

  Further review has shown that both heat #'s listed above are valid heat #'s for 1/2" sch 80 pipe. The weld is shown on the weld map on a line identified as connection 1 off of panel 1-L-163. This panel has two lines, connection 1 & 2, shown on two different weld maps. The data sheet for the adjacent weld, 1-067G-T161-02, was retrieved and it identifies the heat # for the 1/2" pipe as 455379. Field verification revealed the heat # should have been 445478. These two lines were probably exchanged. One possible explanation is that the welds were shop-fabricated with the exchange occurring during field installation. A QA record change has corrected the problem since both heat #'s are valid for the installation. In addition, approximately 40 additional welds were reviewed in the same D-G work area. No other anomalies were found; this deficiency is considered an isolated case.

- Three instances of separation issues for cables inside panels/boxes

  A field assessment of 13 panels and boxes was performed to determine compliance with electrical separation criteria, as requested by the Electrical Calculation Review Team. These boxes were selected from calculation WBPEVAR9001002 which, on a one time only basis, determined which panels and boxes contained multiple separation divisions/trains. The following three (3) boxes were found to be in non-conformance with separation criteria:

ATTACHMENT V-3 (cont'd)
DEFICIENCIES

1. In Switch 1-SW-46-AC-S, six (6) inch free air space was not maintained between "B" an "S" train cables.

2. In junction box 1-JB-292-1933-S, six (6) inch free air space was not maintained:

   - between "A" and "S" train cables and between "B" and "S" train cables due to excessive air gaps around isolation relays mounted on barrier plates

   - between "A" and "ND" cables and between "S" and "ND" cables due to insufficient barrier length

3. In junction box 1-JB-290-6157-S, six (6) inch free air space was not maintained between "S" and "ND" train cables.

There are currently two (2) PER's on the subject of electrical separation (WBPER940119 and WBPER940731). WBPER940119 was written primarily for deficiencies found in implementation of DCN P-5479. WBPER940731 was written for deficiencies found in MEP's M27A, M27B and Panel 0-L-430S for lack of conformance to criteria set forth in drawing 45W1640, 45W3000 and DCN P-04234-A.

The revised corrective action plan for this PER (NOTE: The 2 PER's are being combined into WBPER940119) is being developed. Items that will be considered in the corrective action will be clarity of the criteria, adequacy of the training of personnel on separation, and the scope of panels/boxes which must meet the criteria.

A review has been performed of current practices in work order preparation for any annotations/requirements for maintaining electrical separation. No specific instructions are routinely provided. Separation is currently a consideration only as required by specific attributes in the various MAI's.

ATTACHMENT V-3 (cont'd)
DEFICIENCIES

B. DEFICIENCIES FROM GENERAL FIELD ASSESSMENT

- Junction box (NEMA-1) not reviewed for seismic qualification (1 instance)

  Upon visual inspection of several junction boxes, one box was noticed to differ from adjacent boxes in construction. Upon investigation this box was found not to have been reviewed for seismic qualification by NE-Civil.

  Standard Drawing SD-E13.6.3-1 Note 3 required Nuclear Engineering Civil approval of all vendor supplied NEMA 1 boxes that are to be installed in seismic Category 1 structures.

  In April, 1990 a DCN (M-08858) was issued which replaced a pullbox (1-JB-292-4827-B). The type specified was a KBK-7 which is a field fabricated box made in accordance with the standard drawing. In November, 1993 an "AA" F DCN replaced the box with a slightly larger box but of a JTA type. This type is a vendor supplied box. This box did not have NE-Civil approval as a qualified seismic Category 1 component. WBPER940749 has been written to resolve this nonconformance and determine corrective action requirements.

  Junction boxes which have been affected by design changes following the completion of the Civil/Seismic walkdowns of NEMA-1 seismic qualified boxes will be reviewed for this potential nonconformance condition.

- Cables installed on bottom of tray at fire seal (1 instance, 2 cables)

  Two (2) cables were found penetrating a floor seal (fire barrier) outside the confines of the cable tray 3A2430, beneath it. This is in violation of MAI 3.2 page 6.3.12a.

  This problem was written up in WBPER940740. It is believed that this is an isolated instance, however, the extent of condition review for the PER will make this determination. This tray had not yet been scheduled for walkdown. It is not clear that this condition would have been discovered during the tray walkdown; DCN 33747-A has been issued to add an attribute to specifically look for this condition to the cable tray walkdown.

  As part of the PER resolution, this issue is still being reviewed for final disposition.

ATTACHMENT V-3 (cont'd)
DEFICIENCIES

- Missed installation of electrical grounds (15 instances)

  Although relating to personnel safety and not nuclear safety, several instances of missing electrical grounds were noted in the general field assessment:

  - ground jumpers not installed across flex conduit

  Since some of these anomalies were found in areas where the MAI 1.9 walkdown was complete; this condition was considered a deficiency. WBPER940748 will be expanded to include these missing ground jumpers and to evaluate the extent of condition of missing grounds for other cases, e.g. end devices, conduits. MAI 1.9 walkdown participants have received additional training on these grounding issues for the remaining walkdowns.

  - grounding of miscellaneous steel

  Field assessment indicated inconsistencies in the interpretation of requirements and in the methods considered for acceptable grounding. Subsequently, it was determined that, in most instances, grounding of miscellaneous steel is acheived by physical contact of the pipe, sense line, or conduit to its support. However, it was recommended to modifications that any specific item that could become a hazard during ground fault conditions, be identified and checked for continuity to ground.

  - bonding of grounding connections

  A review was performed of selected conduit-to-box grounding connections to determine the extent to which electrical grounding is achieved. This review indicated that most of the connections utilized provided adequate grounding. However, MAI 1.9 walkdown participants have received additional training in this area so that they can recognize which hardware types provide effective bonding while tracing a path to ground.

ATTACHMENT V-3 (cont'd)
DEFICIENCIES

- Lack of support for cantilevered seal assemblies on solenoid valves (2 instances)

  As a result of the general field assessment two instances were found for ASCO solenoid valves with NAMCO conduit seal cantileved with no support. Support is needed between the valve body and the rigid conduit support after the flexible conduit. This configuration is not covered by existing test data for a harsh environment. Each individual component valve and conduit seal assembly have been qualified for a harsh environment. The existing configuration is also seismically qualified. WBPER950099 has been written to evaluate this condition and the extent of condition; approximately sixty valves/assemblies are involved in the review.

- Cut cable in inboard containment penetration X-27 (1 instance)

  The assessment team observed that the inboard X-27 junction box was open with several connecting large quantities of coiled cables inside.

  Several issues were identified:

  a. cracks in penetration feed throughs where conductor exits the feed through
  b. missing conduit bushings
  c. sleeve material used for end caps
  d. splice using heat shrink material had a gap between the conductor insulation and heat shrink material
  e. possible bend radius issues on one Kapton insulated conductor
  f. flaking of the surface of Kapton on the penetration pigtails

  The plant completion group provided justification of item a. by referencing acceptable criteria HERS 235 QMI# Q930441. Item b. acceptable by G specification G-40-3.2.1.2.B. Item c. resolved due to NESK Raychem kit actually used which looks like sleeve but it is a 50.49 qualified kit. Item d. acceptable since the splice was between different sizes of wire, therefore requiring shimming material to support qualified seal to underlying components. Item e. and congestion issues were resolved by Work Order 94-20914-05 which was amended to address the final inspection and closure of inboard penetration X-27. Item f. is acceptable per G-38.3.7.1.1(F)

ATTACHMENT V-3 (cont'd)
DEFICIENCIES

Subsequent to receipt of this response, the assessment team requested an opportunity to look at the completed work in penetration X-27. One cable with a cut about 1" long, but not cut down to the copper, was found during a cursory observation. WBPER950022 was written to address this condition which is currently being included in WBSCA950002 which addresses several issues involving damage to primary cable insulation of primarily terminations and splices.

- Undersized weld in 1/2-inch coupling to instrument sense line (1 instance)

The field assessment team identified a condition where a fillet weld between a 1/2-inch coupling and a 1/2-inch pipe in an instrument sensing line did not meet the minimum required 3/16-inch weld size over its entire area as required by SSP 7.50. The weld was found by welding engineering personnel to be undersized for approximately 40% of the weld area.

In response to this condition WBPER950028 was written and dispositioned for the weld to be reworked. The PER also performed an evaluation for extent of condition utilizing the results of WBPER930097 and QAI-17.01 and 17.02 and determined this instance to be single case. The work required for this PER has been completed and has been closed.

- Instrument drain line valves installed in wrong flow direction (5 instances from General Field Assessment)

This deficiency is discussed in Section V-3.A above and is listed here for completeness; several of the instrument drain valves installed in the wrong flow direction were found during the general field assessment.

ATTACHMENT V-4
FIELD ASSESSMENT OF RHR SYSTEM
ASSESSMENT TEAM SELECTED ATTRIBUTES

The RHR System Assessment Team submitted a specific list of system components and attributes to be field collected/verified by the Field Assessment Team. These are summarized in Attachment V-2; a number of specific components and some attributes were not looked at due to inaccessibility per the general ground rules, i.e. no tools to be used, no boxes to be opened, etc. A list of typical attributes inspected is also included as part of the table.

The Field Assessment Team passed the data collected to the RHR System Assessment Team for their use. In addition, the Field Assessment Team developed several action items for follow-up with observation action categories noted:

- Two (2) instances of bowed tubing - work requests were written to evaluate/repair; these observations are part of the scope of MAI 1.9. [Action Category-1]

- Several temperature switches were found to be difficult to access for future maintenance; a recommendation was submitted for future enhancement. [Action Category-3]

- One (1) flex conduit appeared to have bend radius too tight - evaluated and found to be acceptable as is. [Action Category-4]

- One (1) panel contained 48 fuses not labelled with fuse numbers - these fuses will be labelled at SPOC turnover per SSP 2.52. [Action Category-1]

ATTACHMENT V-5
FIELD ASSESSMENT OF CIVIL CALCULATION
REVIEW TEAM SELECTED ATTRIBUTES

The Civil Calculation Review Team field assessment focused on the following scope covering over 100 specific attributes:

- Three (3) G-Spec/MAI attributes
- Seven (7) DCNs through implementation

The results of the field assessment identified minor anomalies (differences between the G-spec or DCN specified condition and that observed in the field) which were resolved through Action Items. One G-spec attribute to be confirmed resulted in an anomaly (see G-spec item 2 below). Prior to WBN engineering's response to that item, NRC first identified this issue.

Civil Calculation Review Team field assessment of selected attributes included the following with observation action categories noted as appropriate:

G-SPEC'S

1) Bolt heads or nuts not bearing on curved surfaces (G-89, 4.2.3.12). No anomalies.

2) Expansion anchors in high density concrete need to be evaluated for potential reduced capacity per engineering procedures. (G-32, 3.1.1.2). Deficiency - Mods did not request review per engineering procedure. WBPER950095 issued, see discussion in Attachment V-3.

3) Commodity clearance requirements (MAI 2.3). Observation - requested resolution of clearance anomalies. Clearances are acceptable. [Action Category-4]

DCNs

1) HVAC DCN M-17022-A. No anomalies.

2) HVAC DCN M-16979-A. No anomalies.

3) Platform Steel DCN M-19177A. No anomalies.

4) Platform Steel DCN M-19176A. Observation - Question on smoothness of flame cut slots in steel beams. Determined to be acceptable as-is per G-89 criteria. [Action Category-4]

5) Concrete DCN M-16018-A. No anomalies.

6) Concrete DCN M-19242-A. No anomalies.

7) Concrete DCN M-16831-A. Observation - F-DCN accepted revised anchor spacing per evaluation. Calculation administrative revision was completed to correct reference to the F-DCN. [Action Category-4]

WATTS BAR NUCLEAR PLANT-UNIT 1
INDEPENDENT ENGINEERING & FIELD ASSESSMENT

ATTACHMENT V-6
MECHANICAL NUCLEAR FIELD ASSESSMENT TOPICAL AREAS

Field Assessment Item No.	Topical Area	Field Assessment Requirements
1	Design Baseline Verification Program	Perform field assessment of Feedwater piping from Feedwater Pump to Containment Penetration 1. Validate flow sequence. 2. Validate selected pipe support location and function.
2	Unit 1/Unit 2 Interface	Inspect sample U1/U2 DCN Mod to address unit interface boundaries.
3	As-designed vs As-constructed configuration	Perform field assessment to verify installed flow sequence and hardware alignment against design documents, and general location and function of pipe supports for the following: 1. RHR System 2. ERCW & CCW System from CCW HX/RHR HX to ERCW supply and return 3. MS to AFW Pump Turbine.
4	Component Tagging & Identification	Perform a random assessment of RHR equipment tagging

WATTS BAR NUCLEAR PLANT-UNIT 1
INDEPENDENT ENGINEERING & FIELD ASSESSMENT

ATTACHMENT V-7
SUMMARY OF MECHANICAL FIELD OBSERVATIONS

ITEM	ISSUE	OBSERVATION	RESOLUTION	ACTION #
1	DBVP	FW PIPE SUPPORT IN CONTACT WITH 4" PIPE	ACCEPTED AS-IS BASED ON EXISTING THERMAL/DEADWEIGHT ANALYSIS & HEATUP MONITORING DURING POWER ASCENSION TESTING (REF. DCN S-32561-A)	5
2	U1/U2	VALVE CHAIN OPERATOR NOT SHOWN ON MECHANICAL DRAWING	BILL OF MATERIAL MARK NUMBER FOR VALVE INCLUDES CHAIN OPERATOR. THIS IS CONSISTENT WITH VENDOR DRAWING AND STRESS ISOMETRIC.	5
3	U1/U2	INTERFACE DAMPER 2-FCO-31-425 SHOWN OPEN ON FLOW DIAGRAM. NOTE SAYS IT IS LOCKED CLOSED. FIELD CONDITION WAS LOCKED CLOSED.	FLOW DIAGRAM NOTE REQUIRES DAMPER TO BE LOCKED CLOSED. DRAWING TO BE REVISED FOR SYSTEM 31 TURNOVER	1
4	AD/AC	INCORRECT RHR HEAT EXCH. DRAIN PIPE CONFIGURATION DEPICTED ON FLOW DIAGRAM	ISOMETRIC SHOWS CORRECT CONFIGURATION.	5
5	AD/AC	INCORRECT RHR PUMP SEAL WATER PIPE CONFIGURATION DEPICTED ON FLOW DIAGRAM	DISCREPANCY DUE TO DRAFTING ERROR, INCORPORATING DCA W30293-01. CORRECTED BY DD-94-0569 (DD PROGRAM INCLUDES CAQ DETERMINATION)	4
6	AD/AC	PIPE CAP REQUIRED BY STANDARD DETAIL NOT INSTALLED ON DRAIN/TEST CONNECTION	TO BE REPLACED BY WR#C295877 (WRs ARE TRENDED FOR CAQ)	1
7	AD/AC	REFLECTIVE INSULATION PANEL MISSING	ACCEPTED AS-IS BASED ON VENDOR WALKDOWN. VENDOR DRAWING WILL BE REVISED TO REFLECT THIS CHANGE.	1
8	AD/AC	VALVES NOT PROPERLY DEPICTED ON MECHANICAL DRAWINGS	MECHANICAL DRAWINGS NO LONGER USED TO CONTROL CONFIGURATION. VALVES CORRECTLY SHOWN ON STRESS ISOMETRIC (REF. HAAUP)	5

* Action Categories:
1. To be completed prior to Unit 1 fuel load.
2 Change or action to be implemented at opportune time consistent with site priorities (may be after fuel load).
3 Optional or Enhancement
4. Complete
5. No action to be taken

ATTACHMENT V-8
FIELD ASSESSMENT OF ELECTRICAL CALCULATION
REVIEW TEAM SELECTED ATTRIBUTES

The Electrical Calculation Review Team requested field data and assessment for selected calculations covering:

- Cable Separation in Panels and Boxes
- Ampacity (Sample selected for cases with reduced margin)
  - Cable Tray Cover Installation
  - Conduit Grouping Factor
  - Reduced Tray Fill
- Vertical Cable Support in Conduits (of those reworked from previous PER resolution)
- Computer Cable Routing System (CCRS) Verification

These areas are detailed as follows:

1. Cable Separation in panels and boxes

   One aspect of the calculation review team effort dealt with confirmation of electrical separation compliance to Design Criteria 30-4, "Separation/Isolation," of a random group of panels which contained more than one train of cables.

   Work orders were generated to gain access to this equipment, as required. Action items were written and a brief review of the separation design criteria was performed to determine if any of the conditions found were already reviewed and accepted by engineering. Table V-1 documents the panels/boxes which were reviewed and the disposition for the conditions found.

   Conclusion:

   Overall, the conditions found indicated deficiencies in the electrical separation criteria compliance area. WBPER940119 and WBPER940731 will address the issue in the extent of condition and corrective action development. See the description of the finding in Attachment V-3, Deficiencies.

ATTACHMENT V-8
FIELD ASSESSMENT OF ELECTRICAL CALCULATION
REVIEW TEAM SELECTED ATTRIBUTES

2. Ampacity

a. Cable Tray Cover Installation

As part of the review of the cable ampacity program, the Calculation Review Team asked that several cable tray segments be reviewed to determine if cable tray covers were installed or not. A review was also to be done to check for adjacent segments to check proximity of other covers.

A total of sixteen tray segments were inspected. None of the data collected conflicted with the calculations. However, since not all of the covers have been installed, final resolution is not possible until completion of the cable tray walkdowns.

Attributes selected for this review included:

- Verify covers of less than 6' total length including portions extending to adjacent segments
- Indicate total cover length
- Identify whether covers exist or not, top and bottom

No anomalies were found for this review.

b. Conduit Grouping Factor

Another attribute for field confirmation of the cable ampacity program for which the Calculation Review Team requested field confirmation was in the area of actual field configuration of conduits.

Seven (7) conduits were requested to be evaluated. A conduit was said to be grouped with another if:

- It was within one conduit diameter of the other, and
- The length of run in this configuration is six feet or more

Table V-2 provides a list of conduits and the results of the field assessment. Four (4) circuits were found acceptable based upon actual field arrangements of conduits which allowed some conservatism to be removed from the ampacity calculations.

Three (3) anomalies were found involving 1 x 3 vs 1 x 2 arrays; engineering evaluation confirmed that in all cases no more than two cables will be energized at any one time and this is acceptable.

ATTACHMENT V-8
FIELD ASSESSMENT OF ELECTRICAL CALCULATION
REVIEW TEAM SELECTED ATTRIBUTES

2. Ampacity (Cont'd)

c. Reduced Tray Fill

In the cable ampacity program there are several instances where actual/reduced cable tray fill is utilized to establish a more realistic ampacity. The cable review team requested that ten (10) cable tray segments be field inspected to determine the uniformity of cable depth.

The results showed varying depths and very few segments where good uniformity was maintained. These results were given to the Calculation Review Team for conformity/compliance with the intent of the ampacity calculation. Ampacity of the cables was evaluated to be acceptable based on available margins.

Conclusion:

Anomalies were discovered in the field verification of ampacity criteria, but when evaluated by engineering they were determined to be acceptable based on ampacity margins contained in the calculation.

3. Vertical Cable Support in Conduits

As part of the calculation review team assessment of the vertical cable support calculation, a request was made to the field assessment team to confirm the installation of cable supports in conduits MC906B and 1NM3256F. Two (2) work orders had installed the supports.

Field assessment indicated that the fire stops were installed at the locations specified in the WO's. Depth of the seals could not be verified without impairing the seals.

Conclusion:

The review was limited to two work orders. However, based on the inspections and the assessment they were acceptable.

4. Computer Cable Routing System (CCRS) Verification

A review of the CCRS was performed by the calculation review team for several randomly selected items with the field assessment results noted:

a. Request: Reference tray 5A2061/2062, verify number of cable in raceway (9 per CCRS). Verify that flexible barrier strips have been installed around existing pipe support (per WBPEVAR8811001). Check cable jacket and insulation around support for any sign of damage.

Response: Cables in tray 5A2061/2062 could not have their jacket checked because the cables were coated with Vimasco; no insulation was found around the support; 12 cables were found in the tray rather than the 9 indicated in CCRS; no flexible barrier strips installed. These last 3 items were referred to engineering for evaluation. The unidentified cables were found to be tagged as abandoned cables further down in the tray route and will be added to CCRS. This condition would likely have been discovered during future cable tray walkdown since the walkdown scope includes tags and CCRS data checks. The other conditions were evaluated "acceptable as is".

b. Request: Confirm that 1VC1682A is 3.0" DIA conduit (per drawings 45W812 and 45W814 plus WBPEVAR8810018).

Response: Due to accessibility restrictions only 80% of conduit 1VC1652A was able to be field checked as 3.0 inches in diameter.

c. Request: Confirm following cable sizes: PLS6054 (1 * 2 = 4/0; 2 * 2 = 300); 1PL4983B (2 * 4 = 300)

Response: The cable sizes for the 2 cables were field verified by cable markings to be as specified.

d. Request: Confirm cable route: 1PL4950A (4 * 4 = CCRS).

Response: Field verification of the cable routing for 1PL4950A (4 * 4) was confirmed except for a flexible conduit 1PLC-682A which is installed between 1-MCC-232-A/1A1 and tray node 2590 but is not in the CCRS. This was resolved as this information was slated for future CCRS update via FDCN closeout. Field verification of the cable routing was determined to be acceptable.

e. Request: Check that conduit 1PLC846B terminates at 1-MCC-213-B2/16B.

Response: Conduit 1PLC846B terminates at 1-MCC-213-B2/16 at top hat of MCC, stack 16. Conduit does not go directly to Compartment 16B. This is an acceptable configuration.

Conclusion:

Field conditions adequately reflect the as-designed configuration contained in CCRS; CCRS is being effectively implemented.

TABLE V-1
CABLE SEPARATION REVIEW

Panel/Boxes Inspected	Condition Status
0-JB-287-5135-S	OK; DC-EX-WB-DC-30-4-18
0-JB-287-5213-S	OK; DC-EX-WB-DC-30-4-18
1-JB-292-1391-S	OK
1-JB-292-1933-S	UNSAT.; CONDITION BEING ADDED TO WBPER940119
0-MCC-215-C1/FA-S	OK; DC-EX-WB-30-4-18
0-TB-82C/A-S	OK; DC-EX-WB-DC-30-4-18
1-PNL-99-R52	OK; DC EX-WB-DC-30-4-19
1-SW-46-AC-S	UNSAT; CONDITION BEING ADDED TO WBPER940119
1-TB-46-56A	OK; DC EX-WB-DC-30-4-20
1-PNL-275-R179	OK; ALLOWED PER NOTE 5.L ON DWG 45W3000
1-PNL-245-R180	OK; ALLOWED PER NOTE 5.L ON DWG 45W3000
1-JB-290-6157S	UNSAT; CONDITION BEING ADDED TO WBPER940119
1-PNL-264-R181A	OK; DC EX-WB-DC-30-4-20 AND NOTE 5.L ON DWG 1-45W3000-1

NOTE: Attachment V-3, Deficiencies, provides specific data on the nature of the deficiencies in each panel.

TABLE V-2
Conduits Assessed for Grouping Factor

Conduit	Calc Grouping Factor	Results	Field Verified Correct
1PLC3618	1x1	Conduit is very short (6 inches); no grouping	Yes
1PLC3619	1x1	Conduit is very short (6 inches); no grouping	Yes
1PLC881B	1x1	Conduit sleeve less than 5 ft. long; no grouping	Yes
1PLC886B	1x1	Conduit sleeve less than 5 ft. long; no grouping	Yes
PP2541B	1x2	Conduit grouped with 2 other conduits (PP2540B & PP2542B) in a triad arrangement	No
PP2550A	1x2	Conduit grouped with 2 other conduits (PP2549A & PP2551A) in a triad arrangement	No
PP2544B	1x2	Conduit grouped with 2 other conduits (PP2543B & PP2545B) in a triad arrangement	No

ATTACHMENT V-9
GENERAL FIELD ASSESSMENT

The general field assessment was conducted under the following guidelines and criteria:

- Gather data/field verification of specific attributes requested by RHR System Assessment Team, Electrical/I&C Calculation Review Team, Mechanical Calculation Review Team, and Civil Calculation Review Team; data was gathered to:

  1. satisfy the specific request of the teams noted, and

  2. while in the room or area provide data on observable conditions. The attributes were provided during training sessions. The list of attributes were carried to the field by the assessment team members and used as a guide. The documentation generated from the assessment resulted from observations deemed warranted.

- Gather data/field observations of general workmanship in the "most-complete" areas.

- When an observation was made, e.g. instrument drain valves installed in reverse flow direction; sample size was expanded to determine the extent of the field condition.

- The Field Assessment Team worked in conjunction with the Electrical Engineering Specification Review Team to perform the general electrical workmanship assessment. A sampling of attributes was intended with emphasis on obvious visual anomalies. The approach utilized a sampling of selected attributes from the listing of Specification (G-38 and G-40) requirements against implementing procedures or documents, e.g. MAIs, MIs, etc. plus additional experience-based attributes. The Field Assessment Team selected these criteria using the following process:

  · Criteria which would require opening boxes, disconnecting fasteners, de-terminating wires, removing insulation, etc. were not selected.

  · Criteria being validated through another in-process inspection were generally not selected. Some were chosen for spot checks, and

  · Document-only checks were not selected.

  The criteria remaining in the sample were considered viable and are reflected in the general attribute list in Attachment V-1.

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* G-38: Installation, Modification and Maintenance of Insulated Cables Rated up to 15,000 Volts.

* G-40: Installation, Modification and Maintenance of Electrical Conduit, Cable Trays, Boxes, Containment Electrical Penetrations, Electrical Conductor Seal Assemblies, Lighting and Miscellaneous Systems.

ATTACHMENT V-9
GENERAL FIELD ASSESSMENT

- During the conduct of the Field Assessment, the efforts to support the other teams and to perform a general workmanship assessment were synergized. As an example, the field assessment for separation in boxes/panels as requested by the Electrical Calculation Review Team resulted in 13 boxes/panels reviewed. This was considered to be an adequate sample review for the particular attributes associated with separation criteria. No additional panels were specified for the scope of the field assessment. In a similar judgment, the extent of specific attributes reviewed for the RHR System Assessment resulted in an adequate sampling for some.

- Rooms and areas deemed "most complete" were intended for the general field assessment:

  (A) Completed areas were generally defined as areas where the following walkdowns were complete:

  - MAI-1.9, "Walkdown Verification for Modification System/Area Completion and Damaged, Loose, or Missing Hardware"
  - WD-39, "Electrical Conduit and Conduit Support Walkdown Instruction"

  In these areas more than 50%, but less than 100% of accessible and observable raceways, end devices, couplings, fittings, etc. were reviewed. A set of attributes was developed for review purposes.

  (B) Areas not completed were defined as areas where either the MAI 1.9 or the WD-39 walkdowns were not complete. In these areas less than 50% of all raceways, components and equipment were reviewed and generally only by request from other teams. When another team requested data or verification from an area then, in addition to obtaining the requested data, the field assessment team would perform a general review for obvious discrepancies, e.g. missing ground cable.

- The Field Assessment Team consisted of six individuals averaging over 15 years of field experience.

  - Some members of the team have a detailed knowledge of Watts Bar; others bring their experience from other sites.

  - Team members were provided an overview of G-38 and G-40 General Construction Specifications and related MAIs.

  - Additional background was provided on related PERs, SCARs, CAPs, etc.

ATTACHMENT V-9
GENERAL FIELD ASSESSMENT

- The RHR System Assessment Team requested a sampling of selected instrumentation and control attributes. A less detailed approach was taken to the general field assessment of instrumentation and control where an experienced-based visual inspection was used to supplement requests for specific attributes.

- The Field Assessment Team documented "observations" from the visual inspections and requested data collection. These "observations" were then reviewed to determine which ones constituted a question or an apparent anomaly; these items were classified as action items and were sent to the appropriate TVA Watts Bar group for a response. The responses were accepted if resolution of the action item resulted in a justifiable "acceptable as is" disposition or if some action was started in an official action processing/tracking program such as a work request.

- Deficiencies found during the general field assessment are discussed in Attachment V-3.B. In some cases several instances of the same or similar deficiency were recorded; however, these are grouped under the seven deficiencies in Attachment V-3.B.

VI. MATERIALS AND INSPECTION (M&I)

A. SCOPE

The M&I Assessment team performed an independent assessment of the design, construction, and installation of the WBN systems in accordance with governing code and design basis requirements. Selected portions of the following were assessed:

1. Corrective Action Programs (CAPs)

   - Welding
   - Heat Code Traceability

2. Special Programs (SPs)

   - Microbiologically Induced Corrosion (MIC)

3. Other Issues

   - Nuclear Protective Coatings

   - Corrosion Control Programs
     - Flow Accelerated Corrosion (FAC)
     - Microbiologically Induced Corrosion (MIC)
     - General, Localized, and Galvanic Corrosion
     - Stress Corrosion Cracking (SSC)
     - Borated Water Corrosion (BWC)
     - Cathodic Protection (CP)

   - ASME N-5 Supplements

Selected documents reviewed during the assessment were:

- corrective action documents
- work orders
- specifications
- work implementing instructions
- drawings
- calculations
- code data reports
- procurement documents
- exception requests to general specifications

A. SCOPE (cont'd)

For the CAPs/SPs included in this assessment, the team conducted a review of the work performed by the CAP/SP Closure Task Team. Field assessments were performed as appropriate for specific issues.

Technical adequacy of the programs was evaluated in accordance with the following factors:

- Technical Adequacy
  - compliance and/or consistency with code, regulatory requirements, and industry practices
  - valid design input
  - technical quality

- Accuracy
  - reasonable results
  - satisfaction of primary objectives
  - appropriate design output documentation

- Completeness
  - appropriate scope
  - satisfaction of CAP commitments
  - existence of recurrence controls

B. RESULTS

For each of the Known Issues, the team completed a Known Issues Assessment report which provided the following information as a minimum:

- Scope
- Assessment Methodology
- Field Inspection Requirements/Results (as applicable)
- Assessment Summary/Conclusions
- Documents Reviewed

For each of the three review areas, the results are summarized as follows:

1. Corrective Action Programs (CAPs)

   - Found one (1) deficiency - issued WBPER940771 - see Table VI-1 and Section V, Attachment V-3, for further discussion
   - Reported two (2) observations - see Table VI-2 - Items 1 and 2

B. RESULTS (cont'd)

2. Special Programs (SPs)

- Found no deficiencies
- Reported no observations

3. Known Issues

- Found one (1) deficiency - issued WBPER940727 - see Table VI-1
- Reported nine (9) observations: see Table VI-2, Items 3 through 10 (note: Item 5 is a two-part observation)

C. CONCLUSIONS

- Resolutions of known issues are technically adequate.
- Programs are in conformance with design basis.
- Programs are consistent with licensing commitments.
- Follow-up of observations can provide enhancements.

D. REFERENCES

Canonico, D., Reedy, R., Borter, W., Lichtenstein, J., Zysk, G., Smith, R., Materials and Inspection Independent Assessment, Watts Bar Nuclear Plant - Unit 1, January 30, 1995.

TABLE VI-1
M&I DEFICIENCIES

ITEM	ISSUE	DEFICIENCY	RESOLUTION
1	Heat Code	Recorded heat number does not match installed component.	WBPER940771 initiated. QA record change was processed to correct records. Approximately 40 welds and the installed material were reviewed in the same area and no other instances were found. See Attachment V-3.
2	Coatings	Misapplication of ASTM Deviation Table for Dry Film Thickness (DFT).	WBPER940727 initiated. Area within Zone of Influence (ZOI) reinspected. Unacceptable areas identified within the ZOI during reinspection will be repaired prior to fuel load.

TABLE VI-2
M&I OBSERVATIONS

ITEM	REVIEW ISSUE	OBSERVATION	RESOLUTION	ACTION*
1	Weld CAP	No evidence of Weld Project Coordination Team (WPCT) performing periodic overviews during 1993-1994 time frame.	WPCT has been reestablished and periodic overviews will reconvene during 1995.	2
2	Heat Code CAP	Incorrect heat number recorded on weld data sheet.	Previously identified on punch list for N-5 partial X67-P4. QA record change was processed.	4
3	Coatings	No documentation to support use-as-is disposition for hardness testing of electroplated bolts.	Hardness tests were performed on sample bolting and documented by Central Labs which validate site disposition.	4
4	Corrosion	No criteria provided for use of carbon steel nuts & bolts in SS flanges.	Since this is a contingency for a long term corrosion problem no immediate action required. M&I dept. to issue revision to G-spec to provide criteria. WBN to issue DCN to allow future material replacements.	2
5A	Corrosion (FAC)	Steam Generator (SG) CHECWORKS model inaccurately portrayed system operation. The model which was under review showed pressure drop from 980psi @ SG to ≅ 66psi downstream at manual throttling valves.	System actually operates at higher pressure through both 1st & 2nd stage HXs to downstream control valve. CHECWORKS model has been corrected. Previous model overly conservative.	4
5B		Verification of the contractor modeling had not been completed.	WBN will complete independent reviews of CHECWORKS models. Flow-accelerated corrosion (FAC) team will be consulted for model data input prior to fuel load.	1
6	Corrosion (Cathodic Protection)	No site specifications or implementing documents to address Cathodic Protection (CP). Use of sacrificial anodes in site equipment is unknown.	M&I Dept.to revise G-Spec on CP. WBN to follow requirements of G-Spec to determine where CP is needed. WBN to develop appropriate procedures to address both CP and monitoring of sacrificial anode.	2

*Action Categories:
1. To be completed prior to Unit 1 Fuel Load
2. Change or action to be implemented at opportune time consistent with site priorities (may be after fuel load)
3. Optional or Enhancement
4. Complete
5. No action to be taken

TABLE VI-2 (cont'd)
M&I OBSERVATIONS

ITEM	REVIEW ISSUE	OBSERVATION	RESOLUTION	ACTION*
7	Corrosion (FAC)	No formal prioritization of systems for FAC susceptibility as required by G-97B.	Formal system prioritization has been included in FAC susceptibility calc. WBNOSG4-222	4
8	Corrosion (FAC)	No databases of industry experience & plant experience in existence as required by SSP-612B.	WBN has access to the NER database. WBN may enhance computer equipment which will allow access to EPRIs CHUG Plant Events Database (Industry FAC Database).	3
9	Corrosion (FAC)	Small bore FAC program is incomplete.	Non-CHECWORKS program which includes small bore piping has been developed since this review. White paper has been issued on post fuel load replacement of small bore piping with a FAC resistant material.	4
10	Corrosion (FAC)	Draft FAC susceptibility calculation inaccurately indicated that all low pressure (LP) extraction lines were excluded from the FAC program due to dry steam conditions.	Susceptibility of LP extraction lines was reevaluated and it was determined that some LP extraction lines were susceptible. Additional LP extraction steam line monitoring locations were added to the FAC Monitoring program based on engineering judgement & industry experience.	4

*Action Categories:
1. To be completed prior to Unit 1 Fuel Load
2. Change or action to be implemented at opportune time consistent with site priorities (may be after fuel load)
3. Optional or Enhancement
4. Complete
5. No action to be taken

ENCLOSURE 3

The purpose of this enclosure is to present a qualitative comparison of the results of the independent assessment shown in Enclosure 2 to the results of the 1988 Vertical Slice Review (VSR).

As background, the VSR was performed as part of the Systematic Evaluation used to identify the corrective actions described in the Nuclear Performance Plan, Vol. 4. The final report was issued March 8, 1989.

A quantitative comparison of the two reports is not possible due to the differences in applied resources and discipline focus. However, management's review of the independent assessment have shown that there has been a marked improvement when compared to the VSR results. The table below shows the qualitative comparison of these two reviews.

Independent Assessment Compared to Vertical Slice Review		
Type of Review	Vertical Slice Review excluded large bore piping and supports	RHR Vertical Slice Review, biased towards electrical and I&C for field assessment
Major CAP & SP Areas Reviewed That Relate to 1988 Vertical Slice Review		
DBVP		
Calculations	Inadequate, incomplete or missing	Complete and adequate
Design Outputs Reflecting As-Installed Conditions	Design documents did not reflect as-installed conditions	Design documents, with very few exceptions, reflect as-installed conditions
Cable and Electrical Issues		
Cable Installation	Major findings	Minor findings
Ampacity	Major findings	No findings
Cable Bend Radius	Major findings	No findings
Vertical Drop	Major findings	No findings
Cable Damage	Major findings (post VSR)	One finding (under review)
Separation	Major findings	Panel wiring separation (PER issued)
Flex Conduit	Major findings	Few findings
Grounding	Numerous findings	Findings (PER issued)

Independent Assessment Compared to Vertical Slice Review		
Tagging/Identification	Numerous findings	Several findings
Instrument Lines and Components		
Component Installation	Major findings	Minor finding of valve installed in wrong flow direction (PER issued)
Line Slope	Major line slope findings	Minor line damage findings
Heat Code	Major traceability findings	One minor finding
Damaged, Loose, and Missing Hardware	Numerous findings	Work sequencing contributing to findings, improvement to program ongoing
Operating Procedures	Not in scope of VSR	One in-process finding
Civil/Seismic CAPs	Major design and program finding	Few minor implementation findings
EQ	Major programmatic findings	One minor finding
Conclusions	Major corrective actions required	Implementation of CAPs and SPs generally providing adequate results

ENCLOSURE 4

LIST OF COMMITMENTS

ENCLOSURE 1:

Nuclear Assurance will continue to perform 100 percent reviews of corrective action documents and NRC open item packages to monitor line improvement and until management quality expectations are consistently being met.

Nuclear Assurance is performing additional reviews in Modifications to confirm the extent of condition of the rating problem.

ENCLOSURE 2:

All civil related Category 1 actions will be completed prior to Unit 1 fuel load.

All mechanical related Category 1 actions will be completed prior to Unit 1 fuel load.

All electrical related Category 1 action will be completed prior to Unit 1 fuel load.

All civil related Category 2 actions will be completed by the first Unit 1 refueling outage.

All mechanical related Category 2 actions will be completed by the Unit 1 refueling outage.

All electrical related Category 2 action will be completed by the first Unit 1 refueling outage.