

DETAILED CONTROL ROOM DESIGN REVIEW
SUPPLEMENTAL SUMMARY REPORT
WATTS BAR NUCLEAR PLANT
UNITS 1 AND 2

PREPARED BY:
TENNESSEE VALLEY AUTHORITY
WATTS BAR NUCLEAR PLANT
SPRING CITY, TENNESSEE 37381

FEBRUARY 1990

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1.0 INTRODUCTION

TVA submitted a Detailed Control Room Design Review (DCRDR) Summary Report for the Watts Bar Nuclear Plant (WBN), Units 1 and 2, on October 2, 1987. NRC's evaluation of the report resulted in a DCRDR Safety Evaluation (SE) dated April 28, 1989 (TAC No. 63655). This SE identified open issues in Sections 2.2, 2.3, 2.5, 2.7, and 2.8 and requested TVA to address them in a supplemental DCRDR summary report. NRC also stated their position on resolution of open items listed in Appendix D, "Evaluation of the Applicant's Control Room Design," of the Watts Bar Safety Evaluation Report (SER) (NUREG-0847). The position was to be that TVA must be able to demonstrate how each of these commitments has been satisfied.

The purpose of this report is to:

1. Resolve the DCRDR SE issues.
2. Define the closure process and disposition of NUREG-0847 SER Appendix D issues, including human factor concern (HFC) items identified in the letter from D. L. Lambert to E. Adensam dated February 28, 1985 (L44850228805).
3. Provide an update to the summary report for correction of human engineering discrepancies (HEDs).

1.1 DCRDR SE SECTION 2.2

System Function and Task Analyses to Identify Control Room Operators Tasks and Information and Control Requirements During Emergency Operations

NRC CONCERN:

The approach to system function and task analysis used by the WBN DCRDR team, which is described in detail in Section 4.0 of the summary report, satisfactorily achieved the goal of the required task analysis effort. However, there were three areas of the Westinghouse Owners Group (WOG)-Emergency Response Guidelines (ERG)-based emergency procedures requiring task analysis for which task analysis was not conducted. These areas are:

- a. The six critical safety function trees;
- b. The symptoms sections of the emergency procedures; and
- c. Six emergency contingency actions (ECAs)

- | | |
|---------|---|
| ECA 1.1 | Loss of Emergency Cooling Circulation |
| ECA 1.2 | Loss of Coolant Accident Outside Containment |
| ECA 2.1 | Uncontrolled Depressurization of All Steam Generators |
| ECA 3.1 | Steam Generator Tube Rupture Loss of Coolant Accident with Subcooled Recovery |
| ECA 3.2 | Tube Rupture Plus Loss of Coolant Accident with Saturated Recovery |
| ECA 3.3 | Steam Generator Tube Rupture With Loss of Pressurizer Pressure Control. |

Because of the above deficiencies, the staff found that the licensee had not met the requirement to perform a system function and task analysis of control room operators' tasks.

ACTION TAKEN BY TVA:

In order to meet this requirement, TVA conducted additional system function and task analysis on the ERG-based items identified above. Results of this activity are contained in Section 3.1 of this report.

1.2 DCRDR SE SECTION 2.3

Comparison of Display and Control Requirements with a Control Room Inventory

NRC CONCERN:

The audit team found that the WBN DCRDR team conducted a successful comparison of display and control requirements versus the control room inventory for those areas in which task analysis had been performed. However, because there still existed some areas requiring task analysis, as discussed in paragraph 2.2, the staff found that the licensee had not satisfied this requirement.

ACTION TAKEN BY TVA:

In order to meet this requirement, TVA conducted a supplemental comparison of display and control requirements to the control room inventory for the additional task analysis activity discussed in DCRDR SE Section 2.2. Results of this activity are contained in Section 3.1 of this report.

1.3 DCRDR SE SECTION 2.5

Assessment of Human Factor Engineering Discrepancies (HEDs) to Determine Which Are Significant and Should be Corrected

NRC CONCERN:

The audit team identified two areas requiring additional HED assessment activity. First, any HEDs arising out of the additional task analysis and control room inventory activity to be conducted must be assessed for significance. Second, TVA should reassess HEDs 082 and 199 in order to address the audit team's concerns, which were detailed in Section 2.5 of the letter.

The staff concluded that the licensee has not met the requirement to assess HEDs for significance to determine which ones require correction.

ACTION TAKEN BY TVA:

In order to meet this requirement, TVA assessed:

- ° the significance of the two new HEDs from the additional task analysis conducted to satisfy DCRDR SE Section 2.2; and
- ° the issues associated with HEDs 082 and 199.

Results of the additional assessment activity are contained in Section 3.2 of this report.

1.4 DCRDR SE SECTION 2.7

Verification that Selected Design Improvements Will Provide The Necessary Correction

NRC CONCERN:

The audit team found that no formal mechanism existed to verify that the selected design improvements would result in the implementation of effective corrective action for their respective HEDs. As a result, the staff found that TVA did not meet the requirement to verify that selected design improvements would provide the necessary correction of HEDs.

ACTION TAKEN BY TVA:

In order to satisfy this requirement, TVA implemented a formal process, Administrative Instruction (AI)-1.89, "Closing Out Control Room Human Engineering Concerns and Discrepancies." WBN AI-1.89 is included as Attachment 1.

1.5 DCRDR SE SECTION 2.8

Verification that Selected Design Improvements Will Not Introduce New HEDs

NRC CONCERN:

The audit team found that no formal mechanism existed to verify that the selected design improvements to be implemented would not result in the creation of any new HEDs. As a result, the staff found that TVA did not meet the requirement to verify that selected design improvements will not create any new HEDs.

ACTION TAKEN BY TVA:

In order to satisfy this requirement, TVA implemented a formal process, AI-1.89, "Closing Out Control Room Human Engineering Concerns and Discrepancies." WBN AI-1.89 is included as Attachment 1.

1.6 EVALUATION OF ITEMS LISTED IN LETTER FROM D. L. LAMBERT TO E. ADENSAM, DATED FEBRUARY 28, 1985

NRC CONCERN:

In the DCRDR SE cover letter dated April 28, 1989, NRC stated the following position on closure of the Appendix D open items.

"The staff has also reviewed your letter dated March 7, 1989, concerning your request that the Watts Bar SER, Appendix D commitments be superseded by the WBN DCRDR Summary Report. The staff's position on this matter is that TVA must be able to demonstrate how each of these commitments have been satisfied."

ACTION TAKEN BY TVA:

TVA will demonstrate how each of the Appendix D commitments, including HFCs, listed in the letter from D. L. Lambert to E. Adensam dated February 28, 1985 (L44850228805), has been satisfied. Correlation of each item to the more comprehensive DCRDR (NUREG 0700) review items has been performed and is available for review onsite. Items that were fully encompassed by the later DCRDR are considered superseded and will be tracked and closed out by the encompassing HEDs. In cases where the item was not fully encompassed or was corrected prior to the DCRDR, the item will be closed out separately. The closure process for either type of item is defined by WBN AI-1.89, "Closing Out Control Room Human Engineering Concerns and Discrepancies" (Attachment 1).

1.7 CHANGES TO CORRECTIVE ACTIONS

In the DCRDR SE, NRC noted that TVA planned to correct all HEDs for WBN Unit 1 and common systems before the initial fuel load of Unit 1. Additionally, TVA was requested to inform NRC in writing of any changes in this commitment, including sufficient justification for delays in implementation beyond the initial fuel load date.

Progression of the study, design, and implementation phases of the corrective actions has resulted in some required changes to the corrective actions listed in Appendix F of the DCRDR Summary Report, "Summary of HEDs and Corrective Action Plans." A list of updated corrective actions, along with justification, is included for your consideration in Attachment 2.

2.0 PROCESSES

Unless noted below, the processes used to perform activities reported in this supplement are identical to those described in the DCRDR Summary Report. Deviations and new processes are as follows.

2.1 PROJECT MANAGEMENT AND STAFFING (SECTION 2.0 IN SUMMARY REPORT)

The project management and staffing was as described in paragraphs 5 through 7 of Section 2.1 of the summary report except that individuals' names have changed (see Attachment 3 for a listing of additional team members). Also, the team did not include a nuclear engineer since nuclear discipline expertise was not required for the activities being performed. At times, one individual served as both the human factors specialist and the instrumentation and control engineer.

2.2 METHODOLOGY (SECTION 4.1.3 IN DCRDR SUMMARY REPORT)

Training was as follows: Appropriate team members involved in

- System Function and Task Analysis to Identify Control Room Operators Tasks and Information and Control Requirements During Emergency Operations and
- Comparison of Display and Control Requirements with a Control Room Inventory

satisfactorily completed a two-day course in "Task Analysis for Nuclear Power Plants," which was presented by Essex Corporation.

The course consisted of the following topics:

- Human Factors and the System
- Human Factors Fundamentals
- Task Analyses
- Task Analysis and WOG-ERGs
- Task Analysis Exercise

Appropriate team members involved in

- Assessment of HEDs to Determine which are Significant and Should be Corrected,
- Verification that Selected Design Improvements will Provide the Necessary Correction, and
- Verification that Selected Design Improvements Will Not Introduce New HEDs

satisfactorily completed a two-day course in "Human Factors Fundamentals for Plant Changes," which was presented by Essex Corporation.

The course consisted of the following topics:

- Systems Concept
- The Art and Science of Human Factors
- Human Factors Fundamentals
- Human Error and Transfer of Training

- Human Factors Guidelines
- Task Analysis
- Procedures
- Human Factors for Plant Changes
- Applying Human Factors to Plant Changes
- Assessment of Plant Change Designs

2.3 TABLE 2 DIFFERENCES (SECTION 4.2 OF DCRDR SUMMARY REPORT)

Due to the human engineering concerns (HECs) written as a result of the additional activity, the numbers of Table 2 on page 19 of the summary report under the item "Task Analysis/Verification, Controls, Validation and Total HECs" are now 118, 139, 54, and 1932 respectively.

2.4 PROCESSES NOT DEFINED IN THE DCRDR SUMMARY REPORT

2.4.1 REVISION OF CORRECTIVE ACTION PLANS

HED corrective action plans are updated by listing the appropriate revision level on the corrective action plan and management review and concurrence transmittal forms, and processing the revised form as described in the summary report.

2.4.2 EVALUATION OF ITEMS LISTED IN LETTER FROM D. L. LAMBERT TO E. ADENSAM, DATED FEBRUARY 28, 1985

The correlation of these items to HEDs was performed by the closure team defined in AI-1.89, "Closing out Control Room Human Engineering Concerns and Discrepancies" (Attachment 1). A computer listing of all items was created with the following fields:

- Appendix D or HFC number, as appropriate;
- A "Y/N" (yes or no) field which denotes whether a given issue is encompassed by a HED or group of HEDs;
- Appendix D or HFC description, as appropriate;
- The resolution of the issue as stated in letter from D. L. Lambert to E. Adensam dated February 28, 1985 (L44850228805);
- A listing of HEDs associated with the item;
- A description of HEDs associated with the Appendix D or HFC item; and
- A comments field.

Each issue was examined to determine if it was encompassed by a HED or group of HEDs, and a "Y" or "N" as appropriate was placed in the "Y/N" column. The team determined if the issue was previously corrected by some other program or if the issue still posed a problem. No additional corrective actions were identified. The results of the examination were documented in the comments field.

2.4.3 CLOSURE OF HEDs AND OPEN ITEMS LISTED IN LETTER FROM D. L. LAMBERT TO E. ADENSAM DATED FEBRUARY 28, 1985

A new process was created to close HEDs and Appendix D items. It is defined by WBN AI-1.89, "Closing Out Control Room Human Engineering Concerns and Discrepancies," and is contained in Attachment 1.

2.4.4 ADDITIONAL VERIFICATION AND VALIDATION

Technical and human engineering adequacy of plant hardware attributes, such as precision and accuracy will continue to be documented as TVA implements verification and validation within the NUREG 0899 program. Values in the emergency procedures will be supported by analysis verifying that the instrumentation is capable of performing its intended function.

3.0 RESULTS

3.1 DCRDR SE SECTIONS 2.2 AND 2.3 ITEMS

The Supplemental System Function and Task Analysis to Identify Control Room Operators Tasks and Information and Control Requirements During Emergency Operations and the Comparison of Display and Control Requirements with a Control Room Inventory resulted in the identification of two additional HEDs. These HEDs were assigned Nos. 207 and 209 and are listed on Attachment 2.

3.2 DCRDR SE SECTION 2.5 ITEMS

3.2.1 As a result of task analysis (Supplemental Summary Report Section 1.1) and comparison of display and control requirements with a control room inventory (Supplemental Summary Report Section 1.2), two additional HEDs were identified. HED 207 and HED 209 were written and both were determined to be Category 3 HEDs as described in Table 4 of the summary report. Their corrective action is described in Attachment 2.

3.2.2 TVA has addressed the issue associated with HED 082. The NRC audit team's concern was that relocation of the controller might not adequately correct the HED (setpoint adjustments can be changed accidentally by brushing against the set point controls). HED 082 was a specific example of the team's generic concern that no formal mechanism existed to verify that selected design improvements would result in the implementation of effective corrective action for their respective HEDs.

TVA implemented a formal process, AI-1.89, "Closing Out Control Room Human Engineering Concerns and Discrepancies." WBN AI-1.89 is included as Attachment 1.

This procedure contains a formal process requiring that the concerns that caused the origination of 082 be reassessed at the controller's relocation on the new panel.

- 3.2.3 Reassessment of HED 199 as requested in DCRDR technical evaluation report (TER) Section 2.5 has been accomplished. The reassessment resulted in a confirmation that no corrective action is needed. The additional justification is contained in Attachment 4.

ATTACHMENT 1

WATTS BAR NUCLEAR PLANT (WBN)

ADMINISTRATIVE INSTRUCTION 1.89

IC No.: 90-069

APPENDIX G
Page 1 of 1

Page 1 of 3

INSTRUCTION CHANGE

A. INITIATOR COMPLETES FOLLOWING:

DOCUMENT TITLE: CLOSING OUT CONTROL ROOM HUMAN
ENGINEERING CONCERNS & DISCREPANCIES
DOCUMENT NO.: AI 1.89 REVISION: 0
PAGES AFFECTED: 15A & 15B, PARTIALLY SUPERSEDES IC-90-041 (Appendix D, pgs 15A, B)
REASON FOR CHANGE: TO INCORPORATE CHANGES REQUIRED TO
REVISE HEDCAP AND HEDCAP MANAGEMENT REVIEW
CONCURRENCE TRANSMITTAL DURING CLOSURE

INITIATED BY: Thomas Kelly DATE: 2/5/90 ORGANIZATION: Sp. Project

TYPE OF CHANGE: PERMANENT (PIC) TEMPORARY (TIC): _____ EXPIRATION DATE _____
 CANCELLATION

- Permanent: File PIC by Page Substitution. Place PIC (Page 1) over (in front of) Procedure Coversheet.
- Temporary: File entire TIC in front of Procedure Coversheet.

B. SPONSOR (PROCEDURE OWNER) COMPLETES FOLLOWING:

REVIEWER	DISCIPLINE(S)	SIGNATURES	DATE
POR	ADMIN	M. D. Gardner	2/6/90
CDR	QA/QE	John N. Pantoniopoulos	2/6/90
CDR			1/1
CDR			1/1
			1/1
			1/1

SITE QUALITY ASSURANCE: (concurrence) David McPelle 2/6/90

RECOMMENDATIONS AND APPROVALS	SIGNATURES	DATE
SPONSOR (PROCEDURE OWNER):	<u>[Signature]</u>	<u>2/6/90</u>
PORC CHAIRMAN: (MTG) No. _____	<u>N/A</u>	<u>2/6/90</u>
APPROPRIATE RESPONSIBLE MGR (ARM)	<u>[Signature]</u>	<u>2/7/90</u>
SOS/ASOS NOTIFICATION (IF REQUIRED)	<u>[Signature]</u>	<u>2/7/90</u>

IC No.: 90-041

APPENDIX G
Page 1 of 1

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INSTRUCTION CHANGE

A. INITIATOR COMPLETES FOLLOWING:

DOCUMENT TITLE: CLOSING OUT CONTROL ROOM HUMAN ENGINEERING CONCERNS ^{discipline}
DOCUMENT NO.: AI-1.89 REVISION: 0 PAGES AFFECTED: 3, 7, 15A, 15B, 15C, 15D, 15E
REASON FOR CHANGE: TO INCORPORATE CHANGES REQUIRED TO
WRITE NEW HEDS DURING CLOSURE

INITIATED BY: Hyd Smith DATE: 1/11/90 ORGANIZATION: Sp. Procs

TYPE OF CHANGE: PERMANENT (PIC) TEMPORARY (TIC): _____ EXPIRATION DATE _____
 CANCELLATION

- Permanent: File PIC by Page Substitution. Place PIC (Page 1) over (in front of) Procedure Coversheet.
- Temporary: File entire TIC in front of Procedure Coversheet.

B. SPONSOR (PROCEDURE OWNER) COMPLETES FOLLOWING:

REVIEWER	DISCIPLINE(S)	SIGNATURES	DATE
POP	ADMIN	<u>M. D. Gardner</u> ^{11/17/90}	<u>1/12/90</u>
CDR	QA	<u>John N. Pantoni Zopoulos</u>	<u>1/17/90</u>
CDR			<u>/ /</u>
			<u>/ /</u>

SITE QUALITY ASSURANCE: (concurrence) (SEE ABOVE) / /

RECOMMENDATIONS AND APPROVALS	SIGNATURES	DATE
SPONSOR (PROCEDURE OWNER):	<u>Thomas R. Riley</u>	<u>11/17/90</u>
PORC CHAIRMAN: (MTG) No. _____	<u>NA see 1-18-90</u>	<u>/ /</u>
APPROPRIATE RESPONSIBLE MGR (ARM) <u>DW Smith</u>	<u>Hyd Smith</u>	<u>11/17/90</u>
SOS/ASOS NOTIFICATION (IF REQUIRED)	<u>John Hark</u>	<u>1/18/90</u>

WATTS BAR NUCLEAR PLANT	SITE DIRECTOR PROCEDURE		<input checked="" type="checkbox"/> Safety-Related	<input type="checkbox"/> Non-Safety-Related
	<u>All</u> UNIT	<u>AI-1.89</u> / <u>0</u> Document Number Revision	<input checked="" type="checkbox"/> Quality-Related	<input type="checkbox"/> Non-Quality-Related
TENNESSEE VALLEY AUTHORITY			<input checked="" type="checkbox"/> PORC Reviewed	<input type="checkbox"/> Non-PORC Reviewed
			<input type="checkbox"/> Validated	<input type="checkbox"/> Not Validated

TITLE: CLOSING OUT CONTROL ROOM HUMAN ENGINEERING CONCERNS AND DISCREPANCIES

Effective Date: _____

VALIDATION

Validation Method(s): _____ Checkout: _____
Signature / Date

Scope: Entire Procedure Changes Only Validation: _____
Signature / Date

WRITTEN BY: Floyd Smith Project Management 8/4/89
Signature Name Organization Date

DISCIPLINE	QUALIFIED REVIEWER SIGNATURE	DATE	DISCIPLINE	QUALIFIED REVIEWER SIGNATURE	DATE
SOA	<i>L.E. Ottens</i>	8/4/89			
ADMIN	<i>M.D. ...</i>	8/4/89			

CONCURRENCE SIGNATURES	DATE
<input type="checkbox"/> ANI/ANII	
<input type="checkbox"/> Chief, Training Branch	
<input type="checkbox"/> Manager, Construction (NC)	
<input type="checkbox"/> <i>W.C. ...</i> Manager of Projects	8/4/89
<input type="checkbox"/> <i>... for pem</i> Manager, Project Eng (NE)	8/4/89
<input type="checkbox"/> <i>... for DE MC Cloud</i> Manager, Site Licensing	8/4/89
<input checked="" type="checkbox"/> <i>L.E. Ottens</i> Manager, Site Quality (SOA)	8/4/89
<input type="checkbox"/> Manager, Technical Services	
<input type="checkbox"/> Manager, Site Services	

CONCURRENCE SIGNATURES	DATE
<input checked="" type="checkbox"/> <i>W.C. ...</i> Manager, WBN Procedures	8/1/89
<input checked="" type="checkbox"/> <i>... Miller</i> Plant Manager	8/4/89
<input type="checkbox"/> <i>... Smith</i> Sponsor (Responsible Subv)	8/4/89
<input type="checkbox"/> Supervisor, PC&BS Staff	
<input type="checkbox"/>	

PORC Meeting: 2671 8/04/89 *...*
Number Date Signature, PORC Chairman

Approved By: *...* 8/4/89
Signature, Site Director Date

REVISION LOG

<u>REVISION NUMBER</u>	<u>EFFECTIVE DATE</u>	<u>PAGES AFFECTED</u>	<u>DESCRIPTION OF REVISION</u>
0	8/4/89	N/A	New Site Director Procedure.

1.0 INTRODUCTION

1.1 Purpose

This Procedure establishes a standard process for closing out Human Engineering Concerns (HECs) and Human Engineering Discrepancies (HEDs) identified during the Detailed Control Room Design Review (DCRDR) required by NUREG 0737, "Post TMI Requirements" and in NUREG 0847, "Watts Bar Safety Evaluation Report," (SER) Appendix D. HEDs and HECs in Unit 1, 2, and Common are to be closed by this Procedure. This procedure also covers the process for processing HED's written during the review and closure activity. THIS DOCUMENT IS TO BE CANCELED WHEN ALL HUMAN ENGINEERING DEFICIENCIES HAVE BEEN CLOSED.

1.2 Applicability

This Procedure applies to personnel in the Nuclear Power (NP) organization, including contractor and vendor personnel involved in initiating and closing out HEDs.

This Procedure also applies to the personnel of other TVA organizations when an Interoffice Agreement requires them to perform work controlled by this Procedure.

2.0 REQUIREMENTS

The Requirements are contained in the actions given in the Processes below.

3.0 PROCESSES

Processes are provided for forming the DCRDR Closure Team; identifying pre-DCRDR HECs; tracking all HECs; identifying and tracking items implementing corrective actions associated with each HEC; initiating new HECs and HEDs; and closing each HED after completion of corrective actions.

3.1 Forming The DCRDR Closure Team

The closure team is formed by appointing personnel from the various site organizations possessing the expertise necessary to identify, track, and verify HECs, HEDs, and their associated corrective actions.

Site Director

- A. **APPOINT** a representative from the following organizations, with noted qualifications, to the DCRDR closure team:
 1. **Operations**—A certified Reactor Operator on the Watts Bar reactor with current on-board experience.
 2. **Nuclear Engineering**—A bachelor's degree in engineering with a minimum of five years of applied experience in the application of human factors and applied Instrumentation and Control experience in a nuclear power plant.
 3. **Project Management**—A member of the Watts Bar Project Management Staff.
- B. **ASSIGN** the Lead, Closure Team position to the Project Management representative.
- C. **AUTHORIZE** the Lead, Closure Team to appoint additional members to provide specific expertise as required.

3.2 Identifying Pre-DCRDR Human Engineering Concerns

Human Engineering Concerns were addressed in NUREG 0847 SER Appendix D. Some were corrected; some were input into the DCRDR; and others were determined not valid. In order to be closed out, it is necessary to research, identify, and track these Human Engineering Concerns along with those identified in the DCRDR.

DCRDR Closure Team

- A. **RESEARCH** NUREG 0847, SER Appendix D concerns, **AND**
CROSS-REFERENCE to corrective actions resulting from Detailed Control Room Design Review HECs and HEDs.
- B. **DOCUMENT** the results of this research in the heading of the DCRDR Closure Sheet (Appendix B).

3.3 Tracking All Human Engineering Concerns

HECs identified from NUREG 0847 SER Appendix D and the DCRDR are tracked along with all supporting and related information until final closure.

DCRDR Closure Team

- A. DEVELOP a data base in which each individual HEC can be linked with all its associated individual information:
1. Related HED(s).
 2. Necessary work authorizing document(s).
 3. Necessary design output document(s).
 4. Projected completion date(s).
 5. Overall responsibility.
 6. Present responsibility.
 7. Present status of:
 - a. Review of proposed corrective action.
 - b. Initiation of corrective action implementation items.
 - c. Completion of corrective action implementation items.
 - d. Review and verification of completed implementation items for effectiveness in correcting original concern.
- B. ENSURE information on each HEC is periodically updated.
- C. NOTIFY the Site Director and the Site Licensing Manager of any potential impacts on licensing commitments identified by the data base.

3.4 **Identifying And Tracking Activities Implementing Corrective Actions
Associated With Each Human Engineering Concern**

All activities needed to implement each HEC corrective action are to be identified. A design output document, administrative document, work authorizing document, or combinations and multiples of these documents may be required. The corrective action related to an HEC can only be closed out after all related implementation items have been closed out.

DCRDR Closure Team

- A. **REVIEW** corrective action associated with each HEC.
- B. **REVIEW** items implementing corrective action.
- C. **IF** the corrective action is to be performed by an organization other than the DCRDR team,

COMPLETE the upper portion of a DCRDR Reply Memo similar to Appendix A.
- D. **ENTER** status of corrective action into the data base.

Responsible Organization

- E. **EVALUATE** corrective action as assigned by the upper portion of the DCRDR Reply Memo.
- F. **REPORT** status of implementation on the lower portion of the DCRDR Reply Memo.
- G. **PROVIDE** information and documentation to the DCRDR Closure Team for the closure package.

3.5 Closing Each Human Engineering Deficiency After Completion of Corrective Actions

Items implementing corrective action are evaluated to ensure that the original intended result has not changed through the revision process and that implementation has not given rise to a new human engineering problem.

DCRDR Closure Team

- A. COMPLETE Section I on the DCRDR Closure Sheet (Appendix B).
- B. REVIEW completed corrective action implementation items to ensure compliance with original intent. The method of the review will be determined by the complexity of the modification and may vary from tabletop review to operator evaluation on the simulator for the most complex modifications.
- C. IF the Human Engineering Deficiency does not require correction,

RECORD the justification for not correcting the condition in the disposition blanks in Section III of the DCRDR Closure Sheet.
- D. IF existing items do not completely implement corrective action,

INFORM responsible organization that further action is necessary to implement corrective action and UPDATE the data base.
- E. REVIEW completed corrective action implementation items using Appendix C to ensure that no new human engineering problems are created.
- F. IF new human factors problems are created by corrective actions for Human Engineering Deficiencies,

PERFORM the following steps:
 1. RECORD the human factors problem in Section III of the DCRDR Closure Sheet (Appendix B).
 2. EVALUATE the resultant human factors problem, using Appendix D to determine if it requires correction.
 3. IF the resultant human factors problem does not require correction,

RECORD the justification for not correcting the condition in the disposition blanks in Section III of the DCRDR Closure Sheet.

3.5 Closing Each Human Engineering Deficiency After Completion of
Corrective Actions (continued)

DCRDR Closure Team

4. IF the resultant human factors problem does not require a design change but does require that the condition be corrected,

REVISE the corrective action, RECORD the action taken in the disposition blanks in Section III of the DCRDR Closure Sheet, and UPDATE the data base with the additional corrective action.

5. IF the resultant human factors problem requires a design change,

INITIATE a Design Change Notice in accordance with AI-8.14, "Design Change Notice (DCN)," and RECORD the DCN number in the disposition blanks in Section III of the DCRDR Closure Sheet.

NOTE The necessary revisions and human factors reviews are controlled by the design change process and are not duplicated in this Procedure.

- G. ASSEMBLE all supporting information necessary for verification of corrective action completion.

NOTE This may be accomplished by including hard copy documentation or by cross-indexing so documentation may be readily retrieved by outside representatives who may be unaccustomed to WBN administrative processes.

- H. CLOSE any commitments to the NRC in accordance with AI-13.9, "Verifying and Closing NRC Commitments."

- I. IF commitments contained in the summary report have been modified, PREPARE supplemental summary reports to the NRC.

- J. SUBMIT the DCRDR closure package to DCRM for retention in accordance with AI-4.1.

4.0 RECORDS

The person responsible for preparing a document that becomes a record (or portion of one) completed or accepted under this Procedure is also responsible for the document's legibility, reproducibility, accuracy, and completeness.

4.1 QA Records

The following documents are quality assurance (QA) records and are verified, packaged as indicated, and then transmitted by the DCRDR Closure Team for retention in accordance with the Document Control and Records Management Program per AI-4.1.

Record

DCRDR Closure Sheets

Human Engineering Deficiency Closure Packages

4.2 Non-QA Records

The following documents are non-QA records and are verified, packaged as indicated, and then transmitted by the CRDR Closure Team for retention in accordance with the Document Control and Records Management Program.

Record

Signed DCRDR Reply Memos

5.0 DEFINITIONS

The following terms are controlled by this document. (For terms controlled by other documents, see the "Glossary of NP Directives and Standards Terms and Definitions" in the General Section of the NP Standards Manual.)

Human Engineering Concern

A potential deviation from human engineering guidelines as defined by Section 6 of NUREG 0700, "Guidelines for Control Room Design Reviews," September 1981.

Human Engineering Deficiency

A confirmed deviation from human engineering guidelines as defined by section 6 of NUREG 0700, "Guidelines for Control Room Design Reviews," September 1981.

6.0 INTERFACE DOCUMENTS

The following documents are used in conjunction with this document to control related activities.

6.1 Instructions

AI-4.1, "Processing and Storing Records"

AI-8.14, "Design Change Notice (DCN)"

AI-13.9, "Verifying and Closing NRC Commitments"

6.2 NUREGs

NUREG 0700, "Guidelines for Control Room Design Reviews," September 1981, including Generic Letter 82.33, Supplement to NUREG 0737

NUREG 0737, "Post TMI Requirements"

NUREG 0847, "Watts Bar Safety Evaluation Report"

6.3 Forms Controlled by Other Instructions

None

6.4 Attachments Controlled by Other Instructions

None

6.5 Other Documents

None

APPENDIX A
Page 1 of 1

DCRDR REPLY MEMO

Reply Memo

RIMS _____
TENNESSEE VALLEY AUTHORITY
CRDR TRACKING NO. _____

TO: _____
FROM: _____, PROJECT MANAGER, CRDR CLOSURE TEAM
SUBJECT: WBH. CRDR HED _____ CORRECTIVE ACTION
_____ Message _____
DATE: _____
HED DESCRIPTION: _____

The corrective action described on the attached sheet must be completed and documented. Please indicate your plan and schedule for completion of this corrective action. Completion should include pertinent documentation and should be no later than _____ in order to allow time for assembly of the closure package. Please reply below before _____

_____ Reply _____

DATE: _____ RIMS. _____

1. I acknowledge responsibility for completion of the corrective action.
2. My estimated completion date is _____
3. The point of contact for this work is _____ extension _____
4. Related tracking identifiers are (CAOR, WP, MR, TROI): _____
5. Comments: _____

APPENDIX B
Page 1 of 1

DCRDR CLOSURE SHEET FOR HED _____

Associated with: HECs _____

or: NUREG 0847, Appendix D _____

Section I: Background/Description

Corrective Action Taken: _____

Section II: Verification of Completion of Corrective Action

Action Adequately Corrected HED YES NO
If NO, Is Additional Corrective Action Required YES NO
If No Additional Corrective Action is Required, Justification is as follows:

Section III: Verification that Corrective Action Creates No New Human Factors Problems

Corrective Action Created a New Human Engineering Problem YES NO
If YES, Description of the Problem is as follows:

Disposition of the Problem is as follows:

APPENDIX C

REVIEW CRITERIA FOR HUMAN FACTORS PROBLEM IDENTIFICATION

1.0 CONTROL ROOM WORKSPACE

- A. All instrumentation and equipment necessary to perform the required tasks are present.
- B. Operators are able to position themselves conveniently for performing task actions.
- C. All Procedures and other documents that may be needed for ready reference are available at the work location and are easy to consult.
- D. Emergency equipment for fire, radiation, and rescue is conveniently located.
- E. Illumination levels are adequate for task performance (emergency if required).
- F. Glare does not interfere with reading any labels on instruments.

2.0 COMMUNICATIONS

- A. All needed communication systems have signals which are clear, unambiguous, and loud enough to be heard.
- B. Backup communications are available if primary communications fail.
- C. Emergency face masks do not hinder communications.

3.0 ALARM SYSTEMS

- A. The signal is loud enough to be detected but not so loud as to cause irritation.
- B. Alarms are located above related controls and displays.
- C. Any visual alarm tiles are organized in a matrix - functionally grouped, unambiguous, and readable.

4.0 CONTROLS

- A. Controls are adequate for the functions they perform.
- B. All controls are necessary.
- C. Controls are suitable for operator use.
- D. Controls are durable.
- E. Controls are compatible with emergency gear if required.
- F. Control movements conform to the following conventions:

FUNCTION	CONTROL ACTION
a. On-start, run, open	Up, right, forward, clockwise, pull
b. Off-stop, close	Down, left, backward, counterclockwise, push
c. Right	Clockwise, right
d. Left	Counterclockwise, left
e. Raise	Up
f. Lower	Down
g. Increase	Forward, up, right, clockwise
h. Decrease	Backward, down, left, counterclockwise

- G. Controls are arranged in a logical order.
- H. Controls have some sort of positive indication when activated.
- I. Controls are not positioned such that accidental activation is likely.

APPENDIX C (continued)

REVIEW CRITERIA FOR HUMAN FACTORS PROBLEM IDENTIFICATION

5.0 VISUAL DISPLAYS

- A. Visual displays provide the complete information required.
- B. No unnecessary information is provided.
- C. Scale units are consistent with the degree of precision and accuracy needed by the operator.
- D. Displays do not require operator conversion.
- E. Scales have the correct range.
- F. Characters on visual displays are easy to read.
- G. Any color coding used is consistent with color coding throughout the plant.
- H. Scales can be read easily and setpoints or out of range operation is clear.

6.0 LABELS AND LOCATION AIDS

- A. All controls, displays, and other equipment items that must be located, identified, or manipulated are clearly labeled.
- B. Labels are arranged in a hierarchical scheme.
- C. Labels are placed above the panel elements they describe.
- D. Labels are consistent in their use of words, acronyms, abbreviations, and part/system numbers.
- E. Labels can be easily read from the distance required.
- F. Label lettering is consistent in character selection and size.
- G. Temporary labels are used only when necessary.
- H. If location aids (demarcation, color, mimic lines) are used, they are visually distinctive, easily understandable, and consistent with other location aids.

7.0 PANEL LAYOUT

- A. Controls and displays which are used together during a normal task sequence are grouped together.
- B. Frequently used controls and displays are arranged to reduce search time and minimize the potential for error during use.
- C. Functionally related controls and displays are grouped together when they are identical in purpose or used together to perform tasks related to a specific function.
- D. Controls and displays are laid out in a logical manner such as left-to-right or top-to-bottom.

8.0 CONTROL-DISPLAY INTEGRATION

- A. Controls and displays which are normally used together are located in close proximity to each other.
- B. Controls are mounted below displays or in mimic layouts.
- C. For process flow type systems (other than CVCS), the arrangement of components should follow the process flow.
- D. Controls and displays are laid out to minimize operator movement.
- E. Controls and displays are grouped related to system structure, by task sequence, or in a mimic of a system flow diagram.

APPENDIX D
DETAILED PROCEDURE FOR PROCESSING NEW HED'S

Human Engineering Concern (HEC) Worksheets

The HEC Worksheet identifies the nature of the problem, affected components, data source, person identifying the problem, related data to support assessment and disposition of the HEC, a control number and revision level.

The control numbers identify the primary data collection activity (e.g., operating experience review, controls checklist, verification, etc.) in which the HEC is identified.

Human Engineering Deficiency HED Categorization Record

HEC's determined by the Closure Team to be (1) a valid departure from a human engineering guideline, (2) related to operations in the Main or Auxiliary Control Room or transfer of control to the Auxiliary Control Room, and (3) applicable to Watts Bar, are designated for inclusion in HEDs.

The HED Categorization Record will be used to document the Closure Team's determinations with respect to the significance of the problem(s).

Each HED Categorization Record will have as attachments one or more HEC forms documenting the specific problem(s) included in the HED. The HED Categorization Record includes summary information regarding the problem description, and a formal documentation section for assessment results. Closure Team members present will sign and date the HED Categorization Record, indicating concurrence or non-concurrence with the assessment of the HED.

HED Corrective Action Plan (HEDCAP) Form

An HED Corrective Action Plan Form will be used to document the decisions with respect to disposition of each HED. The HED Categorization Record (with supporting HECs) will be attached to this form. The HEDCAP Form specifies the recommended corrective action to be implemented or the justification for no corrective action.

After review by the Closure Team, each member will sign and date the HEDCAP Form, indicating concurrence or non-concurrence with the proposed corrective action. If the HEDCAP form is a revision, the revision level will be inserted in the top right hand corner of the form. The completed and signed HEDCAP Form constitutes the Closure Team's recommendation to management for closeout of the HED.

APPENDIX D
DETAILED PROCEDURE FOR PROCESSING NEW HED'S

HEDCAP Management Review/Concurrence Form

A HEDCAP Management Review/Concurrence Form will be prepared for each HEDCAP to obtain and document management's position with respect to each recommended corrective action. If the HEDCAP is a revision, the revision level will be inserted in the top right hand corner of the form.

Assessment Team Meeting Record Logbook

Assessment will occur in Closure Team meetings and entered into the assessment team meeting record log book.

HEC To HED Link Report Data Base

For each HEC, the HEC number, HEC short title, and selected other data will be entered. After an HEC is assigned to an HED, the link between the HEC and the corresponding HED is entered into the data base. This enables the team to readily track which HECs are in an HED, and conversely, to identify the HED to which a given HEC is assigned.

APPENDIX D

Revision _____ Date _____

HUMAN ENGINEERING CONCERN (HEC) WORKSHEET I.C. No 90-041

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₂₋₁₈₋₇₆ Page 65 of 9

Plant: Watts Bar Nuclear Plant

Unit: _____

Date: _____

HEC ID No.: _____
(Panel) (Checklist) (Sequence No.)

HEC Short Title: _____

Location: _____ Checklist Item: _____

How was HEC Identified: _____ Identified By: _____

Plant System/Subsystem: _____

Components Involved (UNID/Name): _____

Human Performance Modality Affected (vision, hearing, decision making, etc.): _____

Detailed Descriptions: _____

Impact/Significance of Concern (identify how concern relates to events, modes, functions, tasks, any safety consequences, and describe relationship to any other concerns as appropriate): _____

APPENDIX D

HED NO. _____

CAT: _____

SAFETY (Y/N) _____

HED CATEGORIZATION RECORD

LIKELIHOOD THAT HED WILL CAUSE ERROR						
CAT 4		CAT 1, 2, or 3				
DEFINITELY NOT	VERY UNLIKELY	PROBABLY NOT	MAYBE	PROBABLY	VERY LIKELY	DEFINITELY LIKELY

RESULT OF ERROR (IF UNCORRECTED)						
CAT 3			CAT 1, 2, or 3			
NO EFFECT	REQUIRES ADDITIONAL STEPS	REDUCTION IN OPER PERFORMANCE	LOSS OF COMPONENT FUNCTION	LOSS OF SYSTEM FUNCTION	EXTENDED LOSS OF SYSTEM FUNCTION	EXTENDED LOSS OF PLANT FUNCTION

EFFECT ON MAINTENANCE AND/OR RESTORATION OF A CSF						
CAT 3		CAT 2		CAT 1		
NO EFFECT	POTENTIAL REDUCTION TO CSF MAINT RESOURCE	REDUCED CSF MAINT RESOURCE CAPABILITY	LOSS OF CSF MAINTENANCE RESOURCE	CHALLENGE TO A CSF	LOSS OF CSF	PREVENT RESTORATION

REMARKS/JUSTIFICATION: _____

TEAM MEMBER	TEAM MEMBER SIGNATURE	CONCURRENCE	DATE
Project Manager		YES	NO
Human Factor Spec		YES	NO
Reactor Operator		YES	NO
Instrument Engineer		YES	NO
Other		YES	NO

APPENDIX D

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I.C. No 90-041
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QAM 8
1-8-90

WATTS BAR NUCLEAR
DETAILED CONTROL ROOM DESIGN REVIEW
HED CORRECTIVE ACTION
PLAN

HED No: _____

CAT: _____

SAFETY (Y/N): _____

HED Short Title: _____

References: _____

Plan: _____

Principally prepared by: _____ Date: _____

Team Member	Team Member Signature	Concurrence	Date
CRDR Team Leader		Yes	No
Human Factor Spec		Yes	No
Reactor Operator		Yes	No
Instrument Engineer		Yes	No
Nuclear Engineer		Yes	No
Shift Technical Advisor		Yes	No

APPENDIX D

HEDCAP MANAGEMENT REVIEW
CONCURRENCE TRANSMITTAL

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JH
1-18-90

WATTS BAR NUCLEAR PLANT (WBN) - CONTROL ROOM DESIGN REVIEW (CRDR)
CORRECTIVE ACTION PLAN

Attached is a team proposed corrective action plan for Human Engineering Design
(HED) (Number/Short Title) _____

Please review this plan and provide your concurrence and/or comments
by _____.

CRDR Project Manager

FS:LDR

CRDR Project Manager
WATTS BAR NUCLEAR PLANT (WBN)

Concur. Proceed to implement.

Do not concur. See comments.

Comments: _____

Operations

Plant Mgr. or Supt. O&TS

Program Manager

ATTACHMENT 2

CHANGES TO CORRECTIVE ACTIONS

HED 009

This HED contains several HECs that are not within the scope of the DCRDR, but which came to the team's attention during the DCRDR process. These are concerns about plant equipment not in the MCR or ACR and not used for emergency operations. Nevertheless, it was felt that they should be addressed.

CORRECTION:

Corrective action will be taken as follows: (1) conductivity cells will be installed in the Waste Gas Decay Tanks; (2) training will be conducted on instrument sense lines with vents to common header; (3) the local control station for the turbine-driven AFW pump room will be rewired; (4) labels will be added to the DG Air Dryer control panels (5) H₂ detectors have been installed on CTs in switchyard, new SF-6 gas CTs have been ordered.

REVISED CORRECTION STATEMENT:

Corrective action will be taken as follows: (1) sight glasses will be installed in suction line to waste gas compressors which discharges to the waste gas decay tank; (2) training will be conducted on instrument sense lines with vents to common header; (3) the local control station for the turbine-driven AFW pump room will be rewired; (4) labels will be added to the DG Air Dryer control panels; and (5) H₂ detectors have been installed on CTs in switchyard and new SF-6 gas CTs installed.

JUSTIFICATION

Sight glasses will enable operators to determine if there is any intrusion of water from the waste gas system into the waste gas decay tank.

HED 012 Problems were identified with Main Control Room (MCR) furniture and furnishings, including chairs, stools, tables, communication devices, and personal storage.

CORRECTION:

New chairs and furnishings will be provided. Unused intercoms and radios will be removed. Unneeded equipment will be removed and lockers will be installed nearby.

REVISED CORRECTION STATEMENT:

Unused intercoms and radios will be removed. Unneeded equipment will be removed and lockers will be installed nearby.

JUSTIFICATION:

Chairs and furnishings will be evaluated as part of the extensive control room redesign project.

HED 018 Inconsistent use or lack of color coding was found in the MCR and ACR. In addition, the choice of colors (green) used to denote the RHR and SI systems do not provide clear distinction between systems.

Correction:

The color coding scheme used at Watts Bar is acceptable with the following changes. The RHR and SI system color designators will be changed to improve system recognition. Other modifications include, replacing black reactor trip hand switches with white hand switches, painting black vertical indicators green, and changing 161KV mimic lines from orange to light red to ensure color consistency. Blank panel covers will also be painted to match the panel. A plant document for color use within the MCR will be developed.

Revised Correction/Statement:

The color coding scheme used at Watts Bar is acceptable with the following changes. Black reactor trip hand switches will be replaced with white hand switches and 161KV mimic lines will be changed from orange to light red to ensure color consistency. Blank panel covers will also be painted to match the panel. A plant document for color use within the MCR will be developed.

Justification:

Due to new panel layout, demarcation, and functional tagging, a color change is not necessary. Also after further review of black vertical scale indicators it has been determined that painting is not desirable and may cause damage to instrument cases.

HED 023 Operation of the turbine auxiliary feedwater control switch (HCS-46-57-S) is not consistent with other related control switches.

CORRECTION:

Switch will be changed to a "Pull for Auto/In for Manual" operation. In addition, nameplate engraving modifications will be made to clarify the ACC OVRD/RESET function.

REVISED CORRECTION STATEMENT:

The switch will be replaced with controls which are more consistent with other control room devices.

JUSTIFICATION:

New devices which were procured to resolve a CAQR corrected this HED also.

HED 025 ACR is cramped.

CORRECTION:

The size of the ACR is adequate for its function. Improvements will be made to increase the operators' comfort by providing stools, tables, folding chairs, etc., and limiting the number of personnel in the ACR.

REVISED CORRECTION STATEMENT:

The size of the ACR is adequate for its function. No corrective action is planned. This was rated Category 4, non-safety significant.

JUSTIFICATION:

The size of the ACR is adequate for the extreme emergency situation for which it is intended. Additional items added would make it more cramped.

HED 037 Alarms are not located in appropriate annunciator panels and alarms within panels are not functionally grouped.

CORRECTION:

Detailed recommendations for relocation of specific annunciators have been made. In addition, an evaluation will be made of the Reactor First-Out Annunciator Panel to rearrange all Safety Injection windows in one vertical row. This will be integrated with the studies in HED 47.

REVISED CORRECTION STATEMENT:

Detailed recommendations for relocation of specific annunciators have been made. In addition, an evaluation will be made of the Reactor First-Out Annunciator Panel to group all Safety Injection windows. This will be integrated with the studies in HED 47.

JUSTIFICATION:

Intent of HED is met.

HED 043 There are numerous multiple input annunciators in the control room.

CORRECTION:

Each multiple input annunciator was evaluated using criteria from NUREG/CR-3217 to determine the need for reflash. Reflash will be provided accordingly, as detailed in the HED Corrective Action Plan. This will be integrated with studies in HED 47.

REVISED CORRECTION STATEMENT:

Recommendations from the HED 47 Study were reviewed by Operations and Engineering. As a result, reflash will be provided to the appropriate windows.

JUSTIFICATION:

The reflash recommendation in the annunciator study factored in all HEDs/HECs and was reviewed by Operations to determine all situations where reflash was needed.

HED 048 Improvements are needed in the grouping/labeling/color coding on status lights panels.

CORRECTION:

Grouping of tiles for Phase A and Phase B Isolation (panels XX-55-6E and XX-55-6F) will be improved in accordance with corrective action plan for HED 200. Red/green color coding has been provided for the steam dump valve status lights (panel XX-55-4A). Functional labels will be added for the trip status bistable panels in accordance with corrective action plan for HED 064.

REVISED CORRECTION STATEMENT:

The old status panels are being removed and two new containment isolation status panels (CISP) are being installed with improved grouping/labeling and color recognition.

In addition, red/green color coding has been improved for the steam dump valve status lights (panel XX-55-4A). Revised functional labels and window engravings will be provided for all status panels.

JUSTIFICATION:

The CISP panels are a more comprehensive corrective action than the reworking of the old W panels originally planned.

HED 049 A separate alarm horn for common panel alarms has not been provided for each unit.

CORRECTION:

A separate motor trip-out alarm and annunciator alarm is being evaluated for the unit 1 portion of vertical panels 1-M-15, 0-M-12, and 0-M-26, and for unit 2 portion of vertical panels 2-M-15, 0-M-27A, and 0-M-27B. the vertical panel horns would be located on the end of the vertical panels towards the applicable unit. A cost estimate will be prepared. This was rated Category 4, non-safety significant.

REVISED CORRECTION STATEMENT:

A separate motor trip-out alarm will not be added. The annunciator horns will be split along the vertical panels. This was rated Category 4, non-safety significant.

JUSTIFICATION:

Motor trip-out alarm window legends have been clarified. A motor trip-out is a rare event and each motor's handswitch has a white motor trip-out indicating light.

HED 050 The "blue" permissive panel lights on M-4 change state as unit power is increased or decreased. These lights reflect the mode change, but there is no auditory signal to alert the operator to the change.

CORRECTION:

An alarm module will be added to the lightbox. Specific windows have been designated for auditory alert, according to criteria established with operations.

REVISED CORRECTION STATEMENT:

An alarm module will be added to the lightbox.

JUSTIFICATION:

All windows will give audible indication.

HED 051 The Annunciator System does not provide a signal when an alarm clears.

CORRECTION:

The needs for ringback will be evaluated in the annunciator study (see HED 047).

REVISED CORRECTION STATEMENT:

The new annunciator system will have a return to normal indication to the operator.

JUSTIFICATION:

The annunciator study recommended that a return to normal indication was a desired feature that would help the operator.

HED 054 There is no master isolation status panel.

CORRECTION:

Panel XX-55-6J (formerly used for UHI) will be modified to meet this need. This panel will indicate the following automatic isolation/actuation signals: (1) Phase A isolation; (2) Containment Vent isolation; (3) Phase B isolation; (4) Containment Spray actuation; (5) Auxiliary Building isolation; (6) Control Building isolation; and (7) Feedwater isolation.

REVISED CORRECTION STATEMENT:

Two master isolation status panels will be installed and will indicate the following automatic isolation/actuation signals: (1) Phase A isolation; (2) Containment Vent isolation; (3) Phase B isolation; (4) Containment Spray actuation; (5) Auxiliary Building isolation; (6) Control Building isolation; and (7) Feedwater isolation.

JUSTIFICATION:

Panel XX-55-6J has been removed because a new panel which provided a more comprehensive long-term solution to the problem was installed.

HED 056 There is no alarm for high seal water flow to the reactor coolant pumps.

CORRECTION:

The concern in this HED arises from Technical Specification wording which implies that seal flow must always be less than 40 gpm as a limiting condition of operation. The DCRDR Team will submit a Technical Specification Interpretation Request. The final disposition of this HED will be based on the Technical Specification interpretation.

REVISED CORRECTION STATEMENT:

This flow is set under specified conditions and checked to comply with Technical Specifications by use of Surveillance Instructions. No corrective action is planned.

JUSTIFICATION:

(See above)

HED 057 A low header pressure alarm is needed for the fire protection system.

CORRECTION:

An annunciator alarm will be provided on panel XA-55-15A.

REVISED CORRECTION STATEMENT:

A low pressure alarm will be provided.

JUSTIFICATION:

Panel number was too specific. HED 47 study placed alarm elsewhere.

HED 058 Annunciator flash rates do not meet criteria. One MCR annunciator panel has a different flash rate than the others.

CORRECTION:

These discrepancies have no operational significance. Although in both cases the rate is slower than recommended, it is sufficient to attract operator attention. Since flash rate is not used for alarm prioritization, the different rate for panel XA-55-1A is not of concern. No corrective action is planned. This was rated Category 4, non-safety significant.

REVISED CORRECTION STATEMENT:

Panel XA-55-1A is being replaced as part of the new annunciator system which has adjustable flash rates.

JUSTIFICATION:

The old Panel XA-55-1A was powered separately from the other horseshoe panels. It is now an integral part of the new system.

HED 060 The letter height of annunciator window legends is in some cases less than the criterion height for readability from the location of the annunciator response controls.

CORRECTION:

The Annunciator System is designed to bring the operator to the area of the problem. There is no requirement to read the legend from the control station. The operators are trained to go to the annunciator panels as necessary to read window legends. All windows are easily seen from their associated control locations, with two exceptions: the annunciator control on panel M-26A is too low, making it difficult to operate as well as interfering with the viewing of the associated windows. This control will be moved. In addition, management agrees in principle that it would be helpful, although not essential, for the operator to have an additional annunciator response control dedicated for ERCW, on panel M-27. The length of these panel results in a poor viewing angle from the present control location to some annunciator windows. A cost estimate will be prepared. This was rated Category 3, non-safety significant.

REVISED CORRECTION STATEMENT:

All of the unit 1 main control room annunciator window legends are being replaced and will conform to TVA's standards on letter heights. Controls for windows that are not easily seen have been corrected. They are: (1) the annunciator control on panel M-26A which will be moved, and (2) control station for panel M-27 where an additional control station is being added.

JUSTIFICATION:

Work was evaluated after a cost estimate was prepared and a management decision made to implement these additional corrective actions.

HED 061 Annunciator legends are inconsistently engraved with respect to letter height and stroke width.

CORRECTION:

Engraving guidelines will be developed and issued. Although the windows will not be replaced just to correct this discrepancy, as they are replaced for other reasons (e.g., to improve wording and consistency of acronyms and abbreviations), and when new windows are added, they will be engraved in accordance with the guidelines.

REVISED CORRECTION STATEMENT:

All windows are being re-engraved to a TVA standard as part of the new Annunciator System.

JUSTIFICATION:

A new annunciator system was found to be more effective than upgrading the old system. New window boxes are part of the new system and will be engraved in accordance with TVA standards for consistency.

HED 062 Several annunciator alarms for shared equipment are not duplicated in the unit 2 control room.

CORRECTION:

Alarms that may require action by both unit 1 and unit 2 operators will be provided in both control rooms. Some alarms for common equipment do not need to be duplicated, i.e., those for which unit 1 has the controls and takes all actions.

REVISED CORRECTION STATEMENT:

No corrective action will be taken in the unit 2 horseshoe area prior to unit 1 fuel load. This item will be addressed in the unit 2 CRDR program.

JUSTIFICATION:

As stated, these are unit 2 problems and will be handled during unit 2 CRDR implementation.

HED 067 The window legends on Statalarm boxes (XX-55-27A-A and -B) on panel O-M-27A contain more than three lines of text.

CORRECTION:

The legends are easily readable. Although there are four lines of text, this does not create any difficulty for the operator. No corrective action is planned. This is rated Category 4, non-safety significant.

REVISED CORRECTION STATEMENT:

Legends will be rewritten to provide consistency in wording and to reduce window clutter.

JUSTIFICATION:

An additional review of the annunciator system was performed after the Summary Report was submitted. The need for consistent terminology for all windows was considered necessary.

HED 068 All annunciator inputs are not included in the window legends.

CORRECTION:

It is not necessary or appropriate to identify all annunciator input sources in the window legends. Operating instructions are available to the operator which list all possible inputs. There are some cases in which this type of information on the window is useful to the operators. Guidelines for including input source identification in annunciator legends were prepared by the DCRDR Team. These will be implemented in conjunction with the corrective actions for HED 042 and HED 135.

REVISED CORRECTION STATEMENT:

It is not necessary or appropriate to identify annunciator input sources in the window legends. When partial input information is included on the window tiles, the operator is presented with confusing and incomplete information. As a result of the annunciator study, a new annunciator system was recommended and new window engravings provided. These engravings will not contain input device numbers.

JUSTIFICATION:

Revised writing based on changes made with the new annunciator study recommendation. The new system provides an alarm printout that can be used by Operations to include this type of information if needed.

HED 069 The actuation logic for Phase A and Phase B isolation status lights is inconsistent (XX-55-6C through XX-66-6H and XX-55-6J). Some lights energize on component position while others required the presence of the isolation signal as well.

CORRECTION:

This logic will be made consistent so that actual status of the component is accurately displayed.

REVISED CORRECTION STATEMENT:

These panels are being removed and two new containment isolation status panels installed. The logic will be consistent and display actual status of the components.

JUSTIFICATION:

Evaluation of the various options for displaying containment isolation status resulted in the decision to provide new panels.

HED 072 The emergency borate hand switch does not have a protective cover.

CORRECTION:

A protective cover is not needed. The hold-to-actuate design of this switch precludes accidental actuation, and operators are thoroughly trained on the use of this switch. No corrective action is planned. This was rated Category 4, non-safety significant.

REVISED CORRECTION STATEMENT:

The hand switch has been moved away from the edge of the benchboard as part of the new layout of this panel. No additional corrective action is planned. The hold-to-actuate design of this switch precludes accidental actuation, and operators are thoroughly trained on the use of this switch. This was rated Category 4, non-safety significant.

JUSTIFICATION:

See above.

HED 075 The pocket sump pump controls (Panel M-9) differ from the convention for pump controls. These are OT-2 lever-type switches (used for valves), whereas pump controls are normally W-2 J-handle switches.

CORRECTION:

The pocket sump pump controls will be moved from Panel M-9 to Panel M-15, in accordance with the correction for HED 172. They will be changed to J-handle controls in conjunction with the move.

REVISED CORRECTION STATEMENT:

The pocket sump pump controls will be moved from Panel M-9 Panel M-15, in accordance with the correction for HED 172.

JUSTIFICATION:

Label symbols rather than handle shape is being used to denote type of equipment being operated.

HED 078 It is difficult to balance steam/feed flow due to accuracy of steam flow instruments at low flow. Operator has no useful steam flow indication at low power levels; steam generator level is used to balance steam/feed flow.

CORRECTION:

Automatic bypass controllers have been installed, which should eliminate this problem. Proper operation of these controllers will be verified during low power testing.

REVISED CORRECTION STATEMENT:

Automatic bypass controllers have been installed to eliminate this problem.

JUSTIFICATION:

Method of evaluation of effectiveness of this modification will be conducted on the simulator rather than after fuel load.

HED 081

There are inconsistencies in controller conventions pertaining to direction of control and display movement. In addition, a labeling convention is needed to clearly identify directionality where a setpoint change is made to operate a valve (e.g., increase setpoint to close).

CORRECTION:

Labeling enhancement will be made to emphasize direction of control movement for all controllers in the MCR and Auxiliary Control Room (ACR). Additional training will be provided on differences in controller operation. The feasibility of engineering changes to achieve completely consistent directionality is under investigation.

REVISED CORRECTION STATEMENT:

Labeling enhancement will be made to emphasize direction of control movement for all controllers in the MCR and Auxiliary Control Room (ACR). Additional training will be provided on differences in controller operation.

JUSTIFICATION

The cost of changing controllers throughout the control room was investigated and it was determined to be excessive.

HED 083 Shape coding of switches is inconsistently applied.

CORRECTION:

Switch functions and the availability of different types of handles make complete consistency in shape coding impractical. However, symbols will be added to control labels to indicate the type of plant component being operated (in accordance with the correction for HED 007). In addition, where the potential for and effects of operating the wrong control are significant, demarcation or protective covers will be added. This HED also addresses concerns about size of some star handles. The large star handles which obscure labeling will be replaced with a smaller version.

REVISED CORRECTION STATEMENT:

Switch functions and the availability of different types of handles make complete consistency in shape coding impractical. However, symbols will be added to control labels to indicate the type of plant component being operated (in accordance with the correction for HED 007). In addition, where the potential for and effects of operating the wrong control are significant, demarcation or protective covers will be added. This HED also addresses concerns about size of some star handles. The large star handles will be replaced with suitable replacements.

JUSTIFICATION

Smaller star handles are not available. However, handles which do not obscure the labeling will be procured to replace the large star handles now in the control room.

HED 095 Lack of continuously monitored main turbine bearing vibration.

CORRECTION:

The Westinghouse Turbine Supervisory Instrumentation (TSI) System will be replaced and operator interface improved.

REVISED CORRECTION STATEMENT:

Operator interface will be improved by including TSI input for a screen display on the new PC-type computer interface for the P2500 plant process computer. In addition, the TSI control room recorders are being replaced by faster responding units (see HED 116).

JUSTIFICATION:

Upgrade of the computer and recorder provides capability for continuous monitoring main turbine vibration. Turbine supervisory equipment (probes) was not the underlying cause of HED 095. After further consideration, TVA believes that replacement of the recorder and upgrade of the computer interface directly correct the deficiency and feels that further enhancement is not warranted at this time.

This deficiency was rated Category 3 and is not safety related.

HED 100 Indication is needed for Demineralized Water (DI) head tank level.

CORRECTION:

After researching and evaluating the concerns identified in this HED, it was concluded that the DI head tank level control valve should be modified to operate automatically without causing damage to the makeup DI. The MCR has high and low level alarms, and the local control panel has high and low level indicator lights. These are judged to be sufficient. A level indicator in the shutdown board room will be considered.

REVISED CORRECTION STATEMENT:

The level alarm has been moved into the horseshoe. In addition, the new annunciator system has ringback capability. The control room operator will thus be able to determine when a high or low level alarm clears.

JUSTIFICATION

The HED is still being resolved, just a different corrective action has been employed.

The original problem was the inability to determine DI head tank status from the control room. An operator had to be dispatched to continuously check on the alarm. Ringback resolves this problem.

HED 106 The RCP seal return flow recorders have square root scales which is not the preferred design.

CORRECTION:

The normal range for seal return flow is in the expanded range of the scale and is not difficult to read. The low range recorders will be rescaled to 0-2 gpm to provide scale overlap at the lower end of the scale.

REVISED CORRECTION STATEMENT:

The normal range for seal return flow is in the expanded range of the scale and is not difficult to read. No corrective action is required. This was rated Category 4, non-safety significant.

JUSTIFICATION:

Further evaluation determined that this corrective action was not cost justified. The original decision to rescale the recorders was based on the assumption that minor costs were involved to recalibrate the associated transmitters and provide two new recorder scales. Subsequent Engineering evaluation indicated that this could not be achieved without completely replacing the instrument loops.

HED 114 A number is not provided for the top and bottom graduation marks on some scales.

CORRECTION:

Operators have experienced no difficulties in using these scales. When future scales are placed in the control room, they will contain this enhancement feature. This was rated Category 4, non-safety significant.

REVISED CORRECTION STATEMENT:

Operators have experienced no difficulties in using these scales. No corrective action is planned. This was rated Category 4, non-safety significant.

JUSTIFICATION:

Numbering at the extreme top and bottom of scales is not a feature which is uniformly available in the industry and is not always of benefit. Therefore a commitment to procure all future scales with this feature is inappropriate.

HED 116 The turbine eccentricity recorder is a 24-point recorder with many channels not used. It must cycle through all points before repeating which causes too much lag time when rolling the turbine off.

CORRECTION:

This HED will be resolved by the corrective action for HED 095. The Westinghouse Turbine Supervisory Instrumentation (TSI) System will be replaced.

REVISED CORRECTIVE STATEMENT:

The turbine eccentricity recorder will be replaced by a faster responding recorder as part of the procurement for HED 119.

JUSTIFICATION:

The recorder problem is being corrected. It has been detached from the TSI work, the status of which is covered in HED 95.

HED 132 The failure mode for the percent flux differential indicators is not apparent. They fail mid-scale, the zero graduation mark.

CORRECTION:

There are four independent channels monitoring percent flux differential. This instrumentation should be indicating about the same during the life of the core. They are frequently checked; a channel reading that was different from the other would be easily detected. Out-of-service marks will be put on the scale at the failure position. (See HED 089 for details.)

REVISED CORRECTION STATEMENT:

There are four independent channels which monitor flux differential. A channel reading different from the others is easily detected.

JUSTIFICATION:

Out of service marks would add confusion.

HED 142 Operators would like the computer system to provide system status/configuration information (e.g., valve lines).

CORRECTION:

Computer capability will be enhanced to provide as much of the desired information as possible by interfacing the TSC computer or equivalent with the P2500.

REVISED CORRECTIVE STATEMENT:

No action is required. This enhancement was investigated and found to be impractical due to the number of valve position inputs available to the computer.

JUSTIFICATION:

Further investigation has determined that the process computer (P2500 and SPDS/TSC) have access to less than 2 percent of the required data base, and do not have the necessary capabilities to implement to valve status/configuration desired.

HED 143 The printer has no instructions for reloading paper or ribbon, nor does it have a takeup for printed paper. In addition, when the printer is down, information normally printed is lost.

CORRECTION:

Instructions for loading paper and ribbon will be added at the front of the P-2500 Operator's Guide and a copy of the guide will be provided at the MCR computer console.

REVISED CORRECTION STATEMENT:

New printers which feature easier methods of loading paper and replacing ribbon will be installed.

JUSTIFICATION:

Old printers were obsolete and difficult to use. New printers are much more user friendly in respect to loading ribbon and paper.

HED 144 All annunciator alarms are not recorded by the process computer.

CORRECTION:

Computer points are provided for alarms related to the Solid State Protection System, trip-related alarms, and alarms related to the operating status of critical equipment. This is adequate. No corrective action is planned. This was rated Category 4, non-safety significant.

REVISED CORRECTION STATEMENT:

The new annunciator system will be installed which will record all annunciator alarms on an alarm printer.

JUSTIFICATION:

The annunciator study recommended that a new annunciator system provide additional features such as the alarm printer.

HED 145

Alarm sequence cannot be determined within a scan window. Alarms are recorded in multiplexer rack order when multiple alarms occur within a scan period.

CORRECTION:

The process computer is not used for sequence of events. The sequence-of-events recorder is separate and includes those alarm points which have been determined to be important. They are either trip-related points or inputs that monitor the operating status of critical equipment. Post-trip inputs are monitored on a first-event basis within each protection set. These features are considered sufficient. No corrective action is planned. This was rated Category 4, non-safety significant.

REVISED CORRECTION STATEMENT:

Any P2500 digital points for which an order of occurrence resolution less than two seconds is considered important are included in the P2500 sequence of events monitoring which has four millisecond resolution.

In addition, the new annunciator system has a printout of all alarms which is time dated.

JUSTIFICATION:

Opening statement of original correction is wrong. Revised statement takes credit for flexibility of existing system and the new annunciator printer.

HED 172 The controls and level indicators for the Reactor Building floor and equipment drain sump and auxiliary sump are not located on Panel M-15.

CORRECTION:

HS-77-410, LI-77-410, and LI-77-411 will be moved from their present location on Panel M-9 to Panel M-15. The Corrective Action Plan for HED 170 shows their desired location on Panel M-15. This move will group these controls with other drainage controls. The present valve type control handles will be replaced with pump type handles as appropriate when this change is made.

REVISED CORRECTION STATEMENT:

HS-77-410, LI-77-410, and LI-77-411 will be moved from their present location on Panel M-9 to Panel M-15. The Corrective Action Plan for HED 170 shows their desired location on Panel M-15. This move will group these controls with other drainage controls.

JUSTIFICATION:

Label symbols rather than handle shape is being used to denote type of equipment being operated.

HED 175 Emergency Gas Treatment System handswitches control several components but have only a single status light. Status indication should be provided for all controlled components. Damper position does not have status indication.

CORRECTION:

Procedures will be revised to direct the operator to observe delta pressure indications and system flow. A status light will be installed for each fan damper.

REVISED CORRECTION STATEMENT:

Procedures will be revised to direct the operator to observe delta pressure indications and system flow.

JUSTIFICATION:

Verification of system flow will ensure that each damper is opened. Adding additional status lights would not provide significant additional information to the operator in the main control room. This was rated Category 3, non-safety significant.

HED 178 Hydrogen analyzers and ignition controls, required early during a transient, are located outside the horseshoe.

CORRECTION:

No problems were identified with the operator leaving the horseshoe area during the DCRDR validation exercises. Also, two different measurements of hydrogen concentration are on the TSC computer. The annunciator response SOI for Windows 26 and 36 on XA-55-6D will be revised to reflect that the alarm origin also includes high hydrogen.

REVISED CORRECTION STATEMENT:

No problems were identified with the operator leaving the horseshoe area during the DCRDR validation exercises. Also, two different measurements of hydrogen concentration are on the TSC computer. The annunciator response SOI will be revised to reflect that the alarm origin also includes high hydrogen.

JUSTIFICATION:

Installation of new annunciator system caused relevant window numbers to change. The appropriate windows will be referenced in the SOI.

HED 185 Valve position indication for RHR System Isolation Bypass Valves FCV-74-8 and FCV-74-9 is not present in the MCR.

CORRECTION:

There are Statalarm white status lights on M-6 to monitor valve position. No corrective action is planned. This was rated Category 4, non-safety significant.

REVISED CORRECTION STATEMENT:

Valve position indication lights will be installed for these valves on Panel M-6 in the MCR.

JUSTIFICATION:

The Statalarm box is being removed. As a result status lights were determined necessary for these valves.

HED 203 If standby feedpump begins cavitating, operators have no indication and must be notified by phone of this problem

CORRECTION:

Installation of a low suction pressure trip in Instrument Loop P-2-273 is planned. A time-delay mechanism will be implemented to prevent spurious trips.

REVISED CORRECTION STATEMENT:

A low suction pressure alarm will be installed.

JUSTIFICATION:

No need to have automatic pump trip if adequate MCR alarm is provided.

HED 206 Single status lights for Pressurizer Spray valves may not be adequate to determine valve positions.

CORRECTION:

Modification of XI-68-340 B&D status lights is planned to include a press-to-test function, and these lights are to be added to a procedurally required checklist. Operators can also verify the positions of the Pressurizer Spray valves by use of other indications such as Pressurizer Spray Line Temperature and Pressure.

REVISED CORRECTION STATEMENT:

Red and green status lights will be provided so that valve position can be determined.

JUSTIFICATION:

After evaluation by Ebasco, it was determined that the press-to-test function could not be reasonably implemented. A revised corrective action is in line with the original recommendation.

HED 207 Steam generator Pressure indication in the main control room is not adequate to support procedural requirements.

CORRECTION:

Setpoints in the emergency procedures will be revised to be more conservative and less precise.

JUSTIFICATION:

This is a new HED.

HED 209 Main Feed Water Bypass Flow indication is not available in the main control room.

CORRECTION:

Bypass flow indication will be provided on panel 1-M-4 for each of S/G loop.

JUSTIFICATION:

This is a new HED.

HED 213 Power supply to the annunciators cannot be verified in the MCR.

CORRECTION:

An alarm will be provided for loss of annunciator. The alarm will be on annunciator panel 1-A (control panels 1-M-1 and 2-M-1). An alarm will also be provided for loss of power to annunciator panel 1-A.

REVISED CORRECTION STATEMENT:

Annunciator has two power supplies and the normal and alternate supply loss is annunciated. Panel 1-A is being integrated into the rest of the system and will no longer be a separate annunciator.

JUSTIFICATION:

Panel 1-A is no longer a separate annunciator.

HED 217 There is no spent fuel pit level indication in the MCR.

CORRECTION:

The corrective action for HED 062 adds a spent fuel pit level alarm to the unit 2 control room (the alarm currently exists only in the unit 1 control room). Procedures will be modified to reflect the use of this alarm.

REVISED CORRECTION STATEMENT:

No action is required for unit 1 startup.

JUSTIFICATION:

A unit 2 spent fuel pit level alarm is not needed for unit 1 startup. It will be handled during Unit 2 CRDR implementation.

ATTACHMENT 3

PERSONNEL QUALIFICATIONS

NAME	TEAM FUNCTION	PROFESSIONAL EXPERIENCE NUCLEAR INDUSTRY OR HUMAN FACTORS	LICENSE/ CERTIFICATION	EDUCATION & TRAINING
Floyd Smith	Project Manager	16 Years	Profescional Engineer	B.S.C.E. Tech. Staff & Mgrs.
Robert Griffin	Assistant Project Manager	23 Years	Sr. Reactor Operator for H.F.I.R.	B.S.M.E.
Thomas Raley	Assistant Project Manager	14 Years	N/A	Assoc. Electronics Communications
Geoff Bennett	Operations Represent.	9 Years	Unit Operator	Assoc. M.E.
Timothy Haney	Operations Represent.	11 Years	Unit Operator Instructor	H.S.
Richard Cook	Operations Represent.	12 Years	Sr. Reactor Operator	B.S.Physics
Marvin Wolfenbarger	I&C Engineer/Human Factor Specialist Par- ticipant in Task Analy.	11 Years	N/A	B.S.E.E.
Wilbur Harris	Operations Represent. Task Analysis Leader	10 Years	Sr. Reactor Operator	Assoc. M.E.
James Smith	Operations Represent. Participant in Task Analysis	12 Years	Sr. Reactor Operator Shift Operating Advisor	H.S.
Thomas Talley	Training & Oversight of Task Analysis	16 Years	N/A	BA Experimental Psych. MS Applied Psych.

ATTACHMENT 4

REASSESSMENT OF HUMAN ENGINEERING DISCREPANCIES (HED) 199

HED-199 stated that certain valves could be opened with the Phase A isolation signal not reset by opening these valves manually using a handswitch in the MCR.

TVA believes this design to be acceptable and desirable for the following reasons:

1. To override the containment isolation signal and open a single containment isolation valve requires a single, deliberate, and continual operator action (i.e., holding a spring-loaded switch open against the force of the spring for that valve). When the switch is released, the valve returns to the closed position.
2. The action of an operator holding a valve controller handswitch open is not normal post-accident.
3. This design is not in violation of 10 CFR 50 Appendix A, NUREG 0737 Section II.E.4.2, or Standard Review Plan 6.2.4 II.s.
4. This condition does not violate the IE Bulletin 80-06 requirements for two independent operator actions to reset an engineered safety feature (ESF) function.
5. Since, according to the WBN FSAR, the plant has redundant isolation barriers for each of these penetrations, containment penetration isolation would be maintained, even when one valve is opened.
6. The existing design is not in violation of any design basis as delineated in the Design Criteria for Containment Isolation, WB-DC-40-34.
7. The present design allows the operator the option of opening a valve if it is determined necessary and/or beneficial for accident mitigation. The availability of options is always desirable post-accident in addition to the emergency operating procedures. This allows the operator to handle unexpected events which can better be dealt with by operator appraisal of changing conditions following an accident.
3. TVA's position on this issue is in accordance with that taken by North Anna Nuclear Plant.

For the previously cited reasons, the existing design is adequate and desired. No circuitry modification is needed.

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Approved by: Frank A. Kowalski