HUMAN FACTORS ENGINEERING

EVALUATION OF THE GRAND GULF

UNIT 1 CONTROL ROOM

MISSISSIPPI POWER AND LIGHT

GRAND GULF NUCLEAR STATION

# PREFACE

Task I. D. Control Room Design, of NUREG-0660, the NRC Action Plan Developed as a Result of the TMI-2 Accident, specified that the Office of Nuclear Reactor Regulation (NRR) requires that operating reactor licensees and applicants for operating licenses perform a detailed control room design review to identify and correct design deficiencies. This review is to consist of an assessment of the following:

- Control room layout
- The adequacy of the information provided
- The arrangement and identification of important controls/instrumentation
- The usefulness of audio and visual alarm systems
- The information recording and recall capability
- Lighting
- Other considerations of human factors that impact operator effectiveness

Based on the requirement, Mississippi Power and Light (MP&L), agent for Middle South Energy, Incorporated (MSEI), contracted with the Essex Corporation to perform an independent third party review of the Grand Gulf Nuclear Station Unit 1 Control Room. This evaluation was conducted during the period from June 17, 1980, to October 1, 1980, and employed state-of-the-art human engineering evaluation techniques specially tailored for a control room design review, using criteria from NUREG 1580 "Human Engineering Guide to Control Room Evaluation".

The results of the review showed that while human engineering criteria was applied to the control room in general, certain areas were discrepant. These discrepancies, while not critical individually, collectively could degrade the operability of the control room.

MP&L has issued their plans and schedule for implementing the corrective actions of those descrepencies considered necessary to increase the safety, reliability, and operability of the control room.

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# 1.0 DEFINITIONS

1.1 This section provides definitions or acronyms for abbreviations used throughout this report.

1.1.1 ADS - Automatic Depressurization System

1.1.2 BRKR - Breaker

1.1.3 CAV - Cavity

1.1.4 CCW - Component Cooling Water

1.1.5 CNDS - Condensate

1.1.6 Control Room - Grand Gulf Nuclear Station - Unit 1 Control Room (includes Shared Panels)

1.1.7 D/G 11 - Standby Diesel Generator - Division 1

1.1.8 D/G 12 - Standby Diesel Generator - Division 2

1.1.9 D/G 13 - HPCS Standby Diesel Generator - Division 3

1.1.10 Discrepancy - A component and/or system lacking agreement with human factors engineering principles

1.1.11 DRN - Drain

1.1.12 ECCS - Emergency Core Cooling System

1.1.13 ESF - Engineered Safety Feature

1.1.14 FCTNL - Functional

1.1.15 Human Factor Engineering - The science of applying behavioral principles to systems

1.1.16 HPCS - High Pressure Core Spray

1.1.17 HTR - Heater

1.1.18 LVL - Level

1.1.19 Main Control Room Panels - Panels in the main control room area consisting of the following:

- o P601 - Reactor Core Cooling Benchboard
- o P680 - Operator Control Console
- o P807 - Auxiliary Electrical Control Benchboard (shared)

- o P807 - Auxiliary Electrical Control Benchboard (shared)
- o P854 - Plant Control Vertical Board (shared)
- o P855 - Control Room Ventilation Vertical Board (shared)
- o P856 - Seismic Instrument Cabinet (shared)
- o P862 - Fire Protection Vertical Board (shared)
- o P864 - Diesel Generator Benchboard
- o P870 - Auxiliary Control Benchboard

1.1.20 Meter (185) - GE Type 185 Edgewise Meters

1.1.21 Meter (180) - GE/Bailey Type 180 Meters

1.1.22 Mimic - A pictorial graphic of a system

1.1.23 MSLIV - Main Steam Line Isolation Valve

1.1.24 NRC Guidelines - NUREG-1580 "Human Engineering Guide to Control Room Evaluation"

1.1.25 PH - Phase

1.1.26 PREP - Preparation

1.1.27 RCIC - Reactor Core Isolation Cooling

1.1.28 Reflash - The capability of an annunciator summary window (multiple input) to 'reflash' (realarm) if a second condition appears, with initial condition still present

1.1.29 Ringback - The capability of an annunciator window to 'reflash' (at a slower rate) upon a return-to-normal condition

1.1.20 RHR - Residual Heat Removal

1.1.21 SSW - Standby Service Water

1.1.22 SYNC - Synchronize

1.1.23 VLV - Valve

# 2.0 INTRODUCTION

## 2.1 Purpose

This report is intended to outline the human factors engineering (HFE) review of the Grand Gulf Nuclear Station Unit 1 Control Room. It is also intended for the purpose of identifying the major discrepancies in the control room design and the corrective actions to be taken. Those discrepancies identified as low priority, priority 4 to 5, will not be addressed, since they have no safety or significant reliability implications. These discrepancies will be reviewed by MP&L and corrected depending on increased reliability/performance.

## 2.2 Background

As a result of the Three Mile Island (TMI) accident, the Nuclear Regulatory Commission (NRC) through various studies has identified the importance of control room design on operator performance. As such, the NRC has issued NUREG-0660, "NRC Action Plans Developed as a Result of the TMI-2 Accident" and NUREG-1580, "Human Engineering Guide to Control Room Evaluation". Based on these requirements and the concern for safety, MP&L contracted with the Essex Corporation to perform an independent third party review of the control room design. This review was conducted during the period from June 17, 1980, to October 1, 1980, and served to evaluate and identify areas in the control room design that are discrepant in regard to HFE principles. This review was then used as the basis for this report and MP&L's review.

## 2.3 Objectives

The objectives of the control room design review were to:

- Improve the ability of control room operators to prevent accidents or cope with accidents if they occur by improving the information provided to them.

- o Identify aspects of the control room design that were discrepant in regard to the NRC Guidelines.
- o Identify ways to improve labeling and mimics plus the use of demarcation lines to facilitate operator recognition of systems, subsystems, and components.
- o Prepare guidelines by which the control room environment will be evaluated once the construction is complete.
- o Prioritize the discrepancies in regard to plant safety/reliability.
- o Evaluate and take corrective action to correct the identified discrepancies.
- o Implement the corrective actions in a time frame consistent with the start-up schedule.

2.4 Scope

Since the control room was still under construction and congested, the major scope of the HFE evaluation was based on a full scale photographic mockup of the control room built specifically for this purpose. In addition to the full scale mockup, design drawings, system descriptions, personnel interviews, and actual control room visits provided the necessary information for an effective control room design review.

The HFE evaluation consisted of the following:

- o Control room hardware (controls and displays)
- o Control room workspace
- o Control room labeling and demarcation lines
- o Mimics
- o Annunciators

The control room environment, which was not addressed due to incomplete construction, will be addressed and documented prior to fuel load.

## 3.0 APPROACH

The evaluation of the control room consisted of three basic phases: discrepancy identification (data collection), discrepancy prioritization (data reduction) and selection for backfit. Data collection was accomplished by comparing features of the control room design with principles of HFE as delineated in NUREG-1580, "Human Engineering Guide to Control Room Evaluation". Data reduction consisted of identifying the potential errors associated with those design features found discrepant, estimating the magnitude of the effect, and assigning a priority based on the estimated effort. Selection for backfit consisted of identifying backfits that would reduce the likelihood of the discrepancy-induced operator error. The corrective action was then chosen, based on cost, schedule and improved operator performance with operator performance being the over-riding factor.

### 3.1 Identification of Discrepancies (Data Collection)

The data collection phase consisted of the following:

- o Control Room Survey
- o System Function/Control Function Analysis
- o Control Room Evaluation using NRC guidelines

#### 3.1.1 Control Room Survey

The surveys provided the necessary information on the control room for operator/system interface, such as: reach and visibility envelopes, design convention (standards), operator aids, etc. Areas that would normally have been addressed in these surveys, such as control room environment, were addressed by the generation of evaluation guidelines. These guidelines will then be used to verify conformance once the control room is complete.

3.1.2 System Function/Control Function Analysis

This analysis addressed the control room on a panel and system level. The use of a photographic full scale mockup of the control room, along with design drawings, system descriptions, personnel interviews and control room visits provided the necessary information. The analysis included control location with respect to associated displays, the feedback mechanism concurrent with operation of a control, the necessity for control location, and the accuracy and use of mimics and annunciators.

3.3.3 Human Factors Evaluation Using NRC Guidelines

This analysis addressed the control room on a panel and component level according to NRC guidelines. Each control and/or display was evaluated for compliance with the NRC guidelines.

3.2 Prioritization of Discrepancies (Data Reduction)

The data reduction process consisted of two phases:

- Phase One - This phase was performed by completing a report entitled "Human Engineering Discrepancy Report". This report includes the discrepant component, a statement of the problem, the potential error caused by the discrepancy, and suggested backfits for correcting the discrepancy.
- Phase Two - This phase consisted of establishing priorities of discrepancies in terms of importance. The basic criteria outlined in the NRC guidelines were used as the basis for establishing the priority levels. From answering the seven questions listed in the NRC guidelines, a priority rating was determined for the component. The priority levels are as follows:

  Priority 1 - Safety related with minimum opportunity for operator to correct error.

Priority 2 - Safety related with some opportunity for operator to correct error.

Priority 3 - Reliability related with mimimum opportunity for operator to correct error.

Priority 4 - Reliability related with some opportunity for operator to correct error.

Priority 5 - No impact on safety or reliability.

3.3 Selection of Discrepancies for Backfit

As part of the HFE effort, suggested backfits were recommended for the identified discrepancies. Since a few of the discrepancies had several suggested backfits with varying degrees of effectiveness and cost, each high-priority discrepancy was thoroughly reviewed. A suggested backfit or an alternative solution was then chosen for the corrective action. In some cases, the corrective action for one item was believed to reduce the priority or necessity of another.

## 4.0 RESULTS

The results of the HFE evaluation showed that while human engineering criteria had been applied to the control room, certain areas were discrepant. These discrepancies, while not critical individually, collectively could degrade the operability of the control room.

The review of the control room design indicated that applied HFE principles had been applied from an operability standpoint. These design aspects are as follows:

- Extensive use of mimics
- Functional grouping of systems (to a large extent)
- ECCS separation
- Computer aided operator guides

4.1 High Priority Discrepancies

While the HFE evaluation showed that principles had been considered, the evaluation also showed that the control room is discrepant in some areas. The detailed results of the evaluation are presented in the following appendix:

Appendix A - Summary of High Priority Discrepancies

4.2 Documentation Available for Review

Since the primary objective of the control room review was to identify and remove the causes for operator error, a comprehensive list of discrepancies (Comprehensive Date Files), priority levels (Human Engineering Discrepancy Report), and recommended corrective actions document that this objective has been met. These documents are and will be available for NRC review.

## 5.0 IMPLEMENTATION

In order to increase the operability of the control room thus increasing plant safety and reliability, MP&L plans to correct each of the following high priority items prior to fuel load:

- All priority 1 items
- All priority 2 items determined to be beneficial in increasing safety
- All priority 3 items determined to be beneficial in increasing reliability

The list of corrective actions to be implemented is included in Appendix A. All other identified items will be reviewed by MP&L to determine their effect on increasing the operability of the control room. These items will then be implemented during future outages depending on benefits gained.

## 6.0 REFERENCES


6.1 NUREG-1580 "Human Engineering Guide to Control Room Evaluation"

6.2 NUREG-0660 "NRC Action Plan Developed as a Result of the TMI-2 Accident"

6.3 Bechtel Control Room Design Review (MPB-80/0132)

6.4 NUREG-1270 "Human Factors Evaluation of Control Room Design and Operator Performance at Three Mile Island-2"

6.5 Essex's Final Report "Human Factors Engineering Evaluation of the Grand Gulf Unit 1 Control Room"

# APPENDIX A

## Summary of High Priority Discrepancies

The following pages list the discrepencies from NUREG-1580 that have a priority of 3 or higher. Included in these pages are the following:

- Human Engineering Discrepancy Number
- Components Involved
- Location
- Discrepancy
- Priority
- Corrective Action
- Estimated Completion Date

| DISCREPANCY NUMBER | COMPONENT | LOCATION | DISCREPANCY | PRIORITY | CORRECTIVE ACTION | ESTIMATED COMPLETION DATE |
|---|---|---|---|---|---|---|
| 01 | Control Room Labeling | Main Control Room Panels | Labeling uses inconsistent abbreviations, terminology and syntax. | 2 | Standardize labeling to incorporate consistent abbreviations, terminology and syntax. | 6-30-81 |
| 02 | Control Room Labeling | P870, P680 P854, P862 P856, P855 | Labeling lacks the engineering numbers (such as valve number, etc.). | 2 | Increase label plaque size and incorporate engineering numbers. | 6-30-81 |
| 03 | Panel Labeling | Main Control Room Panels | No system or summary labels exist on the panels to facilitate training and operator recognition. | 2 | Incorporate panel number labels, system names, and summary labels, where necessary. | 6-30-81 |
| 04 | Control Room Control/Display Functional Grouping | P870, P680 | Controls and displays are not always visually grouped by function. | 2 | Incorporate demarcation lines to visually group related controls and displays. | 6-30-81 |
| 05 | Annunciators | Main Control Room Panels | Annunciators lack a true indication of a return-to-normal condition (alarm clear). When an alarm condition clears, the window automatically deenergizes, provided the reset push-button has been depressed. | 1 | Incorporate "ringback" sequence into the annunciator logic system, such that a return-to-normal condition causes the annunciator window to reflash at a slow rate and at a rate easily distinguishable from the alarm rate. | 6-30-81 |

| DISCREPANCY NUMBER | COMPONENT | LOCATION | DISCREPANCY | PRIORITY | CORRECTIVE ACTION | ESTIMATED COMPLETION DATE |
|---|---|---|---|---|---|---|
| 06 | Annunciators | Main Control Room Panels | Annunciators lack any visible priorization and first out capability. Color code has red as a trip rather than alarms that require immediate response. | 1 | Use sequence of event alarm typer in conjunction with CRT display for first out capability. | Presently incorporated |
| | | | | | Re-prioritize annunciators accordingly:<br>a. Priority 1 alarms - Red alarms (critical alarms) will apply to conditions which indicate the plant is in an unsafe condition or direct scram.<br>b. Priority 2 Alarms - Amber alarms (warning alarms) will apply to conditions which require immediate corrective action.<br>c. Priority 3 Alarms - White alarms (caution alarms) will apply to conditions which require corrective action in a timely manner.<br>d. Priority 4 Alarms - Blue Alarms (general alarms) will apply to alarms which provide the operator with system status and/or information. | 4-28-81 |

| DISCREPANCY NUMBER | COMPONENT | LOCATION | DISCREPANCY | PRIORITY | CORRECTIVE ACTION | ESTIMATED COMPLETION DATE |
|---|---|---|---|---|---|---|
| 07 | Annunciators | Main Control Room Panels | Annunciator labeling text is inconsistent in the use of abbreviations, terminology and syntax. There is also an excessive number of characters which create readability problems. | 1 | Standardize abbreviations terminology, and syntax. | 4-28-81 |
| | | | | | Incorporate the use of a triple-tiered information format to present the message in a regular pattern:<br><br>First line - system or component<br><br>Second line - condition monitored<br><br>Third line - alarm status | 4-28-81 |
| 08 | Annunciators | Main Control Room Panels | Annunciator windows that have multiple inputs or channels do not have the capability for reflash if the first alarm has not cleared. | 2-3 | Review each annunciator window with multiple inputs for criticality to plant safety and incorporate the "reflash" sequence on the multiple input annunciators that are critical. | 6-30-81 |
| 09 | Annunciators Audible Alarms | Main Control Room Panels | At present the alarms do not adequately localize to a specific panel. Operator must visually scan to locate alarm. | 2 | Incorporate audible alarms that localize to each panel by direction and frequency. | 6-30-81 |

| DISCREPANCY NUMBER | COMPONENT | LOCATION | DISCREPANCY | PRIORITY | CORRECTIVE ACTION | ESTIMATED COMPLETION DATE |
|---|---|---|---|---|---|---|
| 10 | Annunciators ADS B | P601-18A | These annunciators are located on P601-18A while the ADS system is on the P601-19B panel. This puts them about three feet away from their controls. | 2 | Although the annunciators are not located directly above the controls, they are still visible to the operator. Training and reprioritizing the annunciators in accordance with Discrepancy Number 06 should reduce the necessity for moving the annunciator windows. Therefore, no corrective actions will be implemented at this time. | N/A |
| 11 | Annunciators | Main Control Room Panels | The annunciator windows are not ordered within the annunciator panels in order of priority and/or functional grouping. | 3 | Although the annunciator windows are not functionally grouped in the annunciator panels to the fullest extent, functional grouping was considered. (Design changes which required additional windows have lead to the inconsistent ordering.) The reprioritization of the annunciators in accordance with Discrepancy Number 06 should, however, decrease the necessity for this item. Therefore, no corrective action will be implemented at this time. | N/A |

| DISCREPANCY NUMBER | COMPONENT | LOCATION | DISCREPANCY | PRIORITY | CORRECTIVE ACTION | ESTIMATED COMPLETION DATE |
|---|---|---|---|---|---|---|
| 12 | Mimic Lines | P870,1C, 2C, 3C<br>P864-1C, 2C<br>P601-All C Sections<br>P807-All C Sections | Mimics are difficult to follow due to<br>o Lack of flow arrows<br>o Lack of line termination labels<br>o Incorrect order of valves<br>o Difficulty in determining when one line intersects or crosses another<br>o Poor labeling of controls<br>o Poor use of symbols | 2 | Incorporate flow arrows, standard labeling, and symbols to indicate a connection versus a crossing, etc.<br><br>Incorporate consistent color coding of system processes. | 6-30-81<br><br>6-30-81 |
| 13 | HPCS Mimic Key-operated Rotary Controls:<br>o SYNC Control BRKR #4<br>o SYNC Control BRKR #5<br>o SYNC Control BRKR #6 | P601-16C | Three ESF transformers connect to the HPCS D/G mimic at the breakers, but there is no label to indicate which transformer connects with which breaker. | 2 | Incorporate permanent labels to indicate transformer interface. | 6-30-81 |
| 14 | HPCS Diesel Generator (D/G) Fan Controls/ Fuel Oil Tank Indicators. | P870-5B, 5C | The controls/indicators are located on P870, while the rest of the HPCS system is located on P601. | 2 | Incorporate color coded demarcation lines and summary labels to visually relate controls. | 6-30-81 |

| DISCREPANCY NUMBER | COMPONENT | LOCATION | DISCREPANCY | PRIORITY | CORRECTIVE ACTION | ESTIMATED COMPLETION DATE |
|---|---|---|---|---|---|---|
| 15 | BPCS Mimic - Breaker Controls | P601-16C | The green position flag indicates control position, which is an integral part of the control itself, does not provide enough contrast with the control's background, which is also green. | 3 | Provide visual contrast between the two shades of green. | 6-30-81 |
| 16 | RCIC Mimic | P601-21C | The RCIC mimic depicts the RCIC system goes to the head spray, when in reality it goes to the feedwater system. | 2 | Redesign the RCIC mimic to incorporate the design change and reflect the as-built condition. | 6-30-81 |
| 17 | RCIC "Water Leg Pump" J-handle Control | P601-21C | RCIC system does not include a water leg pump, therefore control serves no function. | 2 | Remove the control from P601-17C. | 6-30-81 |
| 18 | RHR Mimic | P601-17C, 20C | The RHR mimic shows that the head spray comes off Loop A, when in reality it comes off Loop B. | 1 | Relocate the RHR to HEAD SPRAY control and indicator from Loop A to Loop B. | 6-30-81 |
| | | P601-17C, 20C | The RHR heat exchangers A/B service water outlet controls are not connected as they are controlled from P870. | 2 | Remove the controls from P601. | 6-30-81 |
| 19 | Vertical Meters for RHR Heat Exchanger (HX) B | P601-17B | The meters are not sequenced from left to right in a manner consistent with RHR HX A. | 2 | Rearrange the RHR HX B meters in the same manner as RHR HX A. | 6-30-81 |

| DISCREPANCY NUMBER | COMPONENT | LOCATION | DISCREPANCY | PRIORITY | CORRECTIVE ACTION | ESTIMATED COMPLETION DATE |
|---|---|---|---|---|---|---|
| 20 | ADS/Safety Relief Valve Mimic | P601-19C | The ADS valves are integral with the safety relief valves but are not coded in any way to allow the operator to easily determine the ADS valves. | 2 | Relabel the ADS valves to include ADS in the label. | 6-30-81 |
| 21 | Unit 1 and Unit 2 P807 Mimic | P807 All C Sections | The shared panel is set up in a mirror image which creates transfer of training and learning problems. This problem is compounded by the incomplete mirroring. | 2 | Incorporate different control handles and labeling for the Unit 2 side to provide visual and tactual feedback to the operators. | 7-30-81 |
| | | P807-3B | The 500 KV switchyard is reversed from the functional layout of the P807 mimic. | 2 | Incorporate explicity labeling in conjunction with training. | 6-30-81 |
| 22 | Pushbuttons<br>o Remote Manual D/G START<br>o Remote Manual D/G STOP | P864-1C, 2C | The pushbuttons are not discriminable visually. In addition, the critical remote manual D/G stop control is not protected from inadvertent activation. | 2 | Incorporate a red pushbutton for the D/C stop pushbutton.<br>Incorporate a guard to prevent inadvertent activation. | 6-30-81<br>6-30-81 |
| 23 | Mimic for Standby D/G 11:<br>o 4.16 KV BRKR 152-1501<br>o 4.16 KV BRKR 152-1514 | P864-1C | The breaker controls for D/G 11, D/G 12, and D/G 13 interface with ESF transformers No. 12, No. 11, and No. 21. The order of these switches (left to right) for D/G 12 is consistent with the order for D/G 11 and D/G 13. | 2 | Rewire and relabel the D/G 12 controls to be consistent with D/G 11 and D/G 13. | 6-30-81 |

| DISCREPANCY NUMBER | COMPONENT | LOCATION | DISCREPANCY | PRIORITY | CORRECTIVE ACTION | ESTIMATED COMPLETION DATE |
|---|---|---|---|---|---|---|
| 24 | Vertical Meters for D/G 12:<br>o AC VOLTS<br>o AC FREQUENCY | P864-2B | The voltage and frequency meters for D/G 12 are placed in a sequence from left to right that is the opposite of that indicated by panel labeling and the sequence for D/G 11. | 2 | Reverse the meters to be consistent with D/G 11. | 6-30-81 |
| 25 | Rotory Control D/G 11:<br>o FCTNL TEST PH A BUS 15AA | P864-1C | This control is represented by a rotary control but according to drawings and the same control on P864-2C it should be a pushbutton. | 2 | Incorporate a pushbutton and and change labeling accordingly. | 6-30-81 |
| 26 | Pump Controls, Valve Controls and Fan Coil Controls | P870-A11 B Sections | The controls on P870 are all the same thereby requiring the operator to visually search for the various controls in the matrix. | 2 | Incorporate different control handles and/or different shape, color retaining rings to visually differentiate controls. | 6-30-81 |

| DISCREPANCY NUMBER | COMPONENT | LOCATION | DISCREPANCY | PRIORITY | CORRECTIVE ACTION | ESTIMATED COMPLETION DATE |
|---|---|---|---|---|---|---|
| 27 | Rotary Controls:<br>o DIV 1 MANUAL BYPASS<br>o DIV 1 MOTOR OPER VLV TEST<br>o DIV 2 MANUAL BYPASS<br>o DIV 2 MOTOR VLV TEST<br><br>Pushbuttons:<br>o DIV 1 MANUAL INITIATION<br>o A MANUAL INITIATION<br>o C MANUAL INITIATION<br>o DIV 1 MANUAL INITIATION<br>o B MANUAL INITIATION<br>o D MANUAL INITIATION | P870-A11 B Section | These various controls are not labeled as to what function or system is being initiated. | 2 | Incorporate labels with system and function. | 6-30-81 |
| 28 | CCW Mimic | P870-2C | Mimic lines going to and from HX B do not have adequate labeling to indicate beginning and termination points. | 2 | Incorporate labeling to indicate line termination and beginning points. | 6-30-81 |

| DISCREPANCY NUMBER | COMPONENT | LOCATION | DISCREPANCY | PRIORITY | CORRECTIVE ACTION | ESTIMATED COMPLETION DATE |
|---|---|---|---|---|---|---|
| 29 | Turbine Stress Evaluator, Automatic Turbine Test, and Low Pressure Valve Meters | P870-6B | These controls are located on panel P870-6B, however, they should be located on P680 with the other turbine controls. | 3 | Incorporate demarcation lines to provide visual association. | 6-30-81 |
| 30 | Trend Recorder Controls:<br>o Filter Train A Recorder<br>o SSW Loop A flow and pressure recorder.<br>o Filter Train B recorders<br>o SSW Loop B flow and pressure recorder<br>o Hydrogen analyzer recorder | <br>P870-2B<br>P870-1B<br>P870-8B<br>P870-7B<br>P870-4B, 10B | These controls are associated with trend recorders located to the left of the control. In some cases the controls and recorders are separated by an intervening recorder, thus making visual association of the controls difficult. | 3 | Incorporate demarcation lines to provide visual association. | 6-30-81 |
| 31 | 10-Position Rotary Control:<br>o RECOMBINER TO SELECT | P870-4B, 10B | This control has 10 positions when actually only three are used. | 2 | Incorporate explicit labeling to identify positions used. | 6-30-81 |
| 32 | Trend Recorders | Main Control Room Panels | The paper scale is not consistent with the scale on the trend recorder which makes trending and historical reconstruction difficult. | 2 | Incorporate chart paper with scales consistent with recorder scales. | 7-31-81 |

| DISCREPANCY NUMBER | COMPONENT | LOCATION | DISCREPANCY | PRIORITY | CORRECTIVE ACTION | ESTIMATED COMPLETION DATE |
|---|---|---|---|---|---|---|
| 33 | Rotary Controls:<br>o RCIC DIV I MOV TEST PREP<br>o RCIC DIV I ISOLATION RESET<br>o RCIC DIV 2 ISOLATION RESET<br>o MSLIV (Series of Controls)<br>o DIV I MODE SELECTOR<br>o DIV 2 MODE SELECTOR | P601-21B<br>P601-21B<br>P601-21B<br>P601-18C, 19C<br>P870-4B<br>P870-10B | These controls violate population stereotype and plant convention for direction of activation. The norm, close, etc., positions, are on the right side when all others are on the left. | 2 | Rewire and relabel to convert to plant and population stereotypes. | 6-30-81 |
| 34 | Legend Status Lights | P870-B Section<br>P864-B Section<br>P601-B Section<br>P855 | The legend plates are not keyed to prevent replacement on inappropriate lights. | 2 | Permanently attach the legend plates (mylar inserts) to the status lights. | 6-30-81 |
| | Legend Pushbutton | P680, P854 | See above | 3 | See above | 6-30-81 |
| 35 | Legend Status Lights/Legend Pushbuttons | P870, P864<br>P601, P680<br>P854, P855 | Special tools are required to change incandescent bulbs. | 2 | Procure and/or design tools for bulb replacement | 6-30-81 |

| DISCREPANCY NUMBER | COMPONENT | LOCATION | DISCREPANCY | PRIORITY | CORRECTIVE ACTION | ESTIMATED COMPLETION DATE |
|---|---|---|---|---|---|---|
| 36 | 185 Vertical Indicators | | These meters are small and difficult to read. Parallax problems exist due to the pointer design. | | | |
| | | P680 | For the following:<br>o RX water levels<br>o RX presseures<br>o Feedwater flow<br>o Steam Flow | 2 | Replace the meters monitoring these parameters with larger, more readable meters (Bailey 'Signflex' meters). | 6-30-81 |
| | | P680, P864, P870 | For meters that monitor parameters other than current | 3 | Although the meters are small and have a parallax problem, they are readable. Since relative position is more important than the actual reading, the incorporation of tolerance zones (Discrepancy number 37) will reduce the necessity for this item. Therefore, no corrective action will be implemented at this time. | 6-30-81 |
| 37 | Vertical/Horizontal Meters and Trend Recorders | Main Control Room Panels | The scales for the meters and trend recorders do not have tolerance ranges included on the scale face to aid the operator in identifying when a parameter is out of tolerance. | 2-3 | Incorporate tolerance ranges on the meters that are critical to plant safety and reliability.<br>o Light green marked zones will indicate in tolerance zones, or<br>o Yellow marked zones will indicate out of tolerance zones. | 6-30-81 |

| DISCREPANCY NUMBER | COMPONENT | LOCATION | DISCREPANCY | PRIORITY | CORRECTIVE ACTION | ESTIMATED COMPLETION DATE |
|---|---|---|---|---|---|---|
| 38 | 185 Vertical Meters:<br>o PUMP A SEAL CAV #1 PRESS<br>o PUMP A SEAL CAV #2 PRESS<br>o PUMP A SEAL CAV #1 PRESS<br>o PUMP B SEAL CAV #2 PRESS | P680-3B | The scales read 0-3.5 psi when they should read 0-1200 psi. | 3 | Replace Scales | 6-30-81 |
| 39 | 180 Vertical Meter:<br>o 480V BRKR 52-18102 | P807-2B | The scale reads in volts when it should read in amps. | 3 | Replace Scale | 6-30-81 |
| 40 | Turbine Control Panel | P680-9A, 9B, 9C, 9D | The turbine panel is not organized in a manner that lends itself to operability. In addition some of the push-buttons violate population stereotype and the NRC Guidelines for directions of activation. | 3 | Incorporate demarcation lines, color coding, and summary labels to enhance operability.<br>o Rearrange the indicators on P680-9B to increase control/display association<br><br>Rewire and relabel discrepant pushbuttons to conform to plant conventions and NRC Guidelines. | 6-30-81<br><br>6-30-81 |
| 41 | Pushbutton:<br>o TURBINE TRIP | P680-9C | This control is subject to inadvertent activation | 3 | Incorporate protective guard | 6-30-81 |

| DISCREPANCY NUMBER | COMPONENT | LOCATION | DISCREPANCY | PRIORITY | CORRECTIVE ACTION | ESTIMATED COMPLETION DATE |
|---|---|---|---|---|---|---|
| 42 | Pump Control Systems | Main Control Room Panels | There are no ammeters to monitor the functioning of the large horsepower pumps. | 3 | Incorporate ammeters as necessary, for the large horsepower pumps. | Future outage |
| 41 | Legend Lights and Pushbuttons | P680 | The legend lights and push-buttons that have three partitions, thereby having a single incandescant bulb, do not have a lamp test capability. | 3 | The legend lights/pushbutton in question serve no safety function and are normally used only during a test. Therefore, no corrective action will be implemented at this time. | N/A |
| 44 | Computer Console CRT | P680-4B, 8B | The brightness and focus controls are available but not easily accessible. Accessibility is gained by loosing two wing nuts in the back, sliding the CRT backwards, and then accessing controls through the hole in panel front. | 3 | Since the lighting conditions in the control room will remain constant, frequent adjustment should not be necessary. Extensive use of the CRT's to date has not indicated this to be a problem. Therefore no corrective action will be implemented at this time. | N/A |
| 45 | CRT Controls: o EXECUTE KEY | P680-4C, 8C | The execute key, which is instrumental for inputting commands to the computer, is located among other keys in a matrix. The key is not visually distinguishable. | 3 | Incorporate color coded key. | 6-30-81 |

| DISCREPANCY NUMBER | COMPONENT | LOCATION | DISCREPANCY | PRIORITY | CORRECTIVE ACTION | ESTIMATED COMPLETION DATE |
|---|---|---|---|---|---|---|
| 46 | Trend Recorders:<br>o Fresh Air Unit A flow and pressure<br>o Fresh Air Unit B flow and pressure | P855 | The labeling indicates that the recorder monitors two parameters, when in reality it only monitors flow. | 3 | Change label accordingly. | 6-30-81 |
| 47 | Control Rod Drive (CRD) Mimic | P601-22C | The CRD mimic depicts the CRD system returns to the reactor vessel when in reality it does not. | 2 | Redesign the CRD mimic to incorporate the design change and reflect the as-built condition. | 6-30-81 |
| 48 | 185 Vertical Meters:<br>o CNDS BOOSTER PUMP FLOW<br>o CNDS PUMP FLOW<br>o HTR DRN PUMP FLOW | P680-1B | Scales are not consistent with ranges being monitored. | 3 | Replace scale | 6-30-81 |
| 49 | Control Room Layout | Main Control Room Area | The operator at the P680 panel cannot see the C Section of P601 to verify valve alignment. | 3 | Incorporate the use of computer aided operator guides on the CRT's to verify valve alignment. | 6-30-81 |

NOTE: The estimated completion dates are based on present fuel load schedule of August, 1981.