Philadelphia Electric Company

Limerick Plant

Control Room Design Review

Final Report

June 1984

TABLE OF CONTENTS

List of Illustrations

List of Tables

INTRODUCTION

This document constitutes Philadelphia Electric Company's (PECo) Detailed Control Room Design Review (DCRDR) Report for the Limerick Unit 1 Nuclear Generating Station. In August, 1983, PECo submitted to the Nuclear Regulatory Commission the Detailed Control Room Design Review Program Plan for Philadelphia Electric Company's Limerick Plant. That plan described control room design review efforts that had formally commenced with the General Electric Boiling Water Reactor Owner's Group (BWROG) review. The Summary Report of that survey dated September 16, 1982, is included as Appendix B of this report. Incorporating these results and guidelines from NUREG 0700, the Program Plan discussed a schedule and methodology from which the subsequent review efforts were to proceed.

This report documents the results of the review effort to date and consists of three major sections: Methodology, General Findings, and Implementation. The Methodology section includes these subsections.

- BWROG Human Factors Design Summary. This summary provides a synopsis of Owner's Group survey efforts and identifies items to be included in the supplementary review.

- Limerick Supplemental Review/Assessment and Implementation Phase. This subsection provides a synopsis and status of current survey efforts and also identifies those items that remain delayed due to construction.

- Management and Staffing. Discussed in this subsection are any modifications in utility support members that have occurred since submittal of the Program Plan.

- Documentation. Included here are changes that have occurred since Program Plan submittal.

- Review Procedures. This subsection provides a synopsis of the procedures and methodology used in the design review effort.

Section 2, General Findings, defines and discusses nine major categories. An overview discussion provides a perspective of the types of discrepancies identified.

Section 3, Implementation, discusses any modifications to the control room for improvement of the man-machine interface. Such modifications are the results of the review team's assessment of all Human Engineering Discrepancies (HEDs) (Appendix A).

SYNOPSIS OF FINDINGS

The Detailed Control Room Design Review (DCRDR), in addition to the previous BWROG Control Room Survey (CRS), identified Human Engineering Discrepancies (HEDs). Through a systematic disciplined assesssment and design improvement process (to be discussed in later sections) each HED was dispositioned. The assessment process dictated what needed changing and when to implement the changes. The majority of HEDs were determined to be

correctable through enhancements prior to fuel load. For those HEDs not corrected by fuel load, a safety significance analysis was conducted. This analysis is discussed in detail in Section 1.6.5. In summary, as a result of the CRDR findings, analysis and corrections scheduled prior to fuel load, it is felt that Limerick Unit 1 can be operated safely.

The following presents a synopsis of HED distribution:

1. TOTAL number of discrepancies identified	**189**
2. Number of HED Assessment sheets	163
3. Number of discrepancies corrected by Fuel Load	88
4. Number of discrepancies assessed to be acceptable, corrected or no change required	61
5. Number of discrepancies scheduled for correction subsequent to Fuel Load	36
6. Held out for further review	4
TOTAL	**189**

Section 1

METHODOLOGY

1.1 OVERVIEW

The DCRDR was partially addressed by the BWROG's Control Room Survey (CRS) completed in February 1982. That program dealt only with the planning and review phases of the CRDR. The balance of the CRDR was concluded by means of a Supplemental Control Room Survey (SCRS), which completed open items from the CRS, and addressed the assessment and implementation phase of the CRDR. The supplemental survey incorporated the BWROG data and any items not included in that data. All phases of the surveys are discussed below. More detailed information relative to the BWROG survey is contained in the Program Plan Report of July 1983. In addition, Appendix B contains the BWROG Summary Report.

1.2 BWROG HUMAN FACTORS DESIGN REVIEW SUMMARY

This review was performed by operations and engineering personnel from four utilities, human factors consultants, and representatives of General Electric. Efforts of this review, as well as CRS open items due to construction status, included:

- BWROG CRS - A panel by panel evaluation of the Limerick control room by operations, engineering, and human factor personnel, addressing only the planning and review phases of the CRDR; the assessment, implementation, and reporting phases remained for completion in the supplemental review.

- BWROG Operator Experience Review - The survey team interviewed eight operators of varying experience levels using questionnaires developed by the BWROG and follow-up interviews. LER's and scram reports (for Peach Bottom, since Limerick was under construction) for the two years preceeding the survey were also reviewed.

- BWROG Task Analysis - Task analyses and walkthroughs of selected emergency EPG's were performed and evaluated against the Emergency Procedure Guidelines developed by the BWROG.

- Open Items for Supplemental Review - As the Limerick control room was under construction at the time of the BWROG survey, the following items were unable to be completed and were left for a supplemental review: computers, procedures, control room environment, maintenance and surveillance, training and manning, evaluation of panel changes, and open checklist items.

1.3 LIMERICK SUPPLEMENTAL REVIEW/ASSESSMENT AND IMPLEMENTATION PHASE

Those activities listed below were undertaken and completed after submittal of the Limerick Program Plan report.

- Transfer of Human Engineering Discrepancies (HEDs) generated in the original BWROG survey to HED Assessment forms. This activity was designed to provide a smooth

transition between the original BWROG survey and the supplemental review.

- Completion and update of CRS using BWROG checklists.
- Generation and documentation of HEDs using supplemental survey.
- Performance of human engineering suitability analysis.
- Performance of a supplementary experience review LER analysis to update the original review.
- Assessment of significance and prioritization of HEDs relative to safety significance.
- Construction of full-scale, Unit 1 and Common Panel, plant specific mockup at the Limerick site.
- Design and implementation of panel enhancements on a full-scale mockup.
- Development of proposed resolutions for HEDs determined to be significant and assigned a priority of 1, 2, or 3.
- Performance of a verification of resolved HEDs to ensure they adequately addressed the discrepancy and that they did not create another HED.

Due to the status of construction activities in the control room, portions of the survey in the following areas could not be

performed in detail. A schedule for completing these items has been included in the General Findings section of this report.

- Environment
- Maintenance
- Computers

1.4 MANAGEMENT AND STAFFING

The Program Plan discussed the multidisciplined review teams employed in the BWROG's survey and the subsequent supplemental review. In general, the teams functioned as presented in the Program Plan.

The core CRDR team consisted of the following people:

T. Cabrey (Review Team Leader)	Nuclear* and IC Systems Engineer
M. J. Leahy	IC System, Instrumentation and Control Engineer
J. Doering	Operations Engineer (SRO)
R. Chidley	Human Factors Consultant
A.C. Macris	Human Factors Consultant

*T. Cabrey served for three years as a Shift Technical Advisor at Peach Bottom and was appropriately trained in nuclear engineering.

This team was supplemented as required by:

G. Edwards (Former Project Leader)	IC Systems Engineer, Power Generation Engineer
G. Madsen	Asst. Operations Engineer (SRO)
E. Cosgrove	Shift Superintendent (SRO)
W. Barnshaw	Shift Superintendent (SRO)

All of the above were extensively involved in team deliberations and review of solution designs. Also, M. J. Leahy, Review Team leader for the CRDR at Peach Bottom, provided representation from that plant. Other engineering personnel were consulted by team members as required in relation to analyzing and resolving HEDs. Although General Electric personnel were available, the team had no requirement for their input. Resumes for members not included in the Program Plan are included in this report as Appendix C.

The team met to develop criteria and establish procedures, and to review each phase of the supplementary review and design of proposed solutions. Leadership and guidance were provided by human factors consultants. The team was able to form a consensus in all deliberations after thorough discussion and follow-up investigation as required. All team members had the right to formally register a dissenting opinion.

Possible solutions to HEDs were initially proposed by the human factors consultants. The team reviewed the possible solutions, considered other solutions, and assigned follow-up action. Specific investigations of HEDs were performed by individual team members and by sub-teams. All work was presented to the team for discussion, review, revisions, and final approval.

1.5 DOCUMENTATION

A significant number of reference documents were required to conduct the CRDR. For the purpose of consistency with NUREG 0700, those reference documents are referred to as Input Data.

During the course of the total review process, documentation of findings, analysis, and results were developed. This documentation is referred to as Output Data. Both Input and Output Data are discussed below.

1.5.1 Input Data

The Limerick CRDR utilized the latest revision of the below listed materials as they existed between August 1983 and May 1984.

- System descriptions
- Piping and instrumentation drawings
- Control room floor plans
- Panel arrangement drawings
- Panel mockup
- Lists of acronyms and abbreviations used in the control room
- Plant design guide providing limited descriptions of coding conventions
- Operator training materials
- NUREG 0700
- BWROG CRDR Program Methodology
- BWROG Human Factors Engineering Control Room Survey
- BWROG Human Factors Engineering Control Room Survey Supplement

1.5.2 Output Data

Output data is primarily comprised of the documentation generated as a result of the review process. The data forms are discussed in Section 1.6 with sample forms included therein.

- Human Engineering Discrepancy (HED) Assessment Form - Figure 1-1 (form) and Appendix A (completed form).
- HED Significance Checklists - Figure 1-2.
- HED Verification Forms - Figure 1-3.
- Supplementary operator experience questionnaire - Appendix D.

1.6 REVIEW PROCEDURES

This section describes the procedural process used in the supplemental control room review and subsequent assessment and implementation phases of the program. This information is provided in sections as follows:

- Supplemental control room survey
- Human engineering suitability verification
- Operator experience review
- Control Room function validation

1.6.1 Supplemental Control Room Survey

A supplemental CRS was done using checklists developed by the BWROG in order to update and complete the existing survey data generated during the initial CRS. The BWROG designed the checklists, to incorporate criteria included in NUREG 0700. Appendix C contains unadministered copies of initial and supplemental survey checklists. The survey process is outlined below:

- Panels installed after the BWROG survey were evaluated against both the initial and supplemental BWROG checklists. The BWROG checklists were used to ensure traceability and consistency in the survey process.

- Panels which had undergone design changes since the initial survey were reviewed to determine if the changes affected any of the initial HED results.

- All panels were evaluated using the supplemental checklists.

The HEDs from the BWROG Control Room Survey were documented as a report that listed HEDs in an abbreviated format. In order to provide accountability and format for managing each HED, the BWROG HED listings were converted to a HED Assessment form (Figure 1-1). In addition, all HEDs identified by the supplementary review were recorded on this form. This form was used to assign specific HED numbers (cross-referenced to the BWROG report), identify the criteria used and the source, and to further expand on the specific discrepancy. The development of the HED Assessment Form was accompanied by an analysis of each BWROG HED to ensure the nature of the discrepancy was understood. The form also served to organize the overall process of assessment and resolution of HEDs.

1.6.2 Human Engineering Suitability

A thorough verification of human engineering suitability of the control room panels was performed as an independent review by human factors personnel who are also qualified in nuclear operations. A top down analysis was conducted for all panels examining functional and spatial arrangement both within each panel and between panels. The analysis used panel arrangement drawings, technical and training material, and instrumentation drawings.

HED ASSESSMENT

HED No. _____

EP = _____

_____

TITLE:

COMMENT:

Item: Ref.: Source:

IDENTIFICATION: Panel:
Component Name:
ID or Number:

DESCRIPTION:

MITIGATING CONSIDERATIONS:

POSSIBLE SOLUTIONS:

RESOLUTION: (Code) (Priority) (Sched:)

TRAINING REQUIREMENTS:

PROCEDURE REQUIREMENTS:

Approval Signature: Date:

( ) Additional page(s) attached

Figure 1-1. Human Engineering Discrepancy Assessment Form

Items that were identified as not conforming to general human suitability guidelines were identified as discrepancies, transferred to HED assessment forms, and included in the assessment process.

1.6.3 Operator Experience Review

A supplemental experience review was performed in a manner similar to the BWROG methodology (discussed in the Program Plan) to update operator experience since the completion of the original CRS. Fifteen operators of various experience levels were given updated questionnaires (Appendix D). A summary of results of the initial BWROG operator questionnaire is contained in Appendix B, BWROG's Summary Report, developed by human factors consultants for PECo. At the time of the writing of this report, analysis of the supplemental operator questionnaire results has not been completed. Upon completion, a summary of the findings will be included as an addendum to this document.

1.6.4 Licensee Event Report Review

Plant specific LER data generated since the BWROG review of the Peach Bottom plant were reviewed for their applicability to the Limerick CRDR effort. Emphasis was placed on LERs resulting from plant procedural/operational deficiencies such as updates in plant technical specifications; inadequacies in operator training; and inadequate or improper instrumentation, such as a missing display or alarm. Of the 195 LERs reviewed, only 32 fell

into one or more of the above categories. The results of the LER review are included as Appendix E, Operator Experience Review, Licensee Event Report Summary.

1.6.5 Assessment of HEDs

All HEDs were initially sorted into three categories:

- Those that can be resolved by enhancements.
- Those that form a class of problems that could be part of a common resolution.
- Those that must be considered individually because of their unique nature.

Enhancement design was commenced as the first step of the assessment phase. The CRDR team was first briefed on the human factors approach and methodology. Then the criteria for enhancements was discussed. Based upon the criteria, a proposed sample panel enhancement was developed by the consultants and reviewed by the team. Also, proposed terminology to be used on the control room panels was submitted for review. After a full team review of the proposed enhancements, an enhancement methodology was established. All panel enhancements and new label terminology was reviewed by the team and by additional operating personnel. Revisions were made as directed by the team, and the resulting enhancements were placed on the full scale mockup.

A large number of HEDs were corrected by the enhancement designs. Because the enhancements will be completed prior to fuel load, it was not necessary to determine the priority of the HEDs resolved by enhancements. Other categories of HEDs that have been designated for completion prior to fuel load also were not assigned priorities.

HEDs not to be corrected prior to fuel load were subjected to an assessment of significance and safety implications, and were assigned a priority as defined in the Program Plan. A Significance Checklist was completed for each HED to be assessed (Figure 1-2). This form was completed by the assembled team, with each member discussing his perspective of the factors on the checklist. A consensus was recorded and a final significance was assigned. Checks were placed after those items the team agreed were significant. These were used to clarify and focus the discussion of significance, but were not weighted or added. The team then considered the EP (Evaluation Product) assigned by the BWROG checklist. All these factors were considered with respect to the specifics of the discrepancy under discussion. Finally, a consensus of significance, with respect to the probability of causing an operator error, was obtained and was recorded at the bottom of the form.

Having decided the significance, the team assessed the safety aspects of the discrepancy. The list of considerations is shown in Table 1-1. Based upon this guidance, the team reviewed the

HED SIGNIFICANCE CHECKLIST

HED NO. _____

A. PHYSICAL PERFORMANCE

1. Reduction of effectiveness of the operator's body and mind caused by:
   a. Undue fatigue:
      (1) Duration of operation _____
      (2) Frequency of demands _____
      (3) Environmental conditions _____
   b. Discomfort _____
   c. Injury _____

2. Restriction of the operator's ability to perform:
   a. Control suitability _____
   b. Availability _____

B. SENSORY/PERCEPTUAL PERFORMANCE

1. Reduction in visual sensing:
   a. Visibility of instrument or information _____
   b. Readability of information _____
   c. Visual distractions _____

2. Impairment of audio reception:
   a. Audibility _____
   b. Noise level _____

3. Perception of information received visually or audibly:
   a. Identification of information sought _____
   b. Understandable information _____

C. MENTAL PERFORMANCE

1. The degree of stress:
   a. Rapidity of response required _____
   b. Severity of situation (emergency procedure) _____
   c. Accuracy of response required _____

2. The tendency to cause confusion:
   a. Misleading information or arrangement _____
   b. Complexity _____

Figure 1-2. HED Significance Checklist

3. Mental workload:
   a. The degree of information collection requirements
   b. Correlation of information
   c. Mental manipulations
   d. Evaluation and decision

4. Coordination with others in or outside control room:
   a. Absence/remote location of information or controls
   b. Delay of feedback information

SIGNIFICANCE RATING: Indicate the overall probability of this discrepancy causing operator error.

Highly Likely		Possibly		Not Likely
5	4	3	2	1

Figure 1-2. HED Significance Checklist (Continued)

TABLE 1-1. DETERMINATION OF SAFETY SIGNIFICANCE OF A HED

In determining the safety significance of a HED, the combined judgement of the team is needed in consideration of the specific condition caused by the HED or a combination of HEDs. The team members should consider the following:

1. HEDS that cause errors on systems that directly effect safety such as:
   a. Engineered safety features
   b. Reactor coolant and protection systems
   c. Containment isolation and control systems
   d. Emergency core cooling systems and their support systems
   e. Auxiliary feed systems
   f. Reactor control systems
   g. Off gas isolation systems
2. The potential for violation of technical specifications.
3. HEDs that are known to have caused errors that will lead to unsafe operation.
4. HEDs that could cause the inadvertant activation or de-activation of a safety related system or a system needed to safely shut down the plant.

definitions of priority assignments. These priorities were defined in the Program Plan and are reprinted in Table 1-2. The priority definitions are related to NUREG 0801 categories for cross-reference. Finally the team decided upon the appropriate priority. The assigned priority was recorded in the HED Assessment form in the resolution section.

As resolutions to HEDs were approved by the team, the resolution was recorded on the HED Assessment form. At that time, a follow-up action required for training or for procedure modification was considered. Also, a tentative schedule was determined in broad terms based on the degree of difficulty in correcting the HED and the assigned priority. Priority 1 HEDs were assigned a schedule for completion by Fuel Load. Priority 2 and 3 HEDs were assigned schedules after Fuel Load. Priority 4 HEDs were assigned longer term schedules or were listed as not to be accomplished.

In addition, each HED was assigned a Resolution Code. The code was designed to identify the type of solution that is to be implemented (Table 1-3). The code assignment served to clarify the methods and degree to which the HED will be resolved. Where the human factors criteria will not be met with the resolution, an appropriate discussion is included.

The Program Plan had a separate discussion of procedural HEDs developed by the BWROG. In practice it was found simpler to combine all HEDs and deal with them at the same time. The entry

TABLE 1-2. HED PRIORITY CATEGORIES

- Priority 1 (High Safety Significance)

  HEDs that are documented or judged likely to adversely affect the management of emergency conditions by the control room operators. This priority includes all HEDs that have high safety significance that could result in unsafe operation, any that have resulted in unsafe operation, as well as any that could result in errors of serious consequences. (0801 Cat.IA,B,C, Cat.IIA, Cat.III.)

- Priority 2 (Low Safety Significance)

  HEDs that have caused problems or appear likely to cause problems during normal and off-normal operations that could not result in unsafe operations. (0801 Cat.ID, Cat.IIB,C.)

- Priority 3 (Operational Reliability)

  HEDs that are not safety significant but could degrade operational efficiency and reliability, either singularly or in combination with other HEDs. This priority includes HEDs that are individually of minor consequence, but in combination with other HEDs or other conditions could degrade operator effectiveness under stress.

- Priority 4 (No Significant Improvement)

  HEDs judged by the review team to have no significant effect on operations and are not documented as causing problem during operation. This priority includes all HEDs that do not fit into any of the above categories.

TABLE 1-3. HED RESOLUTION CODES

Code	Description
A	Meets Human Factors Engineering (HFE) guidelines originally or as improved.
B	Minor deviation, but satisfies the underlying performance principle implied by HFE guidelines.
C	Meets HFE guidelines through a combination of solutions.
D	Meets HFE guidelines through other means that are judged to satisfy the intent of the guidelines.
E	Does not meet HFE guidelines; a correction may increase potential for error.
F	Solutions do not meet all guidelines, but are judged to be acceptable for safe operation for the reason stated.

on the HED Assessment sheet "Procedure Requirements" was used to spell out any specific procedural changes required. All BWROG HEDs were thus dealt with as a single group.

1.6.6 HED Verification

The HED Verification form included in the Program Plan and reprinted as Figure 1-3 was used by the team to review all resolved HEDs. Using this form, the team concentrated upon the adequacy of the resolution recorded on the HED Assessment form. This review ensured that the original discrepancy was addressed, that the resolution considered human factors as well as engineering design, and that safety was carefully considered. Finally, it considered whether the resolution adequately solved the problem and whether that resolution might cause another problem either singly or in combination with another resolution.

The team used the enhancement designs and the HED Assessment forms as tools to determine relationships between HEDs. The integrated nature of the redesign assured that correlations between HEDs were identified. Each resolution was relatively straightforward and its impact could be clearly assessed. The assessment methodology addressed like discrepancies as a group, so that class solutions could be designed. In this way, inter-relationships were considered from the very beginning. This made the verification relatively simple and effective. Our plan to cross reference HEDs by computer matching was therefore deemed unnecessary, and the data base for such an effort was not developed.

HED VERIFICATION

HED No(s) _____

VERIFICATION STATUS:

	Code	Unit #1	Unit #2
Approved	__		
Safety priority	__		
Applicable	__	__	__
Schedule	____	____	____

RESOLUTION ANALYSIS	SAT / REV
1. Code correct? yes / no Should be: __	____ ____
2. Addresses discrepancy identified by code?	____ ____
3. Meets human factors requirements?	____ ____
4. Safety considerations:	
a. Safety questions not addressed?	____ ____
b. Cause temporary reduction in safety?	____ ____
c. Increase risk of failure or misoperation?	____ ____
5. Compounding effect:	
a. Causes another discrepancy?	____ ____
b. Adversely combines with other resolutions?	____ ____
6. Cause negative retraining?	____ ____

SCHEDULING	Unit #1	Unit #2
1. Circle applicable unit:		
2. Assigned priority:	____	____
3. Schedule: Prior to first fuel load	____	____
First refueling outage	____	____
Second refueling outage	____	____
Not implemented	____	____

Team Review Action:

Figure 1-3. HED Verification Form

1.6.7 Final Validation

A validation of control room function is planned prior to fuel load to determine whether the operating crew can effectively accomplish their tasks using the improved control room panels. Validation will emphasize the ability of the crew to ascertain and evaluate plant status, and to diagnose transients using emergency operating procedures. These will be performed as walkthroughs on the mockup as reconfigured with design improvements. The results of this final validation will be reported in an addendum to this report.

1.6.8 Task Analysis and Verification

A detailed Task Analysis of the Limerick unique emergency operating procedures was performed by the operations department at Limerick, as reported in the Program Plan. This undocumented Task Analysis verified that the Emergency Operating Procedures could be implemented from the control room. At the May 4, 1984 meeting between the BWROG CRDR Subcommittee and the NRC Human Factors Safety Division we were informed that a formally documented task analysis is required. Accordingly, Limerick will, in conjunction with Peach Bottom, perform a follow-up Task Analysis on the Emergency Operating Procedures to meet the requirements defined by the NRC. Due to the late identification of this additional work item, the task analysis has not yet been performed. A properly documented task analysis will be completed prior to Limerick's first refueling outage. The team considers

this an acceptable approach in light of the original EOP task analysis. The follow-up task analysis will use a team approach and will identify each task along with the requirements and characteristics of instruments and controls that are necessary to complete the task. Then the existing control room instruments will be compared to the requirements and characteristics and the overall suitability will be assessed.

Section 2

GENERAL FINDINGS

This section highlights the findings obtained from the DCRDR, and is divided into categories that generally follow the human engineering guideline categories contained in NUREG 0700, Section 6. The categories covered include:

Category

1. Control Room Workspace
2. Panel Layout/Functional Relationships
3. Panel/Work Station Findings
4. Annunciators
5. Controls
6. Displays
7. Labels
8. Process Computer
9. Communications

2.1 CONTROL ROOM WORKSPACE

2.1.1 Multi-Unit Control Rooms

The Limerick plant consists of two NSSS units with both control rooms in the same space (Figure 2-1). The consoles and vertical boards behind them are identically arranged for each unit and not mirror-imaged. The only exceptions are common panels such as 00C-681 (mirror-imaged within the panel) and 20C-655 (common portion). As a result, an operator is oriented in the identical

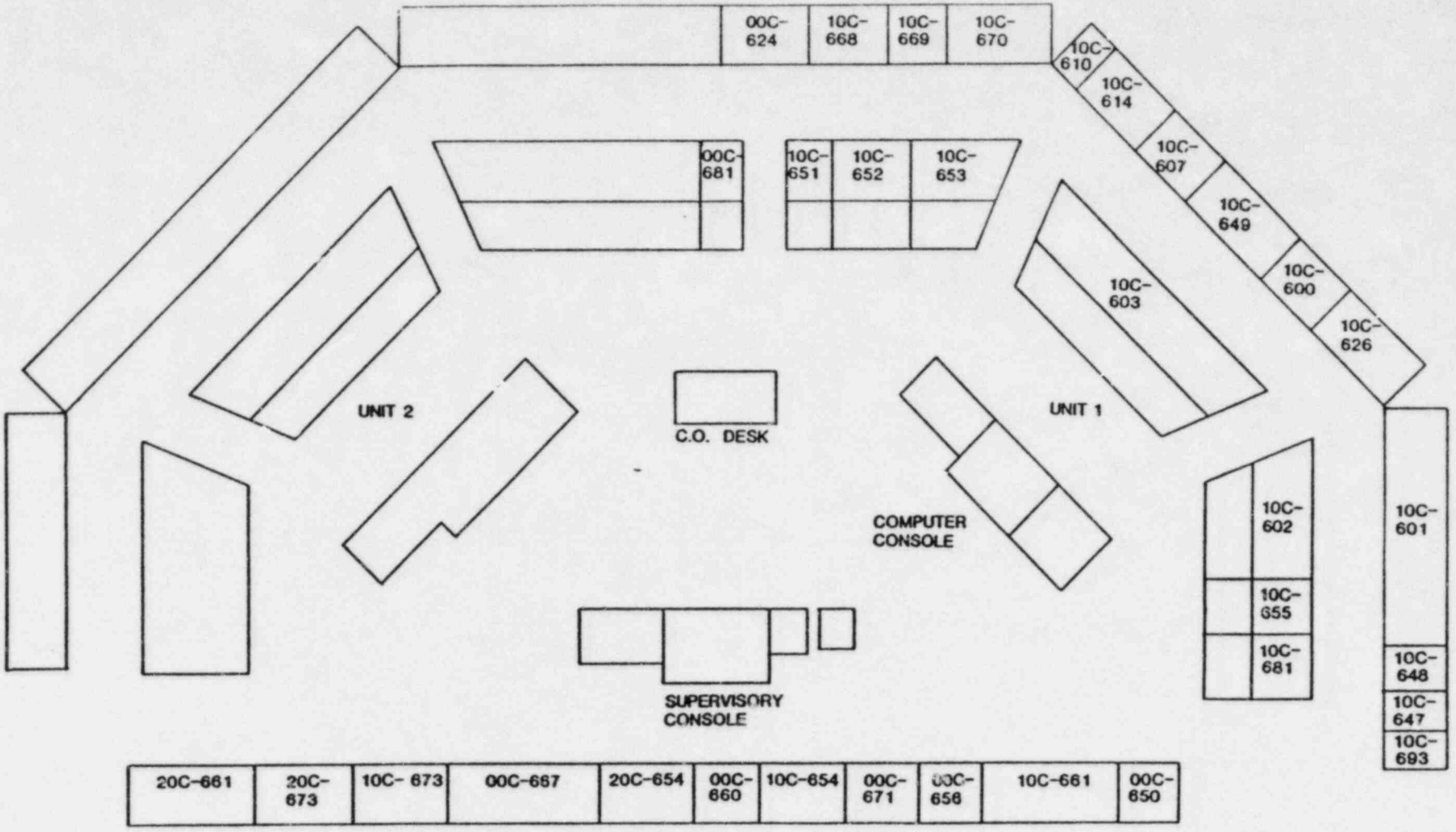

Figure 2-1. Control Room Arrangement

configuration when positioned in front of either plant's control panels. The back panels behind the supervisory console are a combination of Unit 1 and Unit 2 and common plant functions. These panels deal primarily with electrical power distribution.

As indicated in Section 1, the Limerick CRDR was a two phase effort commencing with the BWROG Control Room Survey. At that time, all panels within the control room space for Unit 1 and common panels were surveyed. The subsequent CRDR effort considered only those panels in the "at controls" area where actual operator functions are performed. Those panels located outside the "at controls" area are not used as part of the shift team operations, but are intended for use by supplementary operators in the later stages of a major accident. The status of these panels are monitored by summary annunciator alarms in the "at controls" area. Consoles, vertical boards and back panels included within the scope of this review are listed below.

CONSOLES

20C-655	Plant Services (Common Portion)
00C 681	Heating & Ventilating
10C-651	Feedwater
10C-652	Condensate
10C-653	Turbine
10C-603	Reactor Control
10C-602	Reactor Water Cleanup & Recirc.
10C-655	Plant Services - Unit 1
10C-681	Heating and Ventilating

VERTICAL BOARDS

00C-624	Area & Process Radiation Monitoring
10C-668	Feedwater
10C-669	Condensate
10C-670	Turbine
10C-610	RPS Test & Monitoring
10C-614	NSS Temp Recorder & Leak Detection
10C-607	TIP Control & Monitoring
10C-649	Rod Status Display
10C-600	RAD Monitoring & Cont Gas Analyzing System
10C-626	ADS & MSIV Leakage Control
10C-601	Reactor Containment Cooling & Isolation
10C-648	Reactor Core Cooling & Isolation
10C-647	HPCI (High Pressure Cooling Injection)

BACK PANELS

10C-673	Gaseous Radwaste Recombination
00C-667	ESW/RHRSW (A,B,C,D)
00C-660	Start Up Power
10C-654	Generator and Aux. Power
00C-671	Plant Electrical Metering
00C-656	Plant Electrical Metering
10C-661	Safeguard System (A,B,C,D)

REMOTE SHUTDOWN

10C-201	Remote Shutdown Panel

Four vertical sections (listed below) were not considered within the scope of the overall CRDR for the reason stated previously, actual control room operations were not performed at these boards, or the configuration of the control room had changed.

ØØC-693 Plant Seismic Station

1AC-696 } Post Accident H_2 Recombination
1BC-696 }

ØØC-650 Fire Protection Systems & Evacuation Alarms

ØØC-675 Deleted (removed from plant)

2.1.2 Workspace and Environment

2.1.2.1 Workspace. Aspects of workspace that were addressed included: panel separation, accessibility, and specifically, sight lines and reach distances. Of concern was the amount of workspace between the consoles and vertical boards. This space is not in compliance with HFE design criteria but is adequate for all tasks to be performed. (See discussion in Section 2.2.)

The locations of desks and work areas are adequate. The format of procedures (flow charts) and the large flat areas available to open and use the procedures is acceptable and would not affect surfaces with controls on them.

2.1.2.1.1 Sight Lines. Display location is dependent upon three primary factors: display height and orientation relative to the control room operator's line-of-sight (LOS) when positioned directly in front of the display; display distance and orientation when positioned off to the side of the display; and size of display markings relative to reading distance. The

Limerick control room has been evaluated against accepted human factors guidelines (MIL-STD-1472C; NUREG 0700; McCormick, 1976) in each of these areas, and the results are included below.

Displays should be placed within 45 degrees of the operator's horizontal line of sight to permit accurate reading without severe parallax effects. Frequently used or emergency displays should be located within 15 degrees of the operator's horizontal LOS. The maximum angle that an operator can see along is 75 degrees from the horizontal LOS. However, this angle requires maximum head and eye rotation on the part of the operator, and cannot be maintained for extended periods of time. Displays located in excess of the 45 degree requirement should be angled toward the operator to such a degree that the angle from the display face to the operator's horizontal LOS is 45 degrees or greater (Figure 2-2). Horizontal displacement of displays should not be less than 45 degrees from either side of the operator's workstation to ensure minimal parallax.

Almost all displays located on consoles in the Limerick control room fall within the 45 degrees requirement mentioned above for both the 5th percentile female and the 95th percentile male (Figure 2-3). Those that exceed the 45 degree specification are mounted on the lower portion of the backboard, and are angled as recommended, so that the angle of the display face to the operator is 61 degrees (Figure 2-4), well within recommended guidelines.

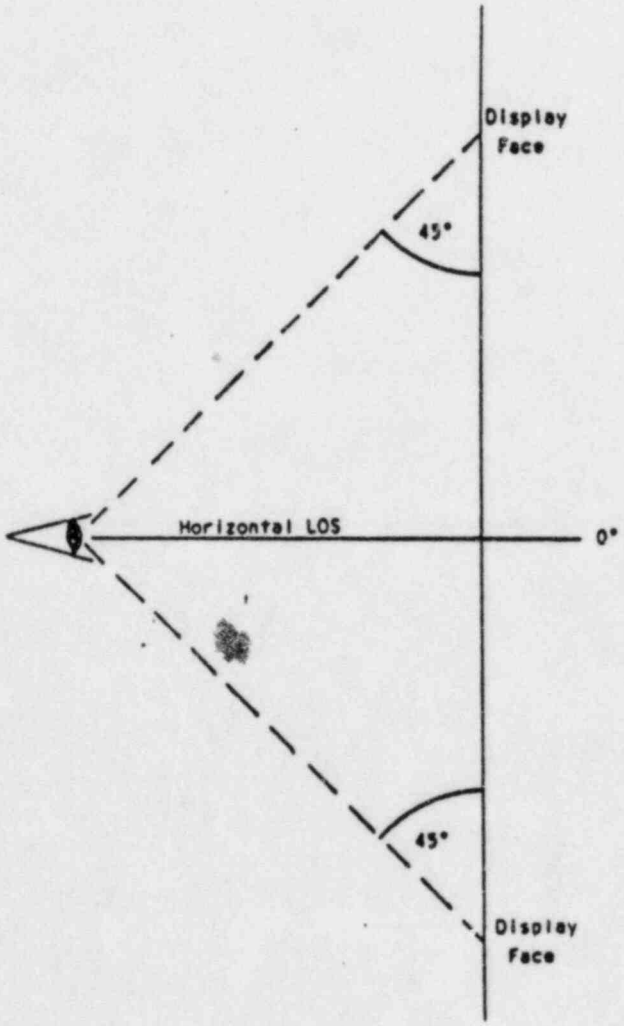

Figure 2-2. Operator's Horizontal Line of Sight

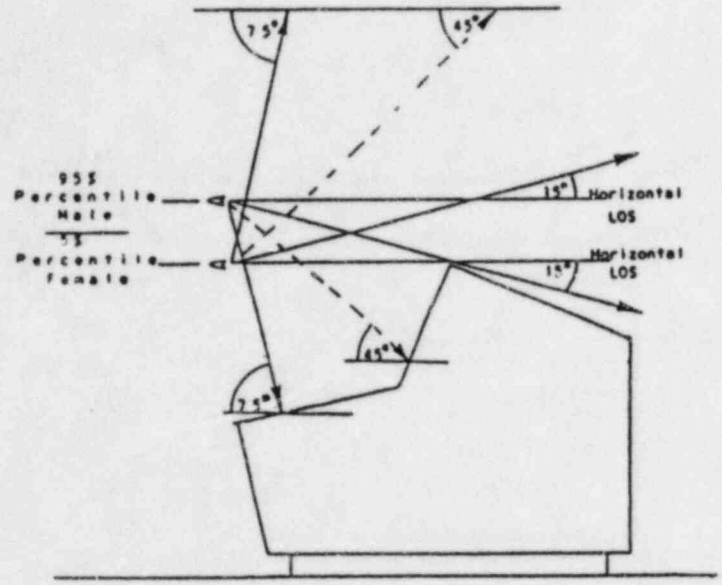

Figure 2-3. Console Anthropometric Requirements

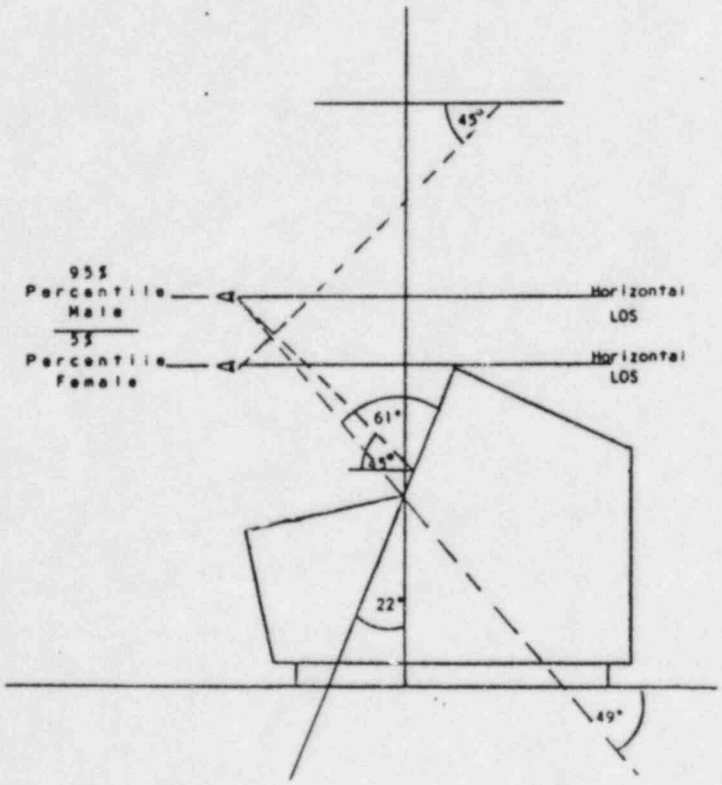

Figure 2-4. Console Display Face Angles

While most displays on the control room vertical boards exceed the optimal recommended visual angle of 15 degrees, only the annunciator windows exceed the maximum visual angle of 45 degrees (Figure 2-5). This is not considered a problem for panels located along the back wall of the control room, since operators can position themselves away from those panels to bring the annunciators into better view.

The annunciator height is a potential problem for an operator positioned between the vertical boards and the consoles. The annunciator portion has been angled down to facilitate viewing when between the console and vertical boards. This angle is still less than the required 45 degrees (Figure 2-6) for the 5th percentile female. However, the difference is small (visual angle is 42 degrees, a discrepancy of only 3 degrees) and acceptable for the 5th percentile male at 46 degrees. Therefore this is not considered a significant operational problem.

A further analysis was conducted to check vertical board indication visibility while positioned in front of the consoles (see over). The intent of this analysis was to determine whether it is necessary to move a control or indication to a more observable location, or to provide an annunciator alarm to alert the operator.

The team determined that components on the vertical boards 48 inches from the floor and above were necessary to view from in front of consoles. This analysis took no credit for aisles

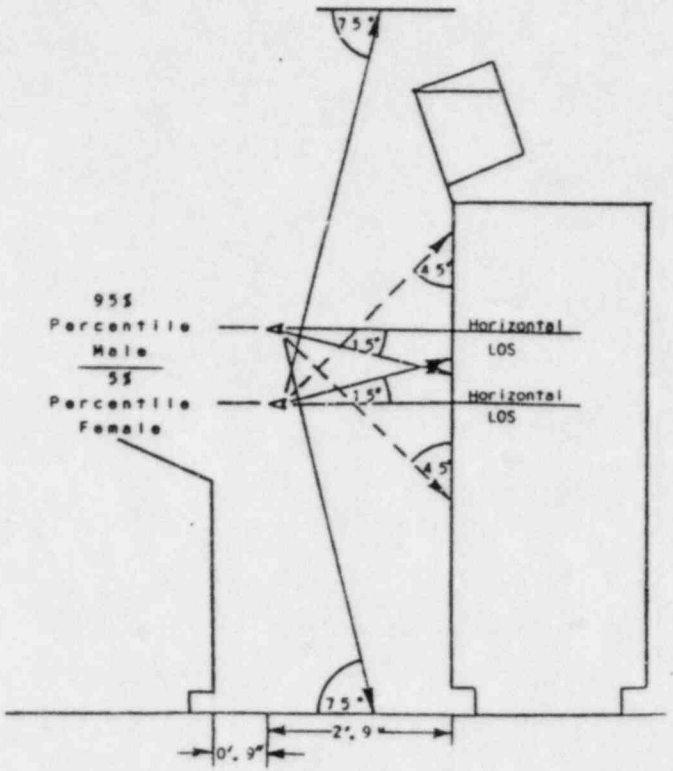

Figure 2-5. Vertical Board Anthropometric Requirements

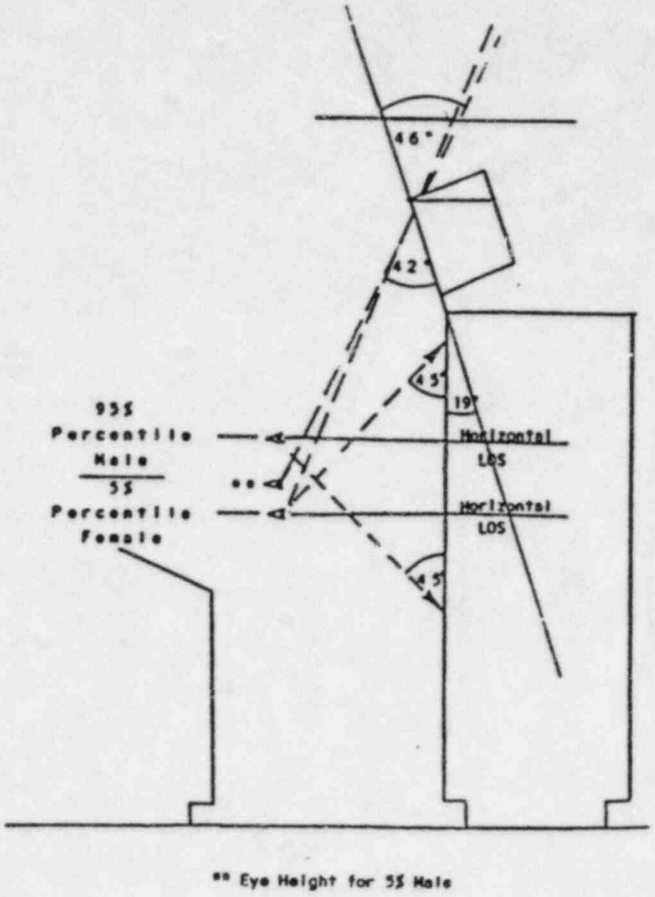

Figure 2-6. Eye Height and Viewing Angles at Vertical Board

between consoles or frequent normal movement of operators to the back panel area, but considered only what could not be seen by the operator standing in front of the consoles (Figure 2-7).

Working backwards it was determined that a minimum height of eye to view these components was 58 inches. This includes the 5th to 95th percentile male and 30th to 95th percentile female. An exception was for emergency systems used for emergency core cooling, which are located on one of the vertical boards behind the 10C-602 console. For situations that require ECCS, the control room team procedure requires that the Chief Operator take station at the ECCS boards to operate them as a member of the emergency procedure control team.

The degree of visibility was considered satisfactory if an abnormal condition resulted in an alarm indication that could be observed by the operator, or would result in some other condition easily detected by the operator and alerting him to take appropriate action.

The analysis revealed no instances where it would be necessary to move a control or indicator, or to add an annunciator alarm. Related indicators and recorders are visible to alert the operator well before a response is required. These related indications were determined to provide at least as much alert to the operator as if the direct indication or control in question were observed. For the ECCS panels, all instruments and controls were observable by the operator when at his emergency station.

EYE HEIGHTS

	Male	Female*
5%	59.9	55.5
95%	69.0	63.9

* 30% Female = 58.0

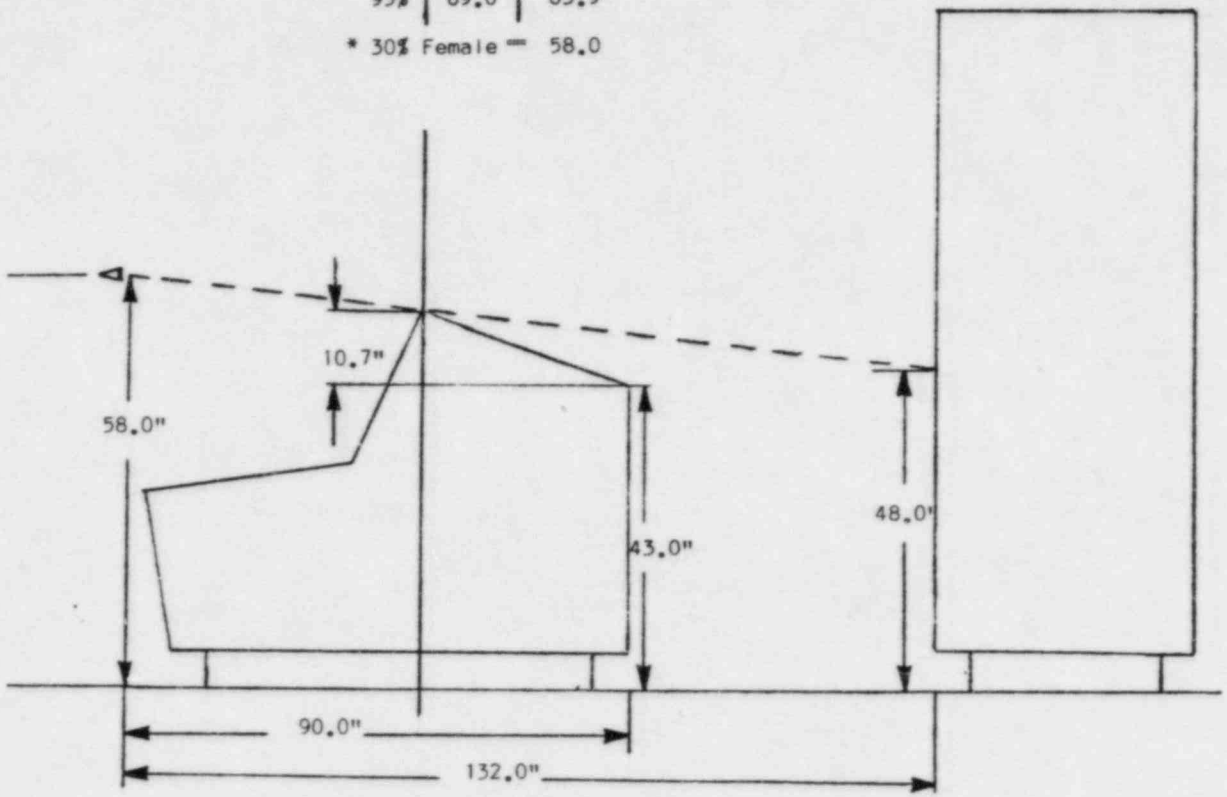

Figure 2-7. Viewing Distance to Back Panel Area

Since there exist no control stations where the operator remains seated, the horizontal displacement of the displays is not a problem since the operator can move to more clearly observe displays that would normally exceed the 45 degree limit for seated operators.

Viewing distance and display readability are discussed in Appendix F Scale Graduations.

2.1.2.1.2 Reach Distance. Some reach distances on control consoles exceeded the recommended distances. In addition, control density is such that several hand switches are located close to the edge of the panel and thereby susceptible to inadvertent activation. As a result, to meet HFE guidelines regarding control distance from console edge, a handrail has been proposed. This further complicates reach distances.

The addition of a guardrail extending outward 1.5 inches from the edge of the console would aid in the prevention of accidental activation of those controls located too near the edge of the benchboard, and effectively put those controls beyond the NUREG 0700 recommended minimal control distance of 3.0 inches. The rail would cause the controls at the rear of the benchboard to exceed the NUREG 0700 recommendation for maximum reach distance of 25.0 inches. However all of these controls would still be within the extended functional reach distance of the 5th percentile female (28.9 inches - MIL-STD-1472C), which is not considered to cause a problem.

Several consoles have controls located on the upright portions of the benchboards. These controls already exceed the maximum reach distance, and the addition of the rail would increase this distance even further. However, there are few of these controls, and with the handrail the control distances would still be within the extended functional reach of the 5th percentile male and the 50th percentile female. Therefore, the addition of the rail would require torso flexion, which is not considered a significant detriment to operation.

For exact control distances and specifications see Table 2-1 Console and Vertical Panel Control Distances and Figure 2-8 Console Dimensions.

The vertical back panels have controls both above and below the recommended heights for reach distance. The most important of these controls are located on the ECCS panels 601, 647, and 648. The analysis of sight lines described in the preceeding section (2.1.2.1.1) revealed that those controls located low on the panels are infrequently used and therefore are acceptable. Very few controls are located high on the panels and those are infrequently used. A 64 inch, 5th percentile male currently an operator at Limerick, was used to successfully demonstrate the ability to reach and operate all controls that are high on the vertical panel. It was concluded that the height on controls is satisfactory.

TABLE 2-1. CONSOLE AND VERTICAL PANEL CONTROL DISTANCES

CONSOLE PANEL
CONTROL DISTANCES (in inches)

CONSOLES

PANEL	CURRENT DISTANCE FRONT	CURRENT DISTANCE REAR	DISTANCE W/RAIL (1.5 in.) FRONT	DISTANCE W/RAIL (1.5 in.) REAR
20C-655	2.1	25.2	3.6	26.7
10C-655*	2.4	24.3	3.9	25.8
00C-681	2.9	24.4	4.4	25.9
10C-681	3.7	24.5	5.2	26.0
10C-651*	2.1	25.0	3.6	26.5
10C-652*	2.3	24.8	3.8	26.3
10C-653	2.3	24.6	3.8	26.1
10C-602*	2.6	24.8	4.1	26.3
10C-603*	2.6	24.3	4.1	25.8

* Panels have controls on vertical portion of console.
- All measurements made from bottom of the control to edge of benchboard.

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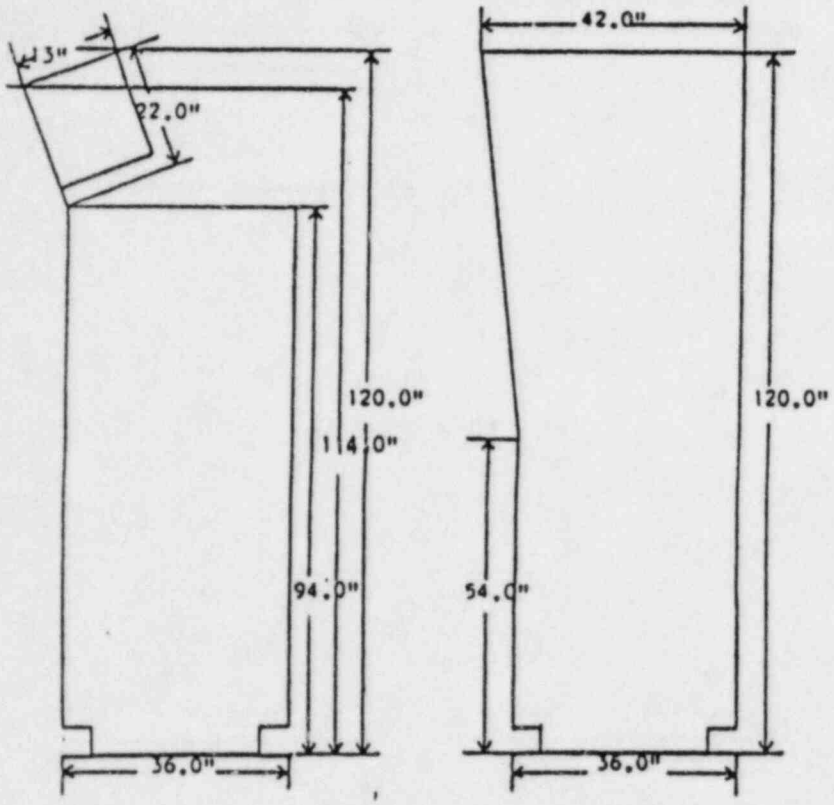
VERTICAL PANEL
CONTROL HEIGHT (in inches)

VERTICAL PANELS

PANEL	LOW	HIGH	
10C-624	34.8	72.1	
10C-668	23.7	70.5	
10C-669	34.4	79.0	
10C-670	26.5	69.8	
10C-614	27.4	65.8	(Recorder)
10C-607	17.4	57.9	
10C-610	N/A	N/A	(CRD Scram Test Points)
10C-600	29.7	58.3	
00C-660	42.1	59.8	
10C-654	29.3	71.7	
10C-656	N/A	N/A	(Plant Watt Hour Metering)
10C-671	N/A	N/A	(Plant Watt Hour Metering)
10C-661	31.1	66.4	
10C-647	25.2	67.6	
10C-648	25.1	51.2	
10C-626	32.3	79.3	
10C-601	16.0	67.5	
10C-649	N/A	N/A	(Full Core Status Display)
Remote Shutdown (10C-201)	6.3	80.0	

PANEL DIMENSIONS

VERTICAL PANELS



CONSOLES

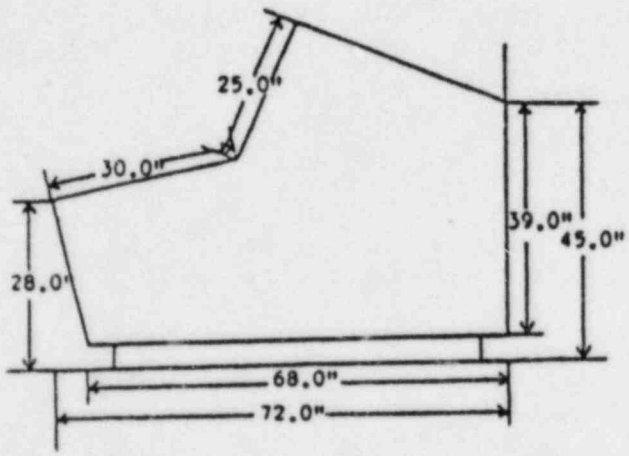


Figure 2-8. Console Dimensions

2.1.2.2 Environment. These areas can not be evaluated completely until control room construction is completed. A list of items not addressed by the CRDR is presented in Table 2-2. A complete evaluation of workspace arrangement, environment, sound and lighting levels will be completed when appropriate.

TABLE 2-2. ITEMS NOT ADDRESSED BY CRDR

Due to the construction status of the control room, the evaluation does not address the following:

- Illumination
  - Control room ambience
  - Component illumination
  - Reflectance factors
- Atmosphere
  - Heating
  - Ventilating
  - Air conditioning
- Noise
  - Annoyance factors
  - Masking of verbal communications
  - Masking of auditory signals
- Verbal communications
  - Communications systems
  - Implementation of systems
- Emergency equipment
  - Special hardware
  - Protective clothing
- Portable furnishings - desks, chairs, tables, etc.
- Computers

2.2 PANEL LAYOUT/FUNCTIONAL RELATIONSHIPS

In addition to the control room survey, which constitutes a component by component analysis, a top-down analysis was conducted as described in the Program Plan. This analysis concentrated on groupings and relationships. This section discusses overall functional relationships between control panels, and the integral nature of operations.

The design of the control room for Unit 1 features three consoles arranged in a curved shape, with vertical boards behind them (facing the operator) (Figure 2-1). Access to the vertical boards is provided at the ends of each console. All consoles are designed for a standing operator. Overall, this is a good arrangement for a control room because it results in a relatively compact set of controls and instrumentation with good visibility to most of the panels.

The potential problem with visibility of the lower portion of the vertical boards behind the consoles by the operator standing at a normal work station in front of the console was discussed previously in 2.1.2 Workspace and Environment (see Figure 2-7).

The central 10C-603 console is intended as the primary operating station for the plant. It contains the reactor controls and indicators, some feedwater controls, and emergency reactivity controls. Immediately adjacent to 10C-603 is 10C-602, which contains the Recirculation Systems. Further to the right on 10C-602 are the controls for Primary Support Systems. The

furthest left console 10C-651/652/653 is for feedwater, condensate, and turbine controls and indicators respectively. Additional controls for this system are on the vertical boards behind.

The overall arrangement of the consoles was found to provide good concentration of frequently used controls at the prime operating station, requiring a minimum of operator movement. There were no instances of controls belonging on the front panels being found on vertical boards.

Control of electrical systems is contained on back panels that are directly behind the operator when standing at the consoles. Organizationally, these panels are assigned to the Chief Operator who faces them when seated at a desk.

The overall control room and individual panel arrangement is logical, with instruments and controls grouped by functions. However, functional groupings of components were generally not visually differentiated making it difficult to identify groups. The ability to correlate meters and recorders to the associated groups of controls was difficult in some systems, even though there was generally a conscious effort to align indicators with controls. This situation was caused primarily by the need to add many components subsequent to the original design.

Mimics were used only for the ECCS and Containment Isolation Systems on 10C-601, 10C-648, and 10C-647, and for the Electrical and Off Gas Systems on the back panels. Generally, the mimics

were found to be congested and too complex to be helpful to the operator. Mimics, although not present on the consoles, would aid operators in following the sequence of control operation.

Little color was used on the boards therefore color confusion was minimal. A code for types of handles to be used on control switches was established prior to panel design, but has been applied inconsistently. The variety of handles used resulted in some being rather large, thereby tending to obstruct the view of labels and legends for that control on the console benchboard sections.

2.3 PANEL/WORK STATION FINDINGS

This section summarizes in general terms, the findings of the top-down analysis with respect to consoles or combined work stations. The details are documented on individual HED Assessment sheets (see Appendix A). Figure 2-9 illustrates the consoles and vertical boards in perspective to aid in orienting the reader. Figure 2-10 illustrates the location of Electrical, Emergency Service Water and Off-Gas back panels that are discussed separately.

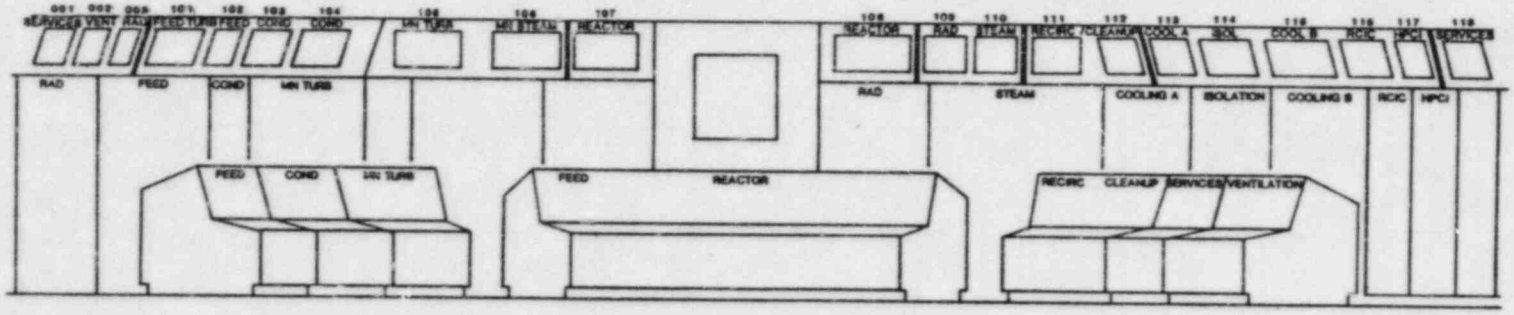


Figure 2-9. Consoles and Vertical Boards in Perspective

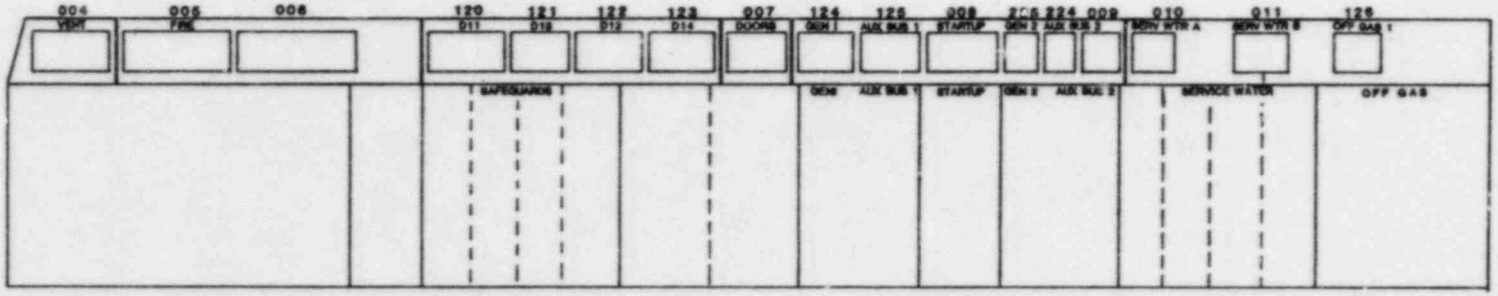


Figure 2-10. Location of Electrical Emergency Service Water and Off Gas Panels

2.3.1 Condensate, Feedwater, Turbine Console (10C-651, 652, 653) and Vertical Board (10C-668, 669, 670)

The console benchboard section contains controls, with indicators and recorders on the upright section. The controls are grouped by systems, and are separated by demarcation lines. Sequential relationships and flows within and between condensate and feedwater, or steam are not evident nor supported by mimics. The feedwater and condensate groups are separated by other unrelated groupings.

The indicators on the upright are generally arranged over the controls to which they relate. The condensate indicators, however, are distributed across the upright and become intermixed with the feedwater indicators.

The respective vertical boards (10C-668, 669, 670) provide a good complement to the console controls and indicators. The primary finding was that the many rows of like switches were somewhat misleading. This was due primarily to the intermixing of controls for different operations and that the control functions appeared difficult to understand.

The Turbine Test and EHC controls use a standard General Electric layout and are well grouped.

2.3.2 Reactor Control Console (10C-603)

The Reactor Control Console is the center console and primary operator station for plant operation. The below discussion starts at the left of the console across to the right.

The left side contains the feedwater controls and indications. The indications on the upright are located over their related controls.

The center contains the rod drive controls with a core map pushbutton selector, for individual rod controls. This arrangement is adequate. On each side of the rod drive control are the nuclear indicators and controls. Indicators here are generally located above their associated controls. The labeling and use of acronyms could be confusing. No demarcation lines aid in differentiating the various functions related to monitoring power level.

The right side is arranged by functional groups with demarcation lines. However, because of a change to the board, an important indication of the Standby Liquid Control System is located with the Control Rod Drive indications.

2.3.3 Vertical Boards (Behind 10C-603)

The vertical board directly facing 10C-603 is the Rod Status Display. It contains numerous indications for each rod displayed as in the actual core. The ability to distinguish between these indications can be difficult.

Other vertical boards on either side of the Rod Status Display, facing 10C-603, contain various test panels and radiation monitoring instruments. To the left, 10C-610, 614 and 607 are easily distinguished but lacking in operational identification. To the right, 10C-600 and 626 contain Hydrogen and Oxygen

Containment Analyzer, Process Radiation Monitors, and Main Steam Isolation Valve Leakage Control System (MSIV-LCS) and the Automatic Depressurization System (ADS). On 10C-626 these two systems (MSIV-LCS & ADS) are also grouped but not differentiated, so that the various functions are not easily distinguished. In addition, the Reactor Protection System Status Panel is placed with the Leak Detection System and is not visibly separated or clearly identified as being different.

2.3.4 Reactor Cleanup and Recirculation Console (10C-602)

This console contains primary and balance of plant auxiliaries. The left side, adjacent to 10C-603, contains the controls and indication for the Recirculation System, an important means of controlling reactivity in the reactor. Next is the Cleanup System, and then the drywell drains. These groupings are separated by demarcation lines, but in two instances indicators belonging to one group are located in the next grouping. The Cleanup System indicators on the upright do not correspond to the controls below them. In addition, control arrangement is not ideal for the sequence of system operation.

The right side contains Balance of Plant Systems. They are arranged by functions with indicators directly over the controls, and divided by demarcation lines. The controls for drywell cooler fans, due to separation criteria, do not follow a standard alphabetical order but are logical with respect to separation divisions. The indicators above them are arranged in alphabetical order from left to right.

2.3.5 Emergency Core Cooling Systems (ECCS) (10C-601, 648, 647)

These vertical boards contain the ECCS and the Containment Isolation System. Unlike the consoles and vertical boards discussed thus far, these boards contain extensive mimicking. The fundamental purpose of mimics is to aid operators using complex systems. In this situation, due to component arrangement and density, the mimics tend to be congested without obvious flow paths. Above the mimicked portion are additional controls and indicators. These controls are generally not optimally grouped and difficult to identify. The indicators above are grouped appropriately, but due to their continuity the groupings are not always discernable.

2.3.6 Electrical Back Panels (10C-654, 00C-660, 1AC-, 1BC-, 1CC-, 1DC-661)

The electrical panels use mimics to relate the controls to the system. Generally, the mimics are well arranged. The relationship of the diesel supply panels to the startup panel, and the main generator section to the startup panel is not obvious. The mimics for the auxiliary busses tend to become confusing and the relationship between the auxiliary busses for Units 1 and 2 is not clear. The loads for the main load centers represented by breakers on the panel are not listed in sufficient detail to aid the operator in identifying the major equipment that is powered.

2.3.7 Emergency Service Water and Off Gas (10C-667, 10C-673)

The Emergency Service Water (ESW) panel is divided into four distinct trains of emergency service water. All trains are identical in arrangement. Within a train, controls are grouped but the groups are not distinguished. They are all together in a bank of 29 controls for each loop, making them difficult to differentiate and identify.

The Off Gas System is arranged as a mimic. This board has employed adequate space for the mimic and is easily followed. The mimic is more complicated than it need be. As a result, the main flow path of the gaseous rad waste is difficult to follow, and subsystems are not set off for easy differentiation.

2.4 ANNUNCIATORS

There are approximately 1100 annunciator alarms for Unit 1. These are located around the periphery of the control room on the slant portion of the vertical boards. They are divided into annunciator window arrays of less than 50 alarms each. Each annunciator panel has alarms well grouped by functions and the groups within an array generally relate to the same control panel. However, because of the large number of alarms and the limited space available for annunciator mounting, it has not always been possible to mount the alarms directly over the panel to which they relate. The arrangement of consoles in front of vertical boards means that the annunciator related to the console must vie with the annunciator related to the vertical board for the prime space directly in front of or over both. This means that there is no way to rearrange panels without massive elimination of alarms.

The annunciator panels, however, are arranged logically with respect to the main operator station located in front of 10C-603. Because this is the prime operating station, the annunciator panels have been arranged sequentially in the same order as the consoles, thus giving the same sense of order to the central operator. The annunciators are not identified by system names, nor are they highlighted in any way that makes their order clear. The numbering system used for panels is used for annunciators by changing the first digit from a 6 to an 8 (e.g., panel 668 has annunciator 868 associated with it).

Within an annunciator array, the alarms are usually grouped by systems, but these groupings are not readily identifiable. Consequently it will be more difficult for the operator to remain oriented when a large number of alarms are energized.

The annunciator alarm, acknowledge, reset sequence is as illustrated in Table 2-3.

TABLE 2-3. ANNUNCIATOR ALARM, ACKNOWLEDGE, RESET SEQUENCE

CONDITION	WINDOW STATE	AUDIBLE SIGNAL
NORMAL	NON ILLUMINATED	SILENT
ALARM	FLASHING	BELL
ACKNOWLEDGED	ILLUMINATED STEADY	SILENT
ALARM CLEAR	ILLUMINATED STEADY (Manual Mode) OFF (Auto Mode)	SILENT
RESET	OFF	SILENT
TEST	FLASHING	BELL

Since the windows flash only for the initial unacknowledged alarm and do not reflash when an alarm condition clears, the operator must determine on his own that the alarm has cleared. This means the steady light either goes out automatically, or goes out upon pressing the reset button. An internal selector switch behind each window controls the method of reset. This approach is based upon an operating philosophy that requires aggressive operator follow-up on alarms. For the main operating area of the three consoles and associated vertical panels, there is a master

acknowledge pushbutton at the normal operator station in front of the center console. In addition, there are acknowledge pushbuttons on each of the wing consoles that control alarms related to these consoles only. There are separate acknowledge pushbuttons on the electrical back panels. There are no silence controls.

The audio alarms are bells. The environmental survey has not yet been made so the actual alarm level has not been measured.

Some prioritization has been used on annunciators. This consists of the use of red lights for top priority alarms, amber for intermediate priority, and white for low priority. However, only eight of thirty-two annunciator panels have this type of prioritization. In addition, the method used is not completely effective because it is difficult to distinguish between the amber and white windows. The panels mix high priority alarms with informational alarms. Some panels position higher priority alarms along the top row of the matrix, but this practice is not fully implemented. The same audio alarm is issued for all priorities.

2.5 CONTROLS

The controls and controllers generally meet human factors standards. There are no major problems with controls, but are minor human compatibility problems with Bailey controllers. There are some problems of inconsistent handle shapes and colors used for round pushbuttons.

2.6 DISPLAYS

Visual displays are primarily of two types: vertical analog indicators, and chart recorders. These instruments generally meet human factors standards. With a few exceptions, the scales used on indicators are properly designed, but have not been enhanced to indicate operating zones, limits, or set points. Controller displays are properly designed from a display face perspective, and aside from the counter rotation of the indicating drum are reasonably easy to use.

2.7 LABELS

A hierarchal labeling scheme has not been used on panels. Dymo labels indicating power supply sources have been added under controls and tend to add to the overall congestion on the consoles. Labels were also found to be inconsistent in terminology and use of abbreviations.

2.8 COMPUTERS

Two computer systems will be in use, the process computer, and the Emergency Response Facility Display System (ERFDS). The presently installed process computer system provides simple alarm list displays. This display in many cases, gives backup detail on alarms indicated on the annunciator. The second computer system, the ERFDS, will provide the SPDS capability. At present the system software has not been fully developed, and final evaluation of the system has not been completed. This computer system will be reviewed when available.

2.9 COMMUNICATIONS

The state of construction of the control room and plant precluded adequate review of the communications system. This system will be reviewed and assessed when available.

Section 3

IMPLEMENTATION

This section discusses, in general terms, the design approach for implementing control room modifications to improve the man-machine interface. The modifications are based on the CRDR team's assessment of the HEDs. If taken on the individual basis, it is difficult to ascertain that any one discrepancy would have a significant safety impact. However, a combination of discrepancies can have greater significance. The intent of the team was to resolve as many discrepancies as possible.

This section is comprised of two subsections:

- Overall Panel Improvements
- Component Improvements

These discussions are referenced in specific HED Assessment sheets along with specific resolutions as appropriate.

3.1 OVERALL PANEL IMPROVEMENTS

This section discusses those panel improvements to be implemented on the Unit 1 control room panels and the Remote Shutdown panel.

3.1.1 Control Panel Enhancements

The analysis of HEDs resulting from the control room survey indicated that the majority of discrepancies were in the area of functional grouping, mimicking, and labeling of components, which could be corrected with control panel enhancements. To ensure that the overall panel enhancements would be designed for improved operator performance, some fundamental decisions were reached initially. First, it was decided to establish an accepted operational description of the plant. A large simplified plant systems schematic was used in describing plant systems and components, and was used continually during enhancement design and review team discussions to ensure complete team agreement and understanding of system terminology and system boundaries. The second decision was to determine who in the operational population (level of expertise) the enhancements would be designed to support. The final choice was the newly licensed auxiliary control operator, as he would have had the least operating experience on the panels. With agreement on these two basic issues, a general philosophy of enhancements was agreed upon. Enhancements would:

- Show functional grouping of components
- Utilize mimics where they provide useful information to the operator

- Employ hierarchal labeling
- Meet accepted human engineering practice

With the above criteria as "ground rules," the review team proceeded to evaluate various control panel enhancement techniques. It became quickly evident that the criteria could not be met if all components were to remain in existing locations. As a result, to make the groupings and overall enhancement scheme effective several component relocations have been specified. The decision on relocating components would be based on:

- Maintaining functional group relationships
- Providing aid in mimicking
- Providing correct sequence of operations

3.1.1.1 Color Use. When developing the criteria for color coding, some constraints had to be considered. These constraints were: the absolute limit of the numbers of colors; the maintenance of accepted industry color conventions; and the availability of CRT color graphics.

The criteria for color coding when used as a memory aid was as follows:

- Other cues that specify meaning, will be associated with colors so that color need not be completely definitive. This means more specific identification will be used. As an example, the shape of the grouping and the grouping labels will provide cues, in addition to color, to aid in identification of functions.

- Colors will be chosen such that they imply meaning. For example: red = hot; blue = cooler; magenta = radioactive. But these will not be definitive. Where physical separation and functional differences exist, the same color may have a different meaning, provided no confusion will result. Examples might be: red = steam on the secondary panel; red = high voltage bus on the electrical panel.

- Only defined color codes apply to controller-indicator lights. The Limerick plant convention (which agrees with industry standard) is shown as Table 3-1.

TABLE 3-1. LIMERICK COLOR CONVENTIONS

LENS COLOR	SIGNIFICANCE	APPLICATIONS
RED	OPERATING	a. Motor running b. Circuit breaker closed with Trip circuit intact c. Valve not fully closed
GREEN	NOT OPERATING	a. Motor not running b. Circuit breaker open c. Valve not fully open
MILKY WHITE	NORMAL	a. System in a normal or steady state mode of operation b. System in "Automatic" control mode
YELLOW (AMBER)	NOT NORMAL WARNING TAKE NOTE	a. Alarm condition b. System in other than normal or steady state mode c. System under test
CLEAR	POTENTIAL EXISTS	a. Circuit energized and/or in service b. AC or DC potential monitor Sync. lamps - Bus pilots - Relay circuit d.c. monitor c. Contactor energized
BLUE	MISC.	a. System in "Manual" control mode (Will be accompanied with an alarm or yellow indicating light if operator should be alerted that system is not in a normal control mode) b. "Off" if an off condition must be indicated with a lamp

- Pushbuttons throughout the control room will be colored using the color codes shown in Table 3-2.

TABLE 3-2. LIMERICK PUSHBUTTON COLOR CODES

FUNCTION	COLOR
1. Emergency Trip, Emergency Actuation	RED
2. Reset	WHITE
3. Acknowledge Alarm, Bypass	YELLOW
4. Stop, Shut (not emergency)	GREEN
5. Test	BLACK

3.1.1.2 Mimics. Mimics have been simplified and straightened. By straightening mimic lines and providing color highlighting, the flow direction of mimic lines is made more obvious, requiring fewer arrows. Extraneous mimics have been eliminated. Some controls will be removed from control room panel mimics in order to allow more effective continuity in mimic flow.

Enhancements have emphasized operation under emergency conditions but are equally applicable to normal operations. Controls and indications of major importance have been highlighted with color backgrounds and larger mimic lines, while those relating to routine tests under deliberate and controlled conditions have been de-emphasized by using smaller lines or eliminating mimics altogether. Designs of enhancement shapes as well as color shading have been used to suggest relationships with other functional groups.

3.1.1.3 Panel Labeling. In conjunction with the effort to enhance the control panels, a hierarchal labeling concept was implemented to improve the readability of labels. Prior to determining the specific label contents for individual components, list of standardized terminology and abbreviations was developed for use in selecting label content. Additionally, a label font specification was developed (Appendix G).

3.1.2 Enhancement Implementation

Following the selection of the enhancement technique to be used, enhancements were designed for each console, vertical boards and back panels as listed in Section 2. The enhancements as approved were implemented on the full-scale mockup of the Unit 1 control room. Operational personnel and management were involved in reviewing and commenting on enhancements as implemented.

When the mockup is completely enhanced, a formalized validation will be conducted as part of the Validation of Control Room Functions described in Section 1.4.6 of this report. Subsequent to the validation, any identified problems will be resolved using the mockup.

The final aspect will be to formally document the enhancements. This is being accomplished by generating a complete set of drawings specifying functional grouping shapes, associated colors, demarcation lines, mimics, and labels. These drawings

provide the basis from which panel enhancements will be implemented on the actual control room panels.

Examples of control panel enhancements to be implemented are shown in Figure 3-1. This figure shows before and after enhancement photographs of various control panels as implemented on the control room mockup. It is considered that these enhancements fully correct the problems of grouping and demarcation. Some changes in component locations are specified for the final enhancements. Where these changes will be accomplished after fuel load, an interim enhancement design has been completed and will adequately serve until the final configuration can be obtained.

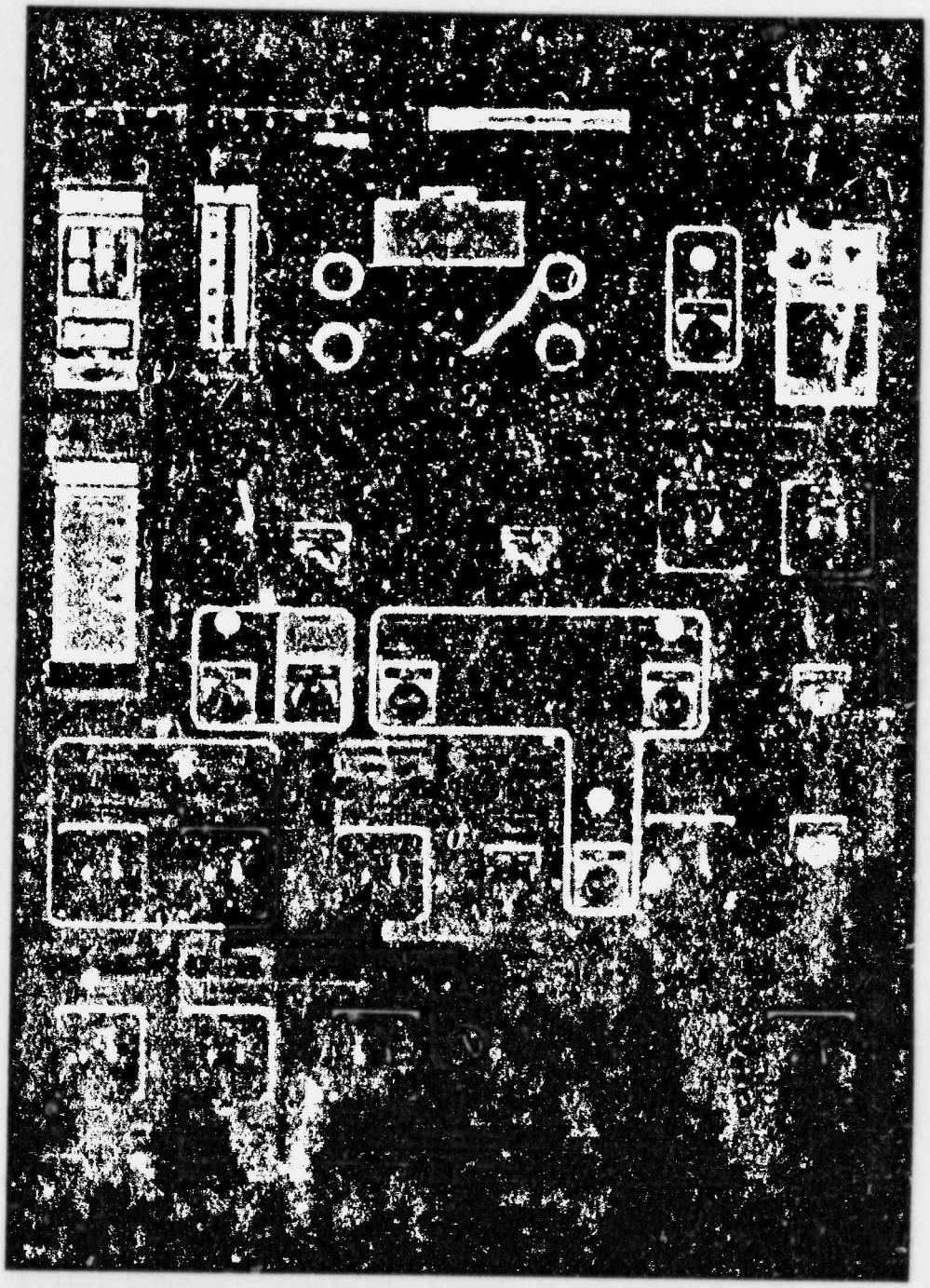


Figure 3-1a. Before and After Control Panel Enhancements

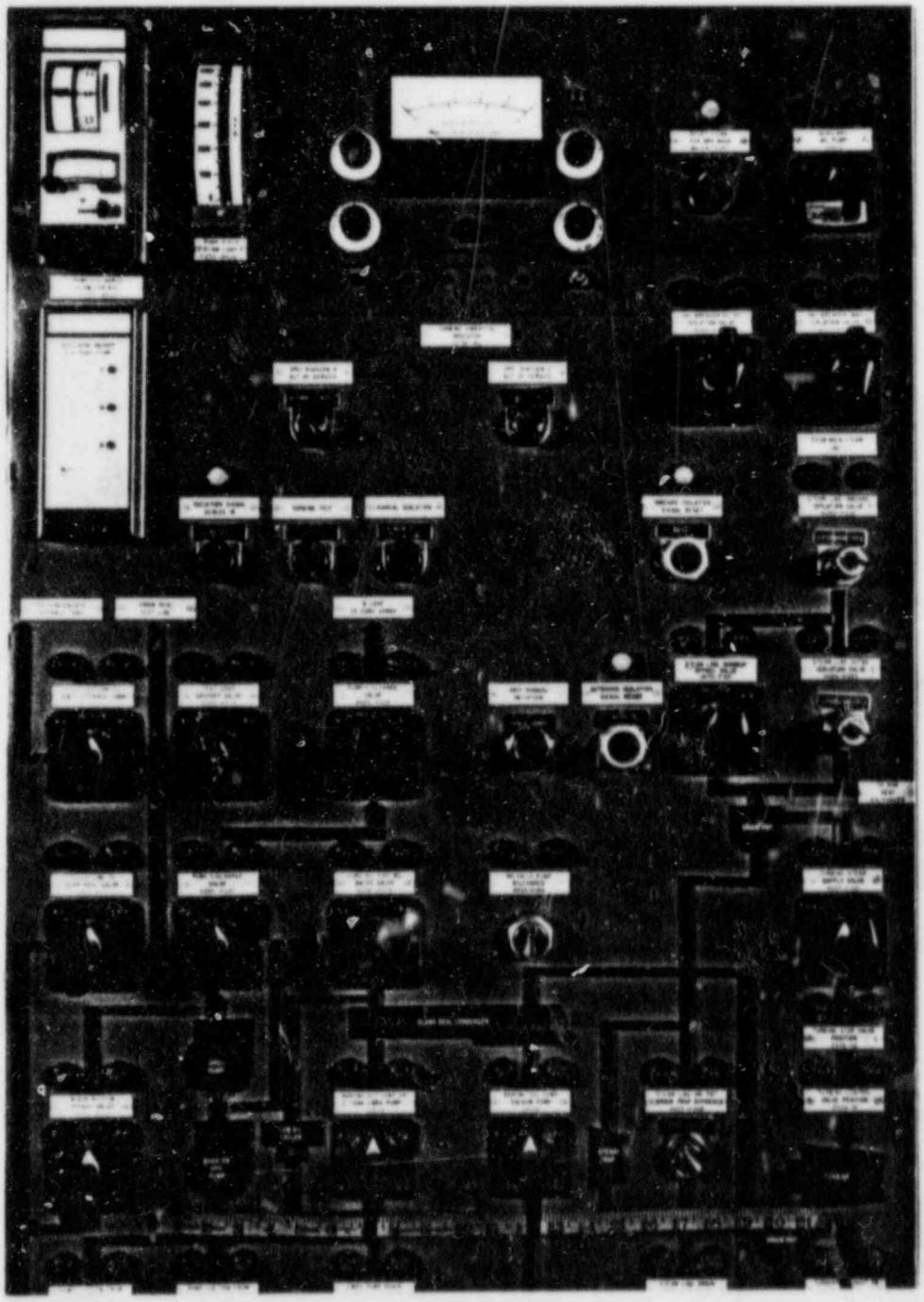


Figure 3-1. Before and After Control Panel Enhancements

3.2 COMPONENT IMPROVEMENTS

As indicated previously, enhancement techniques will correct many panel discrepancies. In addition to enhancements, other approaches to solving discrepancies are necessary. Generally, there are two approaches:

- Class Improvements - A combination of minor changes to a particular type of control or indicator that will correct a whole class of problems.
- Individual Discrepancy Corrections - A solution or combination of solutions that will correct one particular discrepancy.

Specific component improvements are discussed below.

3.2.1 Class Improvements

3.2.1.1 Annunciator System.

Annunciator Panels: The placement of annunciators around the perimeter of the control room has resulted in having some annunciators not located over the associated panel, or in front of the associated console. Investigation of this problem revealed that the arrangement of the annunciator panels is logical within the space allowed for their placement. There is no way to change the location of these panels in order to obtain a better arrangement without a wholesale deletion of alarms.

Figure 3-2 shows the relationship of annunciators to the primary operating station at the center console. With respect to this location, the arrangement can be easily associated with the appropriate console.

The association of annunciator panels is difficult now because they are not named. Only a numerical unit designation is used. Each annunciator will be given a functional name that directly associates it with the appropriate console or vertical board (Figure 2-9 and 2-10). Each console and vertical board will be given similar names to complete the identification and association. In addition demarcation lines will be placed between the annunciator panels at appropriate locations in order to group them by overall functional associations. Each annunciator panel will be given an operating number (as opposed to the panel identification number, e.g., 10C-803) in numerical sequence beginning with "101". The one hundred series (101) will be for Unit 1, the two hundred series (201) for Unit 2 and 001 series for common panels. This number will be used in operating procedures.

Initially some annunciator panels have prioritized windows, using red and amber bulbs. Prioritization by location (high on array infers high priority) is not necessarily the case. To systematically prioritize annunciator panels, operating experience with the plant vstems is necessary. As a result,

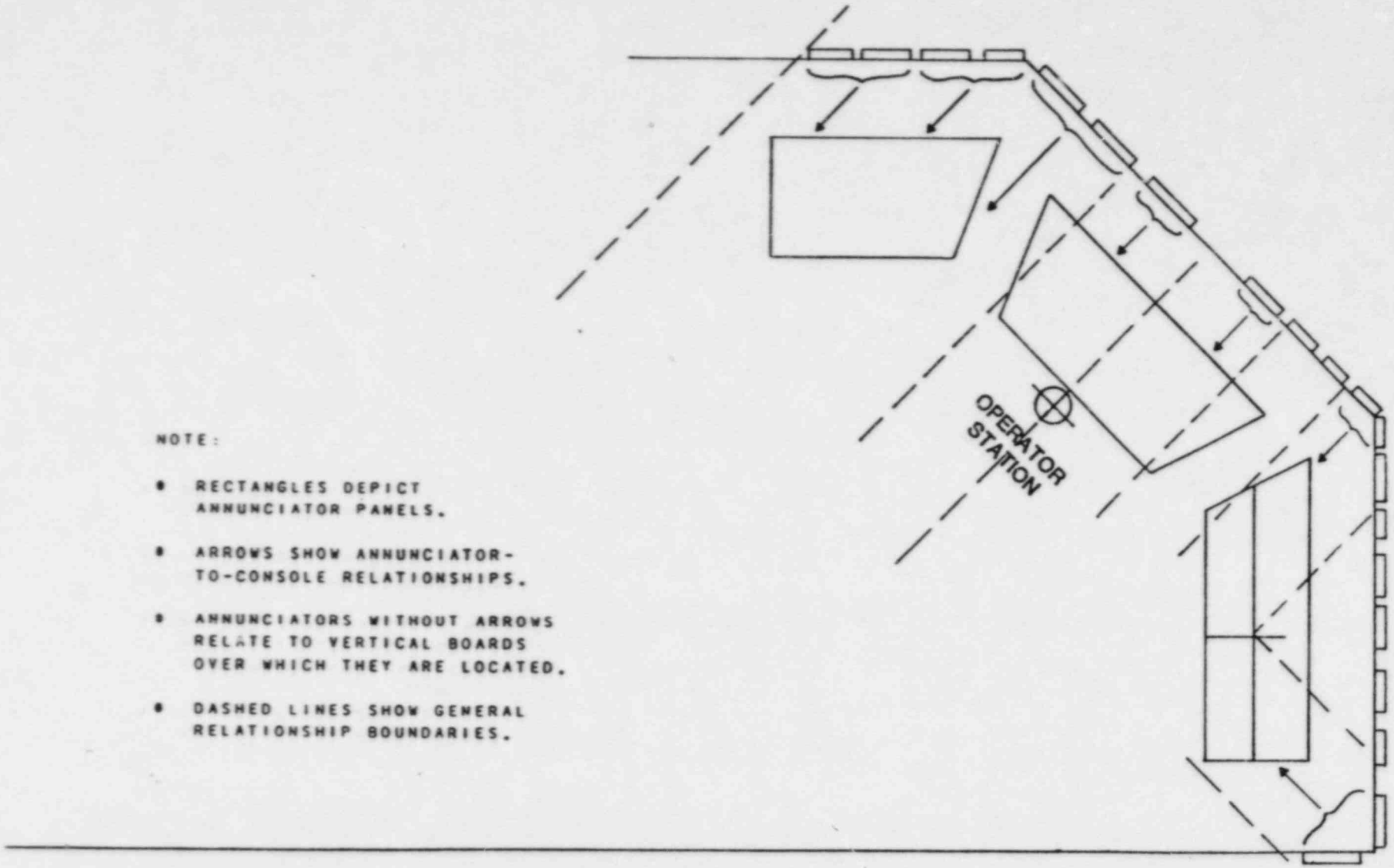


Figure 3-2. Relationship of Annunciator Panels to Operator Consoles

the overall prioritization is scheduled for completion by the second refueling outage. In general, both color and location prioritization techniques will be employed.

A matrix system of identifying alarm windows will be used. This system will use alphanumerics around the periphery of each array of windows (Figure 3-3).

Alarm Sequencing and Control: Annunciator operational sequences are presented in Table 2-3, Section 2. Two major improvements are planned. One is to selectively determine which alarms are to automatically clear and which require manual reset. The other is to install a tone-down system to reduce noise level of all control room annunciators. The existing annunciator controls will be modified such that the Acknowledge Button will be a yellow palm-actuated pushbutton, the Reset will be black and unguarded, the Test will be black and guarded to prevent inadvertent actuation.

3.2.1.2 Controls.

Pushbuttons: Circular pushbuttons throughout the control room did not have consistent color coding. All buttons will be colored in accordance with the color code shown in Table 3-2.

Controllers: The concern was the counter-rotating drum of the Bailey controllers. To aid operators these controllers will be improved by adding an arrow adjacent to the thumbwheel indicating the direction of rotation to

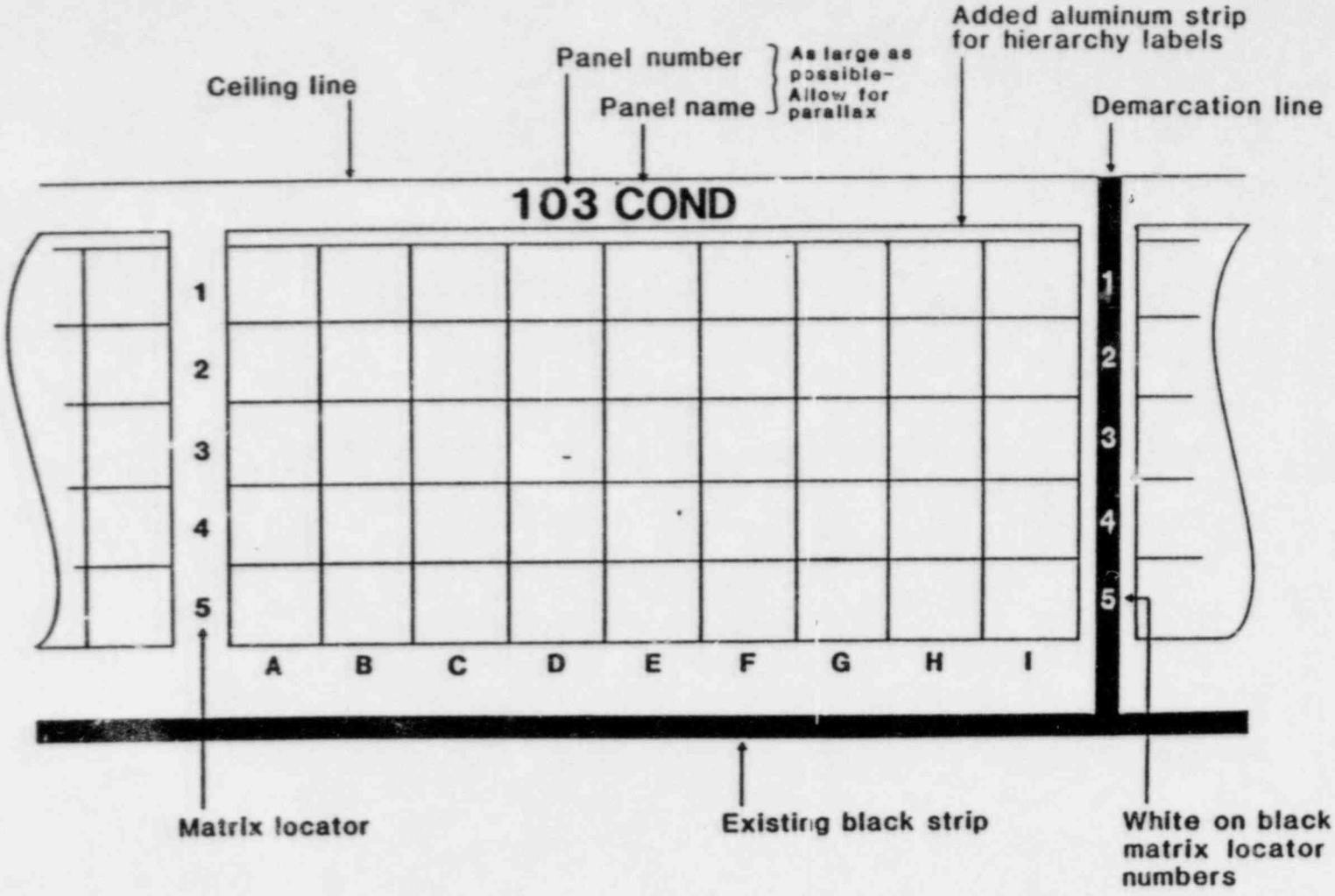


Figure 3-3. Matrix System of Alarm Window Identification

increase the setting. This will reinforce operator action and eliminate the need for the new operator to experiment before making his setting. Experienced operators have no difficulty adjusting to the controller's operation.

3.2.1.3 Displays.

Analog Indicators: As discussed previously, the vertical analog indicators are generally well designed. Scale inconsistencies exist. A specification to provide standard scale progressions has been developed to eliminate inconsistencies. This specification will be used as a guide to correct discrepancies noted on these indicators (see Appendix F).

Analog scales for this plant were designed by the engineering design process so that the normal reading will fall about 1/2 to 2/3 scale. The range of scales have been selected to obtain good definition for readability for the range required and therefore do not necessarily begin at zero. These ranges have been verified against operating procedures as discussed in the Program Plan.

Because of this approach to scale range selection, HEDs identified some scale differences that caused difficulty in making comparative readings. Each HED item was carefully reviewed and where comparative readings are required, the scales will be made the same if appropriate, to the parameters being measured.

HEDs for non-linear scales referred to those that are calibrated to a middle range of readings, such as ammeter scales that range from 50 to 100 , but showed a zero at the bottom. For these, the scale range shown is linear except for the zero position. The team felt that this arrangement is satisfactory, and has the operational advantage of keeping analog meters indicating about mid-scale when readings are normal, but clearly show when the unit is de-energized.

Zone markings have not been installed on the majority of analog displays. This is due to lack of operating experience and the identification of specific system characteristics. The calculated limits, set points and normal zones can change as plants are started and gain operating experience. To zone meters based upon calculated numbers that will probably change when operation begins can be misleading to the operator and cause operator error. Instead, a procedure will be established to allow operator inputs in determining meters to be zoned and to use operating experience to determine correct parameters to be used. This will be a continuing program with appropriate review and decision making. Indicators will be enhanced as required to provide assistance to the operator in operating the plant effectively.

Recorders: Chart recorders use both single and multiple pens. Where multiple pens are used, the colors are distinct and easily distinguishable. The recorder will use the same

hierarchal labeling system as the vertical meters. In addition, multipen recorders have legends to identify pen colors. Each recorder has paper designed to match its scale. The stock number of the paper will be identified for each recorder so that the correct paper will be used for replacement. The general specification for scales will also be used on recorders to ensure overall consistency.

Reg. Guide 1.97 Instruments: Instruments that meet Reg. Guide 1.97 requirements are located throughout the control room. Each instrument will be marked by a vertical yellow stripe to enable operators to quickly identify them. The stripe will be on the face of vertical meters over the section that identifies engineering units. On recorders, the stripe will be on the right edge of the window; it will be similarly placed on other meters. The location of the stripe will be such that it does not interfere with other colors used on the panel (see Figure 3-4).

SPDS: The Emergency Response Facility Display System will provide an SPDS display in the control room. This system is in the final stages of design and implementation. When it is implemented in the control room, an independent human factors review of the system will be performed. The General Electric functional analysis and design documentation will be used and incorporated with the follow-up task analysis as discussed in Section 1.6.8 to ensure operational suitability.

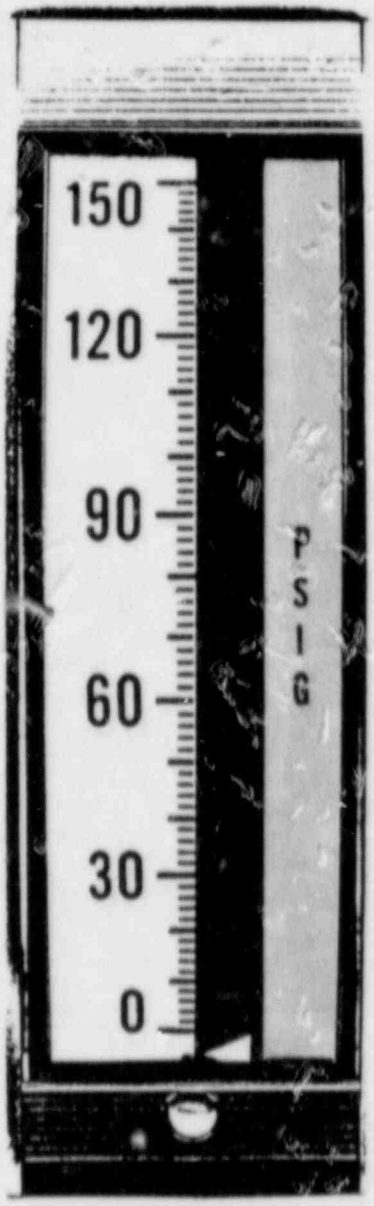


Figure 3-4. Reg. Guide 1.97 Instrument Identification

APPENDICES

Appendix	Title
A	Human Engineering Discrepancies
B	BWROG Summary Report
C	CRDR Team Resumes
D	Supplementary Operator Experience Questionnaire
E	Operator Experience Review, Licensee Event Report Summary
F	Scale Graduations Specification
G	Labeling Font Specification for The Philadelphia Electric Company's Limerick Plant

APPENDIX A

HUMAN ENGINEERING DISCREPANCIES

HED ASSESSMENT

HED No. A1-Ø1

EP = 4

TITLE: System Grouping

COMMENT: Annunciators not above related controls and displays

Item: 5.1 Ref.: C1.2 Source: CRS

IDENTIFICATION: Panel: 661,ØØC-656,626,ADS,6Ø2,668,669,ØØC-65Ø
Component Name: Annunciator System
ID or Number: N/A

DESCRIPTION OF PROBLEM:

While annunciators are grouped within panels by system, they are not always above the related controls and displays. See attached sheet for examples.

RESOLUTION: (Code: D) (Priority: N/A) (Sched: Fuel Load)

All annunciator panels will be assigned a hierarchal name that relates them to their associated panel or console. Each will be numbered in sequence, beginning with 1Ø1 for identification in procedures. Appropriate demarcation will also be used between annunciator panels. (See general discussion of Annunciator Improvements.)

TRAINING REQUIREMENTS: None

PROCEDURE REQUIREMENTS:
Modify alarm response card numbers to conform to new panel number.

Team Approval Signature: Date:

( ) Additional page(s) attached

Relating to panel 661, the D11 alarms are above the D13 controls, the D13 alarms are above the D12 controls, and the D12 and D14 alarms are above panel ØØC-656.

The location of ADS and MSIV leakage control alarms in alarm panel 1ØC826 is the reverse of the location of related controls on panel 626.

The reactor isolation system alarms of alarm panel 1AC8Ø2 are above the ADS panel.

Excess flow check valve and fuel pool alarms of alarm panel 1BC8Ø2 are located with the recirculation and RWCU alarms related to panel 6Ø2.

Radiation monitoring alarms in alarm panel ØØC824 are above panel 668.

Feedwater alarm panel 1BC868 is located above panel 669.

Fire protection alarm panel ØBC85Ø is located above the control room entrance, to the left of fire protection panel ØØC-65Ø.

HED ASSESSMENT

HED No. A1-Ø2

EP = 4

TITLE: Separation of Warning Alarms

COMMENT: Warning and diagnostic alarms not separated from advisory displays.

Item: 5.2 Ref.: C1.3 Source: CRS

IDENTIFICATION: Panel: 67Ø,66Ø,649,673
Component Name: Annunciator System
ID or Number: N/A

DESCRIPTION OF PROBLEM:

Warning and diagnostic alarms are not separated from advisory and informational displays in the following panels:
- condensate pump and circulation water pump trips (not on top row)
- scram input alarms (are not grouped together)
- RHR auto start alarm window not above permissive start alarm

RESOLUTION: (Code: A) (Priority: 2) (Sched: 2nd refueling outage)

Alarm windows within panels to be arranged in prioritized groups such that high priorities will be near the top and low priorities near the bottom. (See general discussion of annunciator improvements.)

TRAINING REQUIREMENTS: Mod. Package (MP)

PROCEDURE REQUIREMENTS: MP

Team Approval Signature: Date:

( ) Additional page(s) attached

HED ASSESSMENT

HED No. A1-Ø3

EP = 4

TITLE: Annunciator Abbreviations

COMMENT: Inconsistent use of abbreviations

Item: 5.3
5.4

Ref.: C2.1

Source: CRS

IDENTIFICATION: Panel: Various
Component Name Annunciator System
ID or Number: N/A

DESCRIPTION OF PROBLEM:

Annunciator abbreviations were not consistent with each other or with overall control room abbreviation conventions. HTX/HX, REACTOR 2Ø LEVEL/REACTOR LEVEL 3, D/G versus D-G, CONT used for both "containment" and "control".

RESOLUTION: (Code: A) (Priority: 3) (Sched: Coordinate w/ other annunciator improvements.)

Alarms to be relabeled using terminology consistent with related control panels. (See general discussion of annunciator improvements.)

TRAINING REQUIREMENTS: MP

PROCEDURE REQUIREMENTS: MP

Team Approval Signature: Date:

( ) Additional page(s) attached

HED ASSESSMENT

HED No. A1-Ø4

EP = 4

TITLE: Type Consistency

COMMENT: Type size and style inconsistent.

Item: 5.5 Ref.: C2.2 Source: CRS

IDENTIFICATION: Panel: ØØC-624,OBC-85Ø,1AC-87Ø
Component Name: Annunciator System
ID or Number: N/A

DESCRIPTION OF PROBLEM:

Inconsistencies in type size and style noted on the following:
- common alarm panel over ØØC-624 (one window has smaller, darker type)
- window 19 of panel ØBC85Ø
- window 17 of panel 1AC87Ø

RESOLUTION: (Code: A) (Priority: 4) (Sched: N/A)

If changes are required in conjunction with other HED resolutions, standard size and style of type will be used. (See general discussion of annunciator improvements.)

TRAINING REQUIREMENTS: None

PROCEDURE REQUIREMENTS: None

Team Approval Signature: Date:

( ) Additional page(s) attached

HED ASSESSMENT

HED No. A1-Ø5

EP = 9

TITLE: Annunciator Height/Viewing Angle

COMMENT: Panels are located too high and at too shallow an angle for easy viewing.

Item: 5.6 Ref.: C2.3 Source: CRS

IDENTIFICATION: Panel: Vertical Boards behind consoles
Component Name: Annunciator System
ID or Number: N/A

DESCRIPTION OF PROBLEM:

It appears difficult for operators to view annunciator panels due to their height and angle when standing between consoles and vertical panels.

RESOLUTION: (Code: D) (Priority: 4) (Sched: N/A)

Annunciators can be read by an operator standing between the consoles and back vertical boards. During emergency operations, the operators work as a team with the supervisor using emergency procedures. The team will provide monitoring of annunciators and will provide mutual support. These actions will provide adequate coverage of all annunciator alarms.

TRAINING REQUIREMENTS: None

PROCEDURE REQUIREMENTS: None

Team Approval Signature: Date:

( ) Additional page(s) attached

HED ASSESSMENT

HED No. A1-Ø6

EP = 6

TITLE: Excessive Annunciator Wording

COMMENT: Many annunciator windows contain excessive wording.

Item: 5.7 Ref.: C2.5 Source: CRS

IDENTIFICATION: Panel: See attached
Component Name: Annunciator System
ID or Number: N/A

DESCRIPTION OF PROBLEM:

Insuccinct wording was found on many annunciator legends. (See attached sheet for examples.)

RESOLUTION: (Code: A) (Priority: 2) (Sched: Coordinate w/ other annunciator improvements.)

Alarms to be reworded using hierarchal labeling to reduce the number of words on window labels. (See general discussion of annunciator improvements.)

TRAINING REQUIREMENTS: None

PROCEDURE REQUIREMENTS: None

Team Approval Signature: Date:

(2) Additional page(s) attached

GENERATOR HYDROGEN COOLERS H2
OUTLET HI/LO TEMP, panel
1BC87Ø, window 34

EHC EMERGENCY TRIP PRESS LO
PRESS TRIP, panel 1AC87Ø
window 46

CONT ENCL ST FLDNG DMPR
PNL ØØC729 TROUBLE, panel
ØØC881, window 2Ø

A REFUELING FLOOR ISOLATION
SIGNAL INITIATED, panel 1ØC881
window 23

1A CRD WATER PUMP TRIP
panel 1BC8Ø3, window 31

UNIT 1 REAC BLDG EL 352
NORTHWEST AIRLOCK SEAL BROKEN,
panel 1ØC889, window 1

CIRC WATER PUMP COOLING WATER
BASKET STRAINER FAILURE, panel
1ØC855, window 43

1 GEN BKRS 452-535/635
POSITION MONITOR CKT CONTROL
PWR FAILURE, panel 1BC854,
window 5

D11 D-G DIESEL OIL STORAGE
TANK HI/LO LEVEL, panel
1AC861, window 19

DIV 1 ADS MANUAL INITIATION
SW ARMED/RELAYS SEALED IN,
panel 1ØC826, window 2

DIV 2 LO REACTOR PRESSURE
RHR PERMISSIVE TO START, panel
1CC8Ø1, window 25

CONTROL RM EMER FRESH AIR
SUPPLY CHARCOAL FILTER A
FIRE,panel ØBC85Ø, window 26

EMER COOLING SUPPLY FROM
CONDENSATE STORAGE TANK
MOV OVLD LOSS OF PWR, panel
1ØC847, window 21

HED ASSESSMENT

HED No. A1-Ø7

EP = 6

TITLE: Annunciator System Identification

COMMENT: Annunciators do not fully identify systems.

Item: 5.8 Ref.: C2.5 Source: CRS

IDENTIFICATION: Panel: 8Ø0,8Ø1
Component Name: Annunciator System
ID or Number: N/A

DESCRIPTION OF PROBLEM:

Some annunciator legends were not specific enough to fully identify the system referred to.
- SUPPRESSION ATMOSPHERIC ANALYZER TROUBLE (panel 1ØC8ØØ, window 28)
- TRAIN A PIPING FILL PUMP AP256 LO PMP DISCH (panel 1BC8Ø1, window 14)

MITIGATING CIRCUMSTANCES:

Annunciator response cards define the meaning of each window.

RESOLUTION: (Code: A) (Priority: 2) (Sched: Coordinate w/ other annunciator improvements.)

Alarms to be reworded using hierarchal labeling and system colors to competely identify the system. (See general discussion of annunciator improvements.)

TRAINING REQUIREMENTS: None

PROCEDURE REQUIREMENTS: None

Team Approval Signature: Date:

( ) Additional page(s) attached

HED ASSESSMENT

HED No. A1-Ø8

EP = 6

TITLE: Incomplete & Incorrect Annunciator Legends

COMMENT: Annunciators have incomplete, sometimes incorrect legends.

Item: 5.9
5.1Ø
5.11

Ref.: C2.5

Source: CRS

IDENTIFICATION: Panel: 1AC-87Ø,1AC-8Ø1
Component Name: Annunciator System
ID or Number: N/A

DESCRIPTION OF PROBLEM:

- No process variable specified on windows 43 and 5Ø, panel 1AC87Ø
- DIV 1 SHUTDOWN COOLING & MIN FLOW VALVES OPEN should read RHR A not DIV 1 (1AC8Ø1)
- CORE SPRAY LINE INTERNAL BREAK is not literally correct (1AC8Ø1)

RESOLUTION: (Code: A) (Priority: 2) (Sched: Coordinate w/ other annunciator improvements.)

Alarms to be relabeled to provide complete and correct labels. (See general discussion of annunciator improvements.)

TRAINING REQUIREMENTS: None

PROCEDURE REQUIREMENTS: None

Team Approval Signature: Date:

( ) Additional page(s) attached

HED ASSESSMENT

HED No. A1-Ø9

EP = 4

TITLE: Multiple Trip Levels, Clarity

COMMENT: Annunciators legends with multiple trip levels do not differentiate levels.

Item: 5.12 Ref.: C2.6 Source: CRS

IDENTIFICATION: Panel: Various
Component Name: Annunciator System
ID or Number: N/A

DESCRIPTION OF PROBLEM:

Some alarm windows use terminology that does not refer clearly to varying setpoints for parameters with multiple trip levels. An example would be "REACTOR LO LEVEL TRIP" versus REACTOR HI/LO LEVEL and REACTOR HI LEVEL TURBINE/RFPT TRIP

RESOLUTION: (Code: A) (Priority: 2) Sched: Coordinate w/ other annunciator improvements.

These alarms to be made clear with better terminology. They represent specific set points. (See general discussion of annunciator improvements.)

TRAINING REQUIREMENTS: None

PROCEDURE REQUIREMENTS: None

Team Approval Signature: Date:

( ) Additional page(s) attached

HED ASSESSMENT

HED No. A1-10

EP = 6

TITLE: Annunciator Multiple Choice Indications

COMMENT: Annunciator legends have multiple choice indications.

Item: 5.13 Ref.: C2.7 Source: CRS

IDENTIFICATION: Panel: See attached
Component Name: Annunciator System
ID or Number: N/A

DESCRIPTION OF PROBLEM:

Many annunciators have multiple choice indications that are not differentiated and therefore are potentially confusing to the operator. See attached sheet.

RESOLUTION: (Code: D) (Priority: N/A) (Sched: Fuel Load)

Association between these alarms and the associated indications has been improved by enhancements to the panels. (See general discussion of enhancements.) See attached.

TRAINING REQUIREMENTS: None

PROCEDURE REQUIREMENTS: None

Team Approval Signature: Date:

(2) Additional page(s) attached

IDENTIFICATION

(a) TRIP RELAY LOW VOLTAGE OR 386 PROT RELAY TRIP, panel 1BC870, window 6

(b) HPCI VAC PUMP/COND PUMP/MOTOR OVLD/LOSS OF PWR, panel 10C847 window 16

(c) COMMON AREA RAD MONITORS DOWNSCALE, panel 00C824, window 35

(d) SGTS VENT HI-LO/INOP RADIATION, panel 00C881, window 26

(e) 1A RFPT MAIN BRG OIL PUMP 1 OR 2 OVLD TRIP/INOP, panel 1AC868, window 1

(f) MSIV LC VALVE/HEATER/BLOWER OLVD/POWER FAILURE, panel 10C826, window 25

(g) 1A/1B/1C RFPT BRG METAL HI TEMP, panel 1AC868, window 26

(h) NORTH STACK/SOUTH STACK ISO KINETIC SAMPLE HI/LO FLOW, panel 00C824, window 30

RESOLUTION

Code D

a. This alarm results in the immediate trip of the turbine and therefore the reactor. It represents the sum of a series of 8 relays in a local cabinet. That cabinet must be viewed to identify the cause of the trip. A computer readout will also give this information. In either case, this is follow-up information not immediately required for operation of the plant.

b. Either alarm causes the loss of either pump. Which pump is affected can be determined on the associated panel by indicating lights. These pump indications are side by side. The board will be enhanced to help the operator identify the pumps.

c. This alarm is for the Area Rad Monitor recorder on the associated board. The recorder contains several channels all of which are properly identified.

d. These windows have been changed as a result of a design change to show individual hi and lo alarms. The Inop alarm has been deleted.

e. Switch indicating lights on the associated board clearly indicate which pumps are affected. Boards will be enhanced to help the operator identify the switches.

f. Switch indicating lights on the associated board clearly indicate which are affected. Boards will be enhanced to help the operator identify the switches.

g. The associated recorder is located directly under the alarm.

h. This alarm was determined not to be required as a result of a design change and has been deleted.

HED ASSESSMENT

HED No. A1-12

EP = 8

TITLE: Alarm Window Identification

COMMENT: Numeral code on windows is small and difficult to read.

Item: 5.15 Ref.: C2.9 Source: CRS

IDENTIFICATION: Panel: All
Component Name: Annunciator System
ID or Number: N/A

DESCRIPTION OF PROBLEM:

The alarm panel numeric code is printed in small numerals on the alarm windows and appears difficult to read from the benchboards. Alarm panels have not been identified.

RESOLUTION: (Code: A) (Priority: N/A) (Sched: Fuel Load)

Numerical codes on windows to be eliminated. An alphanumeric matrix located around the perimeter of the annunciator will be used to identify the alarms. (See general discussion of annunciator improvements.)

TRAINING REQUIREMENTS: N/A

PROCEDURE REQUIREMENTS:

Update alarm response cards with matrix identifiers.

Team Approval Signature: Date:

( ) Additional page(s) attached

HED ASSESSMENT

HED No. A1-13

EP = 12

TITLE: Annunciator Silence Button

COMMENT: No silence button has been provided for annunciator alarm response.

Item: 5.16 Ref.: C5.1 Source: CRS

IDENTIFICATION: Panel: All
Component Name: Annunciator System
ID or Number: N/A

DESCRIPTION OF PROBLEM:
No silence controls are provided with the annunciator response controls. Each set of controls should include a silence control, and it should be possible to silence auditory alert signals from any set of response controls in the primary operating area.

RESOLUTION: (Code: B) (Priority: 1) (Sched: 1st R)

The acknowledge button silences each alarm. A fourth 'Silence' button is not possible with present system. In this system, a silence button would preclude a subsequent alarm from a different window within a particular audio annunciator panel. A tone-down system will be installed.

TRAINING REQUIREMENTS: None

PROCEDURE REQUIREMENTS: None

Team Approval Signature: Date:

( ) Additional page(s) attached

HED ASSESSMENT

HED No. A1-14

EP = 4

TITLE: Annunciator Flash Rates

COMMENT: Flash rates do not change when alarm clears.

Item: 5.17 Ref.: C6.4 C6.5 Source: CRS

IDENTIFICATION: Panel: All
Component Name: Annunciator System
ID or Number: N/A

DESCRIPTION OF PROBLEM:
Flash rate does not slow automatically when an alarm input clears, neither does the rate decrease when alarms are cleared by operator action only.

RESOLUTION: (Code: B) (Priority: N/A) (Sched: Fuel Load)

Current annunciator sequence provides for a silencing of audible and 'steady-on' for lights as an alarm is acknowledged. When an alarm clears, the selector slide switch located inside each alarm window would remain in the 'acknowledged' state or return to 'normal' - (light off, audible off). The reset returns a cleared alarm to normal if in the manual clear mode. If the slide switch is in the auto-clear mode, the alarm light will automatically return to normal. Initially all selector slide switches will be set to the 'Manual' position. Operators will selectively recommend changing switches to 'Auto Clear' position through appropriate administrative procedures.

TRAINING REQUIREMENTS: None

PROCEDURE REQUIREMENTS:

Procedure for setting alarm slide switches.

Team Approval Signature: Date:

( ) Additional page(s) attached

HED ASSESSMENT

HED No. SA2-Ø1

EP = 6

TITLE: Annunciator Multiple Choice Indications

COMMENT: Annunciator legends have multiple choice indications.

Item: N/A Ref.: C2.7 Source: SCRS

IDENTIFICATION: Panel: 673 (See attached)
Component Name: Annunciator System
ID or Number: N/A

DESCRIPTION:

Many annunciators have multiple choice indications that are not differentiated and therefore are potentially confusing to the operator.

RESOLUTION: (Code: F) (Priority: 4) (Sched: N/A)

When alarmed, a floor operator is required to be dispatched to the related equipment. The action is the same on a given window for multiple choice indication. Control room actions would be the same regardless of which multiple choice caused the alarm. Primary concern will be condenser vacuum. This is not a discrepancy.

TRAINING REQUIREMENTS: None

PROCEDURE REQUIREMENTS: None

Team Approval Signature: Date:

( ) Additional page(s) attached

IDENTIFICATION

VARIOUS WINDOWS ABOVE PANEL 673

2 UNIT
GAS RADWASTE
AFTERCOND
HI/LO LEVEL

2 UNIT
RECOMBINER
TRAIN
AFT COND
HI/LO LEVEL

2 UNIT
REFR MACHINE
HI/HI / LO/LO
TEMP

2 UNIT
RECOMBINER
TRAIN
PREHEATER
HI/LO LEVEL

HED ASSESSMENT

HED No. SA2-Ø2

EP = 6

TITLE: Excessive Annunciator Wording

COMMENT: Annunciator windows contain excessive wording.

Item: N/A Ref.: C2.5 Source: SCRS

IDENTIFICATION: Panel: 673 (See attached)
Component Name: Annunciator System
ID or Number: N/A

DESCRIPTION:

Insufficient wording was found on many annunciator legends. (See attached sheet.)

RESOLUTION: (Code A) (Priority: 3) (Sched: Coordinate w/ other annunciator improvements.)

Alarms to be reworded using hierarchal labeling to reduce the number of words on window labels. (See general discussion of annunciator improvements.)

TRAINING REQUIREMENTS: None

PROCEDURE REQUIREMENTS: None

Team Approval Signature: Date:

( ) Additional page(s) attached

HED ASSESSMENT

HED No. D1-01

EP = 9

TITLE: Control/Display Height

COMMENT: Controls and displays exceed height maximum and minimum.

Item: 3.1.1
3.3.9

Ref.: A1.1

Source: CRS

IDENTIFICATION: Panel: 601,647,648,670,654,661,626,600,668,669,
Component Name: N/A 607,00C-667,00C-671,00C-650,
ID or Number: See below 00C-693,00C-660

DESCRIPTION OF PROBLEM:

Panels have controls and displays located both above and below control/display maximum and minimum height requirements:

Controls: 20" to 80", recommended 42" to 60"
Displays: 22" to 92", recommended 48" to 68"

RESOLUTION: (Code: F) (Priority: 4) (Sched: N/A)

All panels have been reviewed for controls and displays above and below the recommended heights. The review revealed no problems with height. See general discussion on height of controls and displays.

TRAINING REQUIREMENTS: None

PROCEDURE REQUIREMENTS: None

Team Approval Signature: Date:

( ) Additional page(s) attached

HED ASSESSMENT

HED No. D1-Ø2

EP = 6

TITLE: Annunciator Anthropometric Height Standards

COMMENT: Vertical panels do not meet measurement standards.

Item: 3.1.1 Ref.: A1.1 Source: CRS

IDENTIFICATION: Panel: Annunciator Panels (exception 675 & 696)
Component Name: Annunciator System
ID or Number: N/A

DESCRIPTION OF PROBLEM:

Annunciator panels are located above the 88 inch maximum allowed; top rows are at 118 inches.

MITIGATING CIRCUMSTANCES:

Annunciators are above the vertical back panels and the normal operating station is in front of the consoles. This allows a satisfactory viewing angle from the normal station.

RESOLUTION: (Code: F) (Priority: 4) (Sched: N/A)

There is no practical way of lowering the height of the annunciators. They are visible and readable from their present location.

TRAINING REQUIREMENTS: None

PROCEDURE REQUIREMENTS: None

Team Approval Signature: Date:

( ) Additional page(s) attached

HED ASSESSMENT

HED No. D1-Ø3

EP = 8

TITLE: Mirror-Imaged Panels

COMMENT: The generator and auxiliary power panels are mirror-imaged.

Item: 3.1.2 Ref.: A1.2 Source: CRS

IDENTIFICATION: Panel: 1ØC-654 & 2ØC-654
Component Name: N/A
ID or Number: N/A

DESCRIPTION OF PROBLEM:

The controls and displays on the generator and auxiliary power panels are laid out in mirror-image of each other.

RESOLUTION: (Code: D) (Priority: N/A) (Sched: Fuel Load)

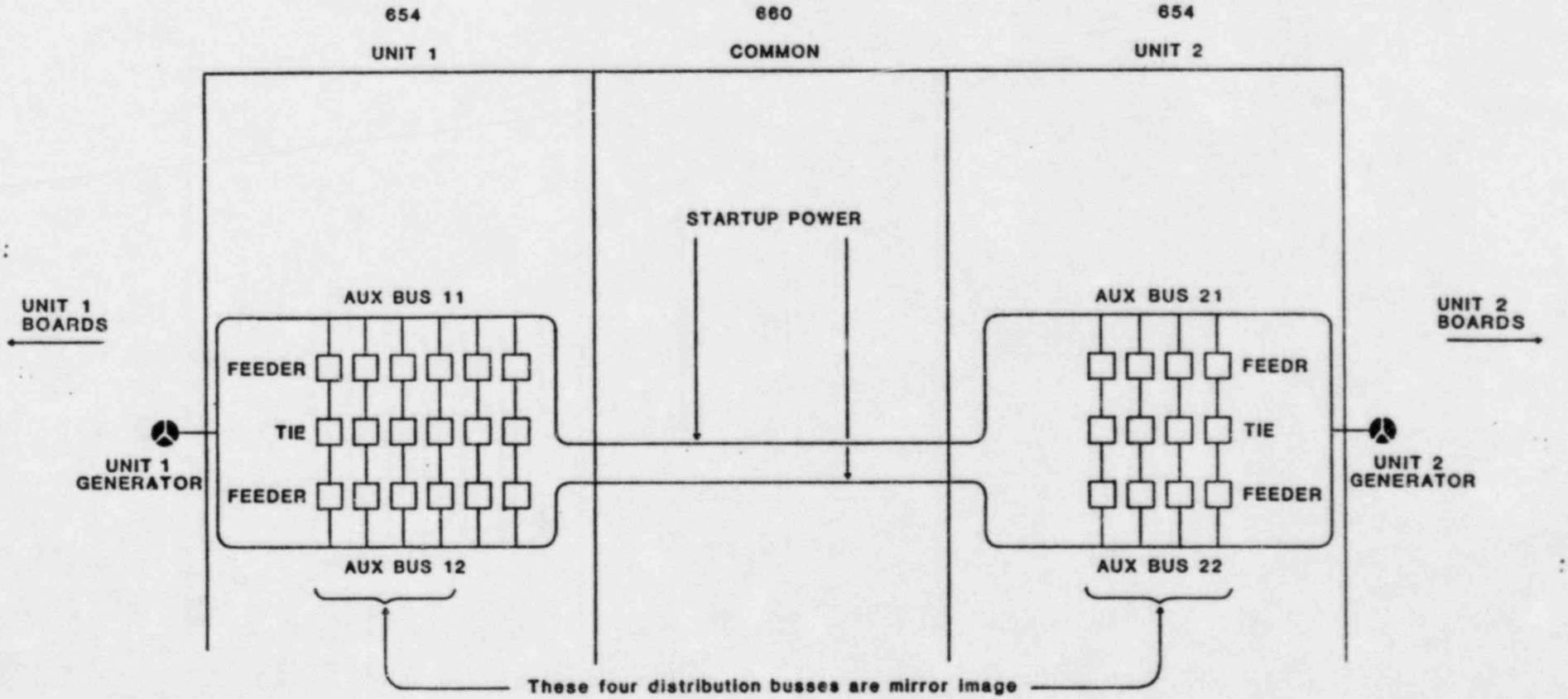
These panels are arranged on either side of 66Ø (Start-up power). This arrangement is to indicate the distribution network of start up power to each unit (see attached). The mirror imaging effects are minimized and compensated for by the design of enhancements, which clearly indicate the load centers and aux bus distribution mimicing. The arrangement is not considered a detriment to operator performance.

TRAINING REQUIREMENTS: None

PROCEDURE REQUIREMENTS: See HED P1-Ø1

Approval Signature: Date:

( ) Additional page(s) attached


654
UNIT 1
660
COMMON
654
UNIT 2
STARTUP POWER
UNIT 1
BOARDS
AUX BUS 11
AUX BUS 21
UNIT 2
BOARDS
FEEDER
TIE
FEEDER
FEEDR
TIE
FEEDER
UNIT 1
GENERATOR
UNIT 2
GENERATOR
AUX BUS 12
AUX BUS 22
These four distribution busses are mirror image

HED D1-03

HED ASSESSMENT

HED No. D1-Ø4

EP = 9

TITLE: Panel Obstruction

COMMENT: Vertical panels behind benchboards are partially obstructed.

Item: 3.1.3 Ref.: A7.1 A7.2 Source: CRS

IDENTIFICATION: Panel: ØØC-624,693,1ØC-669,670,610,614,607,649 1ØC-600,626,601,648,647
Component Name: N/A
ID or Number: N/A

DESCRIPTION OF PROBLEM:

Physical access and visibility of the vertical panels located behind benchboards is obstructed by the benchboards.

RESOLUTION: (Code: F) (Priority: 4) (Sched: N/A)

See attached. (RESOLUTION)

TRAINING REQUIREMENTS: None

PROCEDURE REQUIREMENTS: None

Team Approval Signature: Date:

(1) Additional page(s) attached

RESOLUTION

A team analysis was conducted in the control room to analyze each back panel control and indication that was below the height of 48 inches. For each, it was first determined whether the control was required for an emergency condition or for normal operation. Then an analysis was made of the consequences of not noticing a change in state or exceeding a normal range. For example, a valve that is either open or closed when it is expected to be the opposite, or a pump stopped when expected to be running. This analysis took no credit for isles between consoles or frequent normal movement of operators to the back panel area, but considered only what could not be seen by the operator standing in front of the consoles. It was assumed the operator's height was that of a 64 inch or 5th percentile male. An exception was for emergency systems used for emergency core cooling, which are located on one of these vertical panels behind a console. For situations that require ECCS, the control room team procedure requires that the Chief Operator take station at the ECCS panels to operate them as a member of the emergency procedure control team. Therefore, any instruments and controls he could directly observe from his emergency station were considered satisfactory. All of these controls and indications were considered in the review for normal operations when the operator was not stationed at the ECCS panels.

The lack of direct visibility was considered satisfactory if an abnormal condition would result in an alarm indication that could be observed by the operator, or would result in some other condition easily detected by the operator and alerting him to take appropriate action. In such a case, the action was required to be timely. In those instances where a control out of position would cause an immediate plant shutdown that the operator could not have taken action on even if he had been observing it directly, it was considered satisfactory in its present location. The intent of this analysis was to determine whether it is necessary to move a control or indication to a more observable location, or to provide an annunciator alarm to alert the operator.

The review revealed no instances where it would be necessary to move the control or indication, or to add an annunciator alarm. Related indicators and recorders are visible to alert the operator well before a response is required. These related indications were determined to provide at least as much alert to the operator as if the direct indication or control in question were observed. For the ECCS panels, all instruments and controls were observable by the operator when at his emergency station.

HED ASSESSMENT

HED No. D1-Ø5

EP = 6

TITLE: Annunciator Window Visibility

COMMENT: Annunciator windows are not visible from primary operating area.

Item: 3.1.4 Ref.A7.3 Source: CRS

IDENTIFICATION: Panel: 696,ØØC-675
Component Name: Annunciator Windows
ID or Number: N/A

DESCRIPTION OF PROBLEM:
Annunciator windows for meteorological, post - LOCA hydrogen recombiner panels are not visible from primary operating area.

RESOLUTION: (Code: A) (Priority: N/A) (Sched: N/A)

These panels are located behind the vertical back panels, not in the at-controls area of the control room. They are panels that will be used in the later stages of an accident and are intended to be manned by personnel supplementing the shift team. Panel 696 is the Post Loca Recombiner panel, and 675 is the Meteorlogical Station. General alarms for the 696 panels are located on the annunciator in the at-controls area of the control room. Meteorlogical information is available on a CRT in the at-controls area. This is considered not to be a discrepancy.

TRAINING REQUIREMENTS: None

PROCEDURE REQUIREMENTS: None

Team Approval Signature: Date:

( ) Additional page(s) attached

HED ASSESSMENT

HED No. D2-Ø1

EP = 8

TITLE: Panel Demarcation Lines

COMMENT: Heating and Ventilation panels are not distinguished from each other.

Item: 3.2.1 Ref.: A2.1 Source: CRS

IDENTIFICATION: Panel: 2ØC-681, ØØC-681
Component Name: N/A
ID or Number: N/A

DESCRIPTION OF PROBLEM:

Common heating and ventilation console not distinguished from Unit 2 console by demarcation lines or other means.

RESOLUTION: (Code: A) (Priority: N/A) (Sched: Fuel Load)

A demarcation line will be placed between the Unit 2 and Common sections of the console. Console names will be part of hierarchal labeling. (See general discussion of enhancements.)

TRAINING REQUIREMENTS: None

PROCEDURE REQUIREMENTS: None

Team Approval Signature: Date:

( ) Additional page(s) attached

HED ASSESSMENT

HED No. D2-Ø2

EP = 4

TITLE: Incomplete Demarcation

COMMENT: Part of demarcation line is missing.

Item: 3.2.2 Ref.: A2.1 Source: CRS

IDENTIFICATION: Panel: ØØC-656
Component Name: N/A
ID or Number: N/A

DESCRIPTION OF PROBLEM:

Part of the demarcation line that distinguishes panel ØØC-656 is missing.

RESOLUTION: (Code: A) (Priority: N/A) (Sched: Fuel Load)

A demarcation line is not required and will be removed.

TRAINING REQUIREMENTS: None

PROCEDURE REQUIREMENTS: None

Team Approval Signature: Date:

( ) Additional page(s) attached

HED ASSESSMENT

HED No. D2-Ø3

EP = 6

TITLE: Instrumentation Grouping

COMMENT: Groups of controls and displays are not easily identified.

Item: 3.2.3 Ref.: A2.2 Source: CRS

IDENTIFICATION: Panel: See attached
Component Name: N/A
ID or Number: N/A

DESCRIPTION OF PROBLEM:

While generally grouped by function, grouping is not visually apparent as groups run into one another. See attached comments.

RESOLUTION: (Code: A) (Priority: N/A) (Sched: Fuel Load)

Corrected through enhancement. (See general discussion of enhancements.) ØØC-65Ø not covered by CRDR.

TRAINING REQUIREMENTS: None

PROCEDURE REQUIREMENTS: None

Team Approval Signature: Date:

(1) Additional page(s) attached

Enclose sets of related indicators - panel 652.

Enclose related turbine and main steam displays and selector switches - panel 653.

Separate RFPT controls and IRM/APRM range switches and indicating lights - panel 6Ø3.

Continue demarcation lines to vertical portion of panel 655.

Enclose related displays and controls - panel ØØC-681.

Enclose related displays - panels 647 and 648.

Enclose related electrical meter displays and synchroscopes, panels 654 and ØØC66Ø.

Enclose fire pump displays and controls - panel ØØC-65Ø.

Separate and enclose related sets of small indicators, pushbuttons, and switches on panel 67Ø.

Separate MSIV inboard division 1 and outboard division 2 and ADS division 1 and 3 - panel 626.

HED ASSESSMENT

HED No. D2-Ø4

EP = 6

TITLE: Reactor Scram Buttons

COMMENT: Manual scram buttons not easily distinguished from other controls.

Item: 3.2.3 Ref.: A2.2 Source: CRS

IDENTIFICATION: Panel: 6Ø3
Component Name: Manual Scram Pushbuttons
ID or Number: Same as above

DESCRIPTION OF PROBLEM:

Emergency controls should be visually highlighted for rapid location and to prevent inadvertent use.

RESOLUTION: (Code: A) (Priority: N/A) (Sched: Fuel Load)

Resolved through color enhancements and highlighting. (See general discussion of enhancements.)

TRAINING REQUIREMENTS: None

PROCEDURE REQUIREMENTS: None

Team Approval Signature: Date:

( ) Additional page(s) attached

HED ASSESSMENT

HED No. D2-Ø5

EP = 6

TITLE: Annunciator Response Controls

COMMENT: Annunciator controls are grouped with other controls and are difficult to identify rapidly.

Item: 3.2.3 Ref.: A2.2 Source: CRS

IDENTIFICATION: Panel: All
Component Name: Annunciator response controls
ID or Number: N/A

DESCRIPTION OF PROBLEM:

Annunciator controls require rapid response by the operator, often used with a blind reach. They should be easily identified visually and tactually.

RESOLUTION: (Code: A) (Priority: 3) (Sched: Before Crit.)

Resolved through use of color enhancements. All ACKNOWLEDGE Pushbuttons are tactually distinguishable due to their mushroom (palm-actuated) shape except panel ØØC-667 which will be made consistent with others. The TEST pushbutton will be guarded. (See general discussion of enhancements.)

TRAINING REQUIREMENTS: None

PROCEDURE REQUIREMENTS: None

Team Approval Signature: Date:

( ) Additional page(s) attached

HED ASSESSMENT

HED No. D2-Ø6

EP = 12

TITLE: Hierarchal Labeling and Grouping

COMMENT: Hierarchal labeling techniques generally have not been used in relation to grouping.

Item: 3.2.4 Ref.: A2.3 Source: CRS

IDENTIFICATION: Panel: All
Component Name: N/A
ID or Number: N/A

DESCRIPTION OF PROBLEM:

The intended use of grouping of instruments is not clear from labels. There is no hierarchal labeling system that identifies the main purpose of groupings, nor are groups graphically separated.

RESOLUTION: (Code: A) (Priority: N/A) (Sched: Fuel Load)

Resolved through enhancement and hierarchal labeling of control room. Label font specifications developed. (See general discussion of enhancements.)

TRAINING REQUIREMENTS: None

PROCEDURE REQUIREMENTS: None

Team Approval Signature: Date:

( ) Additional page(s) attached

HED ASSESSMENT

HED No. D2-07

EP = 6

TITLE: Demarcations on Vertical Panels

COMMENT: There is inadequate differentiation of groupings on some vertical boards.

Item: 3.2.4 Ref.: A2.3 Source: CRS

IDENTIFICATION: Panel: 601,00C-660,00C-650,668,626
Component Name: Vertical Panels
ID or Number: N/A

DESCRIPTION OF PROBLEM: The following are not separated:
601 - Mainsteam inboard and outboard isolation
660 - Meters for safeguards transformers, auxiliary switchgear, and start-up busses
650 - Meter and diesel driven remote start switches and indicators for fire pumps
668 - Switch arrays on panel
626 - Systems within divisions of MSIV inboard and outboard leakage control

RESOLUTION: (Code: A) (Priority: N/A) (Sched: Fuel Load)

Panel enhancements have been used to resolve system differentiation and grouping problems on panels 10C-601, 00C-660, 10C-668, 10C-626. Panel 00C-650 not included in CRDR. (See general discussion on enhancements.)

TRAINING REQUIREMENTS: None

PROCEDURE REQUIREMENTS: None

Team Approval Signature: Date:

( ) Additional page(s) attached

HED ASSESSMENT

HED No. D2-Ø8

EP = 4

TITLE: Mimics - Bar Width

COMMENT: Incorrect use of bar width in coding-mimics.

Item: 3.2.5 Ref.: A2.4 Source: CRS

IDENTIFICATION: Panel: 6Ø1,648,647
Component Name: See below description.
ID or Number: N/A

DESCRIPTION OF PROBLEM:

Some mimics use primary width bars for secondary flow paths. These include flow paths from: core spray pumps t' minimum flow bypass valve, main steam drain lines to equalizer valve, bypass line through RHR pump minimum flow valve (6Ø1); and steam line warmup bypass valves in RCIC & HPCI mimics (648,647).

RESOLUTION: (Code: A) (Priority: N/A) (Sched: Fuel Load)

Enhancements have changed all mimics to use three graduations of mimic lines. (See general discussion of enhancements.)

TRAINING REQUIREMENTS: None

PROCEDURE REQUIREMENTS: None

Team Approval Signature: Date:

( ) Additional page(s) attached

HED ASSESSMENT

HED No. D2-09

EP = 4

TITLE: Mimic Contrast

COMMENT: Poor color contrast between mimics

Item: 3.2.6 Ref.: A2.5 Source: CRS

IDENTIFICATION: Panel: 601
Component Name: Mimic lines
ID or Number: N/A

DESCRIPTION OF PROBLEM:

Good contrast between mimics and panel, but red, dark green and dark blue mimics do not contrast each other well.

RESOLUTION: (Code: A) (Priority: N/A) (Sched: Fuel Load)

Mimics have been redesigned with new colors that provide adequate color contrast. (See general discussion of enhancements.)

TRAINING REQUIREMENTS: None

PROCEDURE REQUIREMENTS: None

Team Approval Signature: Date:

( ) Additional page(s) attached

HED ASSESSMENT

HED No. D2-10

EP = 8

TITLE: Mimic Quality

COMMENT: Some mimics appear poorly made and installed.

Item: 3.2.7 Ref.: A2.6 Source: CRS

IDENTIFICATION: Panel: 601, 647, 648
Component Name: Mimic lines
ID or Number: N/A

DESCRIPTION OF PROBLEM:

Mimics appear to be of low quality and have been installed without proper care.

RESOLUTION: (Code: A) (Priority: N/A) (Sched: Fuel Load)

Mimics will be either painted or be of an acceptable adhesive colored taping to ensure proper installation and durability. (See general discussion of enhancements.)

TRAINING REQUIREMENTS: None

PROCEDURE REQUIREMENTS: None

Team Approval Signature: Date:

( ) Additional page(s) attached

HED ASSESSMENT

HED No. D2-11

EP = 4

TITLE: Missing Mimic Lines

COMMENT: Portions of mimic lines are missing.

Item: 3.2.8 Ref.: A2.6 Source: CRS

IDENTIFICATION: Panel: 647,654
Component Name: Mimic lines
ID or Number: N/A

DESCRIPTION OF PROBLEM:

Mimics are incomplete for following areas: HPCI pump discharge valve; steam trap to steam line drain inboard isolation valve; discharge of barometric condenser vacuum pump (647); and 13.2 bus mimic (654).

RESOLUTION: (Code: A) (Priority: N/A) (Sched: Fuel Load)

Resolved through enhancements - completion of mimic lines. (See general discussion of enhancements.)

TRAINING REQUIREMENTS: None

PROCEDURE REQUIREMENTS: None

Team Approval Signature: Date:

( ) Additional page(s) attached

HED ASSESSMENT

HED No. D2-12

EP = 4

TITLE: Incomplete Demarcation Lines

COMMENT: Portions of demarcation lines are missing or incomplete.

Item: 3.2.8 Ref.: A2.6 Source: CRS

IDENTIFICATION: Panel: ØØC-667, ØØC-656
Component Name: Mimic lines
ID or Number: N/A

DESCRIPTION OF PROBLEM:

Demarcation lines are not complete in the following locations: between RHR A and B systems (ØØC-667) and on Panel ØØC-656.

RESOLUTION: (Code: A) (Priority: N/A) (Sched: Fuel Load)

Will be corrected through panel enhancements. See general discussion of enhancements and HED D2-Ø2 (panel 656).

TRAINING REQUIREMENTS: None

PROCEDURE REQUIREMENTS: None

Team Approval Signature: Date:

( ) Additional page(s) attached

HED ASSESSMENT

HED No. D2-13

EP = 12

TITLE: Mimic Flow Path Arrangement

COMMENT: Flow paths and arrangements are not orderly or easily recognized.

Item: 3.2.9 Ref.: A2.7 Source: CRS

IDENTIFICATION: Panel: See attached
Component Name: See attached
ID or Number: See attached

DESCRIPTION OF PROBLEM:

Flow paths are confusing, often appearing to connect where they should not, and sometimes incorrect. See attached.

RESOLUTION: (Code: A) (Priority: N/A) (Sched: Fuel Load)

Resolved through improvement of mimic lines as part of panel enhancements. (See general discussion of enhancements.)

TRAINING REQUIREMENTS: None

PROCEDURE REQUIREMENTS: None

Team Approval Signature: Date:

( ) Additional page(s) attached

RHR 1A mimic lines for minimum flow bypass and suppression pool sparger flow appear to connect, but should not - 601.

Some flow arrows are misplaced, such as that to the A containment hydrogen recombiner cooling water inlet valve - 601.

RHR servicing water crosstie mimic flow arrow is pointing to an end point labeled "from RHR switch system" - 601.

Core spray B suppression pool return lines for test and minimum flow bypass are very close and congested with the main turbine stop valve and demarcation line. Congestion is also evident in the mimic lines from the pumps to the bypass valve - 601.

HED ASSESSMENT

HED No. D2-14

EP = 6

TITLE: Mimic Flow Path Arrangement

COMMENT: Flow paths and arrangements are not orderly or easily recognized.

Item: 3.2.10, 3.2.11, 3.2.13 Ref.: A2.7, A2.8 Source: CRS

IDENTIFICATION: Panel: See attached
Component Name: See attached
ID or Number: See attached

DESCRIPTION OF PROBLEM:

Flow paths are confusing, often appearing to connect where they should not, and sometimes incorrect. See attached.

RESOLUTION: (Code: A) (Priority: N/A) (Sched: Fuel Load)

Resloved through improvement of mimic lines as part of panel enhancements. Redesign of mimics clearly indicate flow paths. (See general discussion of enhancements.)

TRAINING REQUIREMENTS: None

PROCEDURE REQUIREMENTS: None

Team Approval Signature: Date:

( ) Additional page(s) attached

IDENTIFICATION

Flow paths for the RCIC and HPCI systems of panels 648 and 647 are somewhat confusing. The steam traps on the steam drain lines appear to be bypasses and the drain pot bypass valves appear to be the main flow path. Also, the steam trap symbol is missing after the turbine drain pot in the HPCI mimic.

In safeguard system B, panel 661, safeguard switchgear feeder breaker synchronizing switch 101-D12 appears to connect with the 201 safeguard bus. This mimic line should connect with the 101 bus.

A line of demarcation between the reactor water sample line isolation valve switches and the recirculation flow loop A system would clearly show recirculation systems A and B to be identical in layout, panel 602.

HED ASSESSMENT

HED No. D2-14A

EP = 4

TITLE: Rod Position Location

COMMENT: Difficult to locate rod position on array.

Item: 3.2.12 Ref.: A2.7 Source: CRS

IDENTIFICATION: Panel: 649
Component Name: Control Rod Display (Core Map)
ID or Number: N/A

DESCRIPTION:
Large array of lights on panel makes it difficult to identify a specific location within the array - even with labeling along the edges of the array.

RESOLUTION: (Code: A) (Priority: N/A) (Sched: N/A)

This panel provides overall light patterns that can be interpreted by the operator from his normal control station. Abnormal indications requiring specific information are followed up by deliberate action and do not require reading from a distance. The panel serves its purpose as installed and does not require enhancement.

TRAINING REQUIREMENTS: None

PROCEDURE REQUIREMENTS: None

Team Approval Signature: Date:

( ) Additional page(s) attached

HED ASSESSMENT

HED No. D2-15

EP = 4

TITLE: Mimic Flow Direction

COMMENT: No use of intermediate flow arrows

Item: 3.2.14 - 3.2.17 Ref.: A2.9 - A2.11 Source: CRS
3.3.6 A3.3

IDENTIFICATION: Panel: 601,647,648
Component Name: See attached
ID or Number: See attached

DESCRIPTION OF PROBLEM:

Flow direction arrows are placed only at the end of mimics, no intermediate arrows are used.

RESOLUTION: (Code: A) (Priority: N/A) (Sched: Fuel Load)

Mimic lines and arrows improved as part of panel enhancements. Intermediate flow arrows not needed under enhancement schemes. (See general discussion of enhancements.)

TRAINING REQUIREMENTS: None

PROCEDURE REQUIREMENTS: None

Team Approval Signature: Date:

( ) Additional page(s) attached

IDENTIFICATION

Flow arrows used in mimics on panels 601, 647, and 648 are generally located at the end of a mimic bar between components. Some use of intermediate flow arrows may clarify flow paths, especially where the paths are complex (not straight lines).

The end point from the barometric vacuum pump in the HPCI mimic panel 647, is not identified.

The destinations for the 220kv plant output lines are not identified.

The mimics of panels 647 and 648 do not integrate manual valves.

HED ASSESSMENT

HED No. D2-16

EP = 8

TITLE: Component Integration

COMMENT: Mimics are not used to integrate components in some areas.

Item: 3.2.18 Ref.: A2.11 Source: CRS

IDENTIFICATION: Panel: 647,648,696,ØØC-65Ø
Component Name: Mimics
ID or Number: See below

DESCRIPTION OF PROBLEM:

Mimics are not used to integrate components on post LOCA hydrogen recombiners on panel 696, and remote start switches for fire pumps on panel ØØC-65Ø.
Note: 1ØC-696 and ØØC-65Ø are not included as part of the CRDR. (See discussion regarding panels within scope of this effort.)

RESOLUTION: (Code: B) (Priority: N/A) (Sched: Fuel Load)

Mimics used where appropriate. (See general discussion of enhancements.)

TRAINING REQUIREMENTS: None

PROCEDURE REQUIREMENTS: None

Team Approval Signature: Date:

( ) Additional page(s) attached

HED ASSESSMENT

HED No. D3-Ø1

EP = 9

TITLE: Mirror Imaging

COMMENT: Controls and displays are mirror imaged.

Item: 3.3.1 Ref.: A3.1 A3.2 Source: CRS

IDENTIFICATION: Panel: ØØC-681, ØØC-66Ø, 1ØC-654,2ØC-654
Component Name: See below
ID or Number: N/A

DESCRIPTION OF PROBLEM:

Mirror imaging was found in the following controls and displays: controls on panel ØØC-681, circular meter displays on panel ØØC-66Ø, displays and controls between panels 1ØC-654 and 2ØC-654. This type of arrangement should be avoided.

RESOLUTION: (Code: D) (Priority: N/A) (Sched: Fuel Load)

Enhancements have been designed to indicate functional aspects and the specific control display relationships so as to minimize the negative aspects of mirror imaging. (See general discussion of enhancements.) For 66Ø and 654, refer to HED D1-Ø3.

TRAINING REQUIREMENTS: None

PROCEDURE REQUIREMENTS: None

Team Approval Signature: Date:

( ) Additional page(s) attached

HED ASSESSMENT

HED No. D3-Ø2

EP = 6

TITLE: Turbine Lift Pump Controls

COMMENT: Controls for pump operation and for pump tests are not laid out identically.

Item: 3.3.2 Ref.: A3.1 Source: CRS

IDENTIFICATION: Panel: 67Ø
Component Name: Turbine Bearing Lift Pump Inlet Pressure Buttons
ID or Number: See attached print

DESCRIPTION OF PROBLEM:

One set of controls is used to operate the nine lift pumps. Another set of controls is used to test and reset the nine lift pumps. These two groups of controls are not arranged identically.

MITIGATING CONSIDERATIONS:

Tests of the pumps are used in a deliberate manner under no stress conditions. An error in operation would have no signifigant effect.

RESOLUTION: (Code: F) (Priority: 4) (Sched: Fuel Load)

These controls have been enhanced to more easily relate the controls. Tests of the pumps are conducted in a deliberate manner under no-stress conditions. An error in operation would have no significant effect on the plant. Rearrangement is not warranted. (See general discussion of enhancements.)

TRAINING REQUIREMENTS: None

PROCEDURE REQUIREMENTS: None

Team Approval Signature: Date:

( ) Additional page(s) attached

HED ASSESSMENT

HED No. D3-Ø3

EP = 6

TITLE: Control/Display Relationships

COMMENT: Related controls and displays are not grouped together.

Item: 3.3.3 Ref.: A3.1 Source: CRS

IDENTIFICATION: Panel: 668
Component Name: Feed Water Drain and Dump Switches
ID or Number: See attached print

DESCRIPTION OF PROBLEM:

The feedwater drain to feedwater heater switches indicating lights are separated by an un-related group of controls and displays. This makes it difficult to associate them.

RESOLUTION: (Code: F) (Priority: 3) (Sched: Fuel Load)

This set of controls was poorly labeled and gave a wrong impression of their functions. The controls are arranged in the proper sequence, and they have been enhanced and relabeled to clearly indicate their function.

TRAINING REQUIREMENTS: None

PROCEDURE REQUIREMENTS: None

Team Approval Signature: Date:

( ) Additional page(s) attached

HED ASSESSMENT

HED No. D3-Ø4

EP = 6

TITLE: Arrangement of Related Controls

COMMENT: Related controls are not ordered identically.

Item: 3.3.4 Ref.: A3.2 Source: CRS

IDENTIFICATION: Panel: 6Ø3
Component Name: RFPT Turning Gear Switches
ID or Number: See attached print

DESCRIPTION OF PROBLEM:

RFPT turning gear switches are ordered top-to-bottom, but the associated RFPT controllers are ordered left-to-right possibly creating confusion.

RESOLUTION: (Code: D) (Priority: N/A) (Sched: Fuel Load)

These controls have been enhanced to clearly relate the functions. The vertical arrangement of switches for turning gear matches four other columns of feed pump related switches adjacent to the turning gear switches. It is not practical to arrange the three controllers in a vertical line and if so arranged would not line up with other five columns of switches. The enhancement approach is considered to be the best solution.

TRAINING REQUIREMENTS: None

PROCEDURE REQUIREMENTS: None

Team Approval Signature: Date:

( ) Additional page(s) attached

HED ASSESSMENT

HED No. D3-Ø5

EP = 6

TITLE: Control Arrangement

COMMENT: Components are not arranged in expected order.

Item: 3.3.5 Ref.: A3.2 Source: CRS

IDENTIFICATION: Panel: 6Ø3,652,654,681,ØØC-681
Component Name: See attached
ID or Number: See attached prints

DESCRIPTION OF PROBLEM:

See attached.

RESOLUTION: (Code: A & F) (Priority: See attached) (Sched: See attached)

See attached. (RESOLUTION)

TRAINING REQUIREMENTS: Mod. Package

PROCEDURE REQUIREMENTS: Mod. Package

Team Approval Signature: Date:

( ) Additional page(s) attached

RESOLUTION

a. Heat flux detectors: This is the proper order because they are installed in the core from bottom to top. Code F

b. SJAE valves: Controls should be swapped so that A will be on top and B on the bottom. Code: A; Priority: 4; Sched: N/A

c. Drywell Cooling Fans: These fans are used for normal operation ambient temperature control in the drywell. They are lined up and operated under low stress conditions. During emergencies, they are all isolated and running. The unusual sequence is caused by separation requirements, but will not detract from operation. Several alternative arrangements were considered but none were found to be superior to the present arrangement. The fan controls and the associated instruments have been enhanced to allow easy association of any fan with it's temperature indication. Code: F; Priority: 4; Sched: N/A

d. Indicators will be regrouped and enhanced to provide proper grouping and relation to controls. The controls have been enhanced to make their groupings clear and relate them to the indicators above. Code: A; Priority: 2; Sched: 1st Refueling

e. Generator Load Adjust: The switches on panel 654 are incorrect and will be swapped. See HED I2-Ø6. Code: A; Priority: 3; Sched: 1st Refueling

HED ASSESSMENT

HED No. D3-Ø6

EP = 9

TITLE: Functional Grouping

COMMENT: Controls and displays are not arranged in functional or sequential relationships

Item: 3.3.6 Ref.: A3.3 Source: CRS

IDENTIFICATION: Panel: ØØC-681,654
Component Name: N/A
ID or Number: N/A

DESCRIPTION OF PROBLEM:

Functional arrangement of controls and displays is not apparent and component relationships are difficult to comprehend.

RESOLUTION:

654: Code: A Priority: 3 Sched: 1st Refueling
681: Code: A Priority: 2 Sched: 1st Refueling (See D3-Ø5d)

Enhancements and rearrangements have been designed to identify and reinforce function/operational relationships. (See general discussion of enhancements.) (For ØØC-681 refer to HED D3-Ø5, part d.)

TRAINING REQUIREMENTS: Mod. Package

PROCEDURE REQUIREMENTS: Mod. Package

Team Approval Signature: Date:

( ) Additional page(s) attached

HED ASSESSMENT

HED No. D3-Ø7

EP = 9

TITLE: Component Identification

COMMENT: Individual components are difficult to identify in large strings or matrices of similar components.

Item: 3.3.7 Ref.: A3.4 Source: CRS

IDENTIFICATION: Panel: ØØC-681,652,653,654,660,601,ØØC-667
Component Name: N/A 668,626,649
ID or Number: N/A

DESCRIPTION OF PROBLEM:

Switch and indicator arrays and matrices are not differentiated into subgroups, and are therefore difficult to identify in large groups of components with similar functions.

RESOLUTION: (Code: A) (Priority: N/A) (Sched: Fuel Load)

All panels have been enhanced to identify groups of instrumentation and controls and then relate them effectively. Hierarchal labeling has been used to identify each group.

TRAINING REQUIREMENTS: None

PROCEDURE REQUIREMENTS: None

Team Approval Signature: Date:

( ) Additional page(s) attached

HED ASSESSMENT

HED No. D3-Ø8

EP = 9

TITLE: Indicator Label Crowding

COMMENT: Strip of similar labels are confusing.

Item: 3.3.7 Ref.: A3.4 Source: CRS

IDENTIFICATION: Panel: ØØC-681, 1ØC-681
Component Name: N/A
ID or Number: N/A

DESCRIPTION OF PROBLEM:

The strings of indicator labels on the console upright panel make it difficult to identify one component as all the labels are similar.

RESOLUTION: (Code: A) (Priority: N/A) (Sched: Fuel Load)

Labels will be completely changed in conjunction with hierarchal labeling. (See general discussion of enhancements.)

TRAINING REQUIREMENTS: None

PROCEDURE REQUIREMENTS: None

Team Approval Signature: Date:

( ) Additional page(s) attached

HED ASSESSMENT

HED No. D3-Ø9

EP = 9

TITLE: Coding Consistency

COMMENT: There appears to be no coding convention applied.

Item: 3.3.8 Ref.: A3.5 Source: CRS

IDENTIFICATION: Panel: 651,652
Component Name: N/A
ID or Number: N/A

DESCRIPTION OF PROBLEM:

Coding methods such as demarcation lines, shading, spacing and switch shape are not used consistently between panels; variations in these occur on both panels.

RESOLUTION: (Code A) (Priority: N/A) (Sched: Fuel Load)

Overall enhancement design rectifies these discrepancies. (See general discussion of enhancements.)

TRAINING REQUIREMENTS: None

PROCEDURE REQUIREMENTS: None

Approval Signature: Date:

( ) Additional page(s) attached

HED ASSESSMENT

HED No. D3-10

EP = 9

TITLE: Control Reach Distance

COMMENT: Controls are located outside recommended ranges.

Item: 3.3.9 Ref.: A3.6 Source: CRS

IDENTIFICATION: Panel: See attached
Component Name: N/A
ID or Number: N/A

DESCRIPTION OF PROBLEM:

See attached.

RESOLUTION: (Code: F) (Priority: 4) (Sched: N/A)

A systematic walkthrough of the control room was conducted with a 5th percentile male (5'4") clothed operator. All controls were within his functional reach (28.6") A 5th percentile female (clothed) is 51.8" whose extended functional reach is 28.9" (see attached). In addition, these controls (outside recommended ranges) are not frequently used or used for precise operations. As a result, the controls are considered acceptable.

TRAINING REQUIREMENTS: None

PROCEDURE REQUIREMENTS: None

Team Approval Signature: Date:

( ) Additional page(s) attached

Panels which have both controls and displays located high and/or low are:

601	668
647	669
648	607
670	00C-667
654	00C-671
661	00C-650
626	00C-693
600	Remote Shutdown

Displays are located high on panel 00C-660. Some controls, such as the RBM bypass, are located high on benchboard 603 for a seated operator.

HED ASSESSMENT

HED No. D3-11

EP = 6

TITLE: Related Control/Display Location

COMMENT: Control for effecting display is located in excess of arm's reach from the display.

Item: 3.3.10 Ref.: A3.7 Source: CRS

IDENTIFICATION: Panel: 601
Component Name: Hydrogen Indicator Range Selector Switch
ID or Number: Check current print

DESCRIPTION OF PROBLEM:

The Hydrogen Indicator Range Selector Switch is located more than an arm's reach from the display making it difficult to view the indicator while manipulating the switch.

RESOLUTION: (Code: A) (Priority: N/A) (Sched: N/A)

The Hydrogen indicator has been removed from this panel as a result of a design change. No longer a discrepancy.

TRAINING REQUIREMENTS: None

PROCEDURE REQUIREMENTS: None

Team Approval Signature: Date:

( ) Additional page(s) attached

HED ASSESSMENT

HED No. D4-Ø1

EP = 6

TITLE: Indicator Lights

COMMENT: Color usage not consistent.

Item: 3.4.1 Ref.: A4.2 Source: CRS

IDENTIFICATION: Panel: 6Ø2
Component Name: Green Status Light
ID or Number: Power Supply Generator Lockout Bus

DESCRIPTION OF PROBLEM:

Power supply generator lockout bus status light is green, all other status lights in CR are white.

RESOLUTION: (Code: A) (Priority: N/A) (Sched: Fuel Load)

Replace green lens cover with a white one.

TRAINING REQUIREMENTS: None

PROCEDURE REQUIREMENTS: None

Team Approval Signature: Date:

( ) Additional page(s) attached

HED ASSESSMENT

HED No. D4-Ø2

EP = 6

TITLE: Panel Labels

COMMENT: Panel labels are not consistently color coded.

Item: 3.4.2 Ref.: A4.2 Source: CRS

IDENTIFICATION: Panel: All
Component Name: Panel Identification Label
ID or Number: N/A

DESCRIPTION OF PROBLEM:

Some panel labels are white, others are yellow. There appears to be no consistent convention in use.

RESOLUTION: (Code: A) (Priority: N/A) (Sched: Fuel Load)

Panel label identifiers are being changed to be consistent in font size and label plate color. (See general discussion of enhancements.)

TRAINING REQUIREMENTS: None

PROCEDURE REQUIREMENTS: None

Team Approval Signature: Date:

( ) Additional page(s) attached

HED ASSESSMENT

HED No. D4-Ø3

EP = 6

TITLE: Mimic Color Coding

COMMENT: Mimics are not consistently color coded.

Item: 3.4.3 Ref.: A4.2 Source: CRS

IDENTIFICATION: Panel: 661,654
Component Name: Mimics
ID or Number: 4 kv Bus and 220 kv Bus mimics

DESCRIPTION OF PROBLEM:

Yellow is used for the 4 kv bus mimic, but is also used to denote the 220 kv bus mimic. Should be a different color.

RESOLUTION: (Code: A) (Priority: N/A) (Sched: Fuel Load)

A specific color specification for electrical bus voltages has been developed. This specification is being used during enhancement design of appropriate panels. (See general discussion of enhancements.)

TRAINING REQUIREMENTS:

Provide color standards to training department.

PROCEDURE REQUIREMENTS:

None

Team Approval Signature: Date:

( ) Additional page(s) attached

HED ASSESSMENT

HED No. D5-Ø1

EP = 6

TITLE: Indicator Light Label

COMMENT: Indicator light is unlabeled.

Item: 3.5.1 Ref.: A5.1 Source: CRS

IDENTIFICATION: Panel: 654
Component Name: Indicator Light
ID or Number: Above the Generator Ammeter Range Switch

DESCRIPTION OF PROBLEM:

The indicator light is not obviously associated with any control and is unidentified by label. Its function is unknown.

RESOLUTION: (Code: A) (Priority: N/A) (Sched: Fuel Load)

The indicating light illuminates when 'low range' is selected. The switch below is a two position selector switch. Enhancements will associate the light with the switch below.

TRAINING REQUIREMENTS: None

PROCEDURE REQUIREMENTS: See HED P1-Ø1.

Team Approval Signature: Date:

( ) Additional page(s) attached

HED ASSESSMENT

HED No. D5-Ø2

EP = 6

TITLE: Label Location

COMMENT: Labels have been switched.

Item: 3.5.2 Ref.: A5.1 Source: CRS

IDENTIFICATION: Panel: 6Ø3
Component Name: Recorder Labels
ID or Number: XRM-IR623, KRØ1-IR8Ø9

DESCRIPTION OF PROBLEM:

The labels on these two recorders have been inadvertently reversed.

RESOLUTION: (Code: A) (Priority: N/A) (Sched: Fuel Load)

Resolved through reversing labels associated with hierarchal labeling. (See general discussion of enhancements.)

TRAINING REQUIREMENTS: None

PROCEDURE REQUIREMENTS: None

Team Approval Signature: Date:

( ) Additional page(s) attached

HED ASSESSMENT

HED No. D5-Ø3

EP = 6

TITLE: Component Labels

COMMENT: Several components are unlabeled.

Item: 3.5.3 Ref.: A5.1 Source: CRS

IDENTIFICATION: Panel: 6Ø1
Component Name: H_2 and O_2 Systems, CTMT Isolation Mimic Devices, and RHR Loop A recorder
ID or Number: Same as Component Name

DESCRIPTION OF PROBLEM:

There are no labels identifying these components and their function. This is confusing.

RESOLUTION: (Code: A) (Priority: N/A) (Sched: Fuel Load)

Components will be labeled. (See general discussion of enhancements.)

TRAINING REQUIREMENTS: None

PROCEDURE REQUIREMENTS: None

Team Approval Signature: Date:

( ) Additional page(s) attached

HED ASSESSMENT

HED No. D5-Ø4

EP = 8

TITLE: System Labeling

COMMENT: Labels are not used to identify systems.

Item: 3.5.4 Ref.: A5.3 Source: CRS

IDENTIFICATION: Panel: ØØC-681,ØØC-650,651,652,653,668,670
Component Name: N/A
ID or Number: Common throughout Control room

DESCRIPTION OF PROBLEM:

Systems and system designation labels are not used. This causes difficulty in identifying proper controls and indicators.

RESOLUTION: (Code: A) (Priority: N/A) (Sched: Fuel Load)

Resolved through the use of hierarchal labels. (See general discussion of enhancements.) ØØC-65Ø not included in CRDR.

TRAINING REQUIREMENTS: None

PROCEDURE REQUIREMENTS: None

Team Approval Signature: Date:

( ) Additional page(s) attached

HED ASSESSMENT

HED No. D5-Ø5

EP =

TITLE: Label Nomenclature

COMMENT: Inconsistent use of nomenclature, acronyms, and abbreviations.

Item: 3.5.5 Ref.: A5.5 Source: CRS

IDENTIFICATION: Panel: ØØC-65Ø,651,652,6ØØ,6Ø1,6Ø2,6Ø3, 647,648,668,681
Component Name: See attached list
ID or Number: See attached list

DESCRIPTION OF PROBLEM:

Many labels do not use consistent abbreviations, acronyms, or nomenclature.

RESOLUTION: (Code: A) (Priority: N/A) (Sched: Fuel Load)

Consistent nomenclature, abbreviations, and acronyms will be used based upon the approved list. This will be done in conjunction with enhancements and the associated relabeling using hierarchal labeling. The word "volume" will be corrected on panel 65Ø. (See general discussion of enhancements.)

TRAINING REQUIREMENTS:

Provide approved nomenclature list to training.

PROCEDURE REQUIREMENTS: See HED P1-Ø1

Team Approval Signature: Date:

( ) Additional page(s) attached

"Reactor feed pump turbine" is sometimes shown as RFPT and sometimes as RPT, panel 651.

The word "volumn" is misspelled on the river broadcast speaker volume monitor panel 00C-650.

Multiple abbreviations for "valve" and "pump" are used on panel 652.

The nameplate next to PD106-120 is blank, panel 603.

The recirculation pump motor air cooling switch labels use different nomenclature, panel 681.

Recirculation system legends inconsistently use 1A or 1B or no system descriptor, panel 602.

Level control selector switch label should read "1 or 2 Element", panel 603.

Heat exchanger condensate discharge pressure to RCIC, panel 601, has RCIC spelled "RICI" on label.

The device, such as "valve" is sometimes included, sometimes not, on device labels, panels 601, 647, and 648.

Some inconsistency in abbreviations, panels 601, 647, and 648.

Components of similar function are labeled differently on panel 668. Some switches are labeled feedwater heater drain to feedwater heater, others are feedwater drain to feedwater heater.

The process radiation recorder for the H2-02 recombiner, panel 600, is labeled "Recommended".

HED ASSESSMENT

HED No. D5-Ø6

EP = 8

TITLE: Hierarchal Labeling

COMMENT: Labels are not size coded.

Item: 3.5.6 Ref.: A5.7 Source: CRS

IDENTIFICATION: Panel: All
Component Name: Labels
ID or Number: N/A

DESCRIPTION OF PROBLEM:

No hierarchal system of size coding labels appears to exist.

RESOLUTION: (Code: A) (Priority: N/A) (Sched: Fuel Load)

Same as D2-Ø6.

TRAINING REQUIREMENTS: None

PROCEDURE REQUIREMENTS: None

Team Approval Signature: Date:

( ) Additional page(s) attached

HED ASSESSMENT

HED No. D5-Ø7

EP = 9

TITLE: Label Visibility

COMMENT: Components obscure labels.

Item: 3.5.7 Ref.: A5.9 Source: CRS

IDENTIFICATION: Panel: 647,648,661,668,669,670,ØØC-656,ØØC-671, ØØC-660
Component Name: N/A
ID or Number: Common throughout Control Room

DESCRIPTION OF PROBLEM:

Labels are not easily read due to control location and projecting device housings.

RESOLUTION: (Code: A) (Priority: N/A) (Sched: Fuel Load)

Resolution incorporated through hierarchal labeling enhancements and spatial placement. (See general discussion of enhancements.)

TRAINING REQUIREMENTS: None

PROCEDURE REQUIREMENTS: None

Team Approval Signature: Date:

( ) Additional page(s) attached

HED ASSESSMENT

HED No. D5-Ø8

EP = 6

TITLE: Control Identification

COMMENT: Controls are not completely identified.

Item: 3.5.8 Ref.: A5.1Ø Source: CRS

IDENTIFICATION: Panel: 6Ø2
Component Name: Pushbuttons
ID or Number: Recirc. Run-back Reset Pushbuttons

DESCRIPTION OF PROBLEM:

Pushbuttons are for different levels but labels do not specify which levels.

RESOLUTION: (Code: A) (Priority: N/A) (Sched: Fuel Load)

All controls will be identified through hierarchal labeling and proper equipment identification. (See general discussion of enhancements.)

TRAINING REQUIREMENTS: None

PROCEDURE REQUIREMENTS: None

Team Approval Signature: Date:

( ) Additional page(s) attached

HED ASSESSMENT

HED No. D5-09

EP = 6

TITLE: Control Differentiation

COMMENT: Switches are not differentiated properly.

Item: 3.5.9 Ref.: A5.10 Source: CRS

IDENTIFICATION: Panel: 652
Component Name: Low Pressure Condenser to Vacuum Pump Valve Switches
ID or Number: HV07-133,134,135,136

DESCRIPTION OF PROBLEM:

Switches are only differentiated by device number, no proper label identification.

RESOLUTION: (Code: A) (Priority: N/A) (Sched: Fuel Load)

All controls have been labeled by functional names as well as component numbers. (See general discussion of enhancements.)

TRAINING REQUIREMENTS: None

PROCEDURE REQUIREMENTS: None

Team Approval Signature: Date:

( ) Additional page(s) attached

HED ASSESSMENT

HED No. D5-10

EP = 6

TITLE: Label Location

COMMENT: Labels not located near associated insert.

Item: 3.5.10 Ref.: A5.11 Source: CRS

IDENTIFICATION: Panel: 607
Component Name: Panel Insert Labels
ID or Number: N/A

DESCRIPTION OF PROBLEM:

Labels are located between panel inserts and are not clearly associated with either insert. Operator must view the entire panel to determine which insert is which.

RESOLUTION: (Code: A) (Priority: N/A) (Sched: Fuel Load)

Hierarchal labeling will be used to facilitate operator identification. Labels will clearly reflect the components with which they are associated. (See general discussion of enhancements.)

TRAINING REQUIREMENTS: None

PROCEDURE REQUIREMENTS: None

Team Approval Signature: Date:

( ) Additional page(s) attached

HED ASSESSMENT

HED No. SD1-Ø1

EP = 6

TITLE: Control Height

COMMENT: Transfer switches are too low.

Item: N/A Ref.: A1.1, B1.1, B6.3 Source: SCRS

IDENTIFICATION: Panel: RSP
Component Name: Transfer switches
ID or Number: See below

DESCRIPTION OF PROBLEM:

Bottom eight transfer switches are below the minimum height requirement of 22".

RESOLUTION: (Code: F) (Priority: 4) (Sched: N/A)

While transfer switches are low, these switches are infrequently used. When they are used to transfer control to the RSP they are manipulated in a controlled manner once, until control is returned to C.R. The location of these switches does not present operational problems and will remain as installed.

TRAINING REQUIREMENTS: None

PROCEDURE REQUIREMENTS: None

Team Approval Signature: Date:

( ) Additional page(s) attached

HED ASSESSMENT

HED No. SD2-Ø1

EP = 9

TITLE: Demarcation/Mimics

COMMENT: Minimal demarcation and no mimics used.

Item: N/A Ref.: A2.1 A2.2 A2.3 Source: SCRS

IDENTIFICATION: Panel: RSP
Component Name: N/A
ID or Number: N/A

DESCRIPTION OF PROBLEM:

There are no mimics and very few demarcation lines on the RSP.

RESOLUTION: (Code: A) (Priority: N/A) (Sched: Fuel Load)

The Remote Shutdown Panel will be enhanced with mimics and grouping in the same manner as control room panels. (See general discussion of enhancements.)

TRAINING REQUIREMENTS: None

PROCEDURE REQUIREMENTS: None

Team Approval Signature: Date:

( ) Additional page(s) attached

HED ASSESSMENT

HED No. SD2-Ø2

EP = 6

TITLE: Use of Demarcation

COMMENT: No demarcation around related displays.

Item: N/A Ref.: A2.2 Source: SCRS

IDENTIFICATION: Panel: 673
Component Name: N/A
ID or Number: N/A

DESCRIPTION OF PROBLEM:
Related displays are not grouped by demarcation lines or mimics.

RESOLUTION: (Code: A) (Priority: N/A) (Sched: Fuel Load)

Components on this panel have been functionally grouped and enhanced with demarcations and mimics. (See general discussion of enhancements.)

TRAINING REQUIREMENTS: None

PROCEDURE REQUIREMENTS: None

Team Approval Signature: Date:

( ) Additional page(s) attached

HED ASSESSMENT

HED No. SD2-Ø3

EP =

TITLE: Confusing Mimics

COMMENT: Containment atmosphere control mimics are difficult to follow.

Item: N/A Ref.: A2.7 TDA Source: SCRS

IDENTIFICATION: Panel: 6Ø1 - Containment Isolation and Atmosphere Control
Component Name: All mimics in this section
ID or Number: N/A

DESCRIPTION OF PROBLEM:
Initial mimics were changed by controls added in spaces available. The resulting mimics have become very confusing, very difficult to follow. Actual implementation of mimics in control room is incorrect.

RESOLUTION: (Code: A) (Priority: 2) (Sched: Fuel Load (Enh)) 1st Refueling (Relocation)

Eight switches will be relocated in order to allow better mimics which will be added as a result of enhancements. Four switches will be moved to the recombiner panel.

TRAINING REQUIREMENTS: Mod. Package

PROCEDURE REQUIREMENTS: Mod. Package

Team Approval Signature: Date:

( ) Additional page(s) attached

HED ASSESSMENT

HED No. SD2-Ø4

EP = 6

TITLE: Annunciator Control Coding

COMMENT: No apparent color coding of annunciator controls.

Item: N/A Ref.: SC2 Source: SCRS

IDENTIFICATION: Panel: Various (see examples below)
Component Name: Annunciator Controls
ID or Number: See below

DESCRIPTION OF PROBLEM:
Acknowledge, test, reset buttons are sometimes red, sometimes black, sometimes silver. No obvious coding convention appears to exist. Panel 673 uses a silver key switch for "test", no other board does. While an operator may be aware of the layout, during stress an inadvertent error may occur. Other boards often swap colors: red acknowledge button with corresponding test and reset buttons being either red or black.

RESOLUTION: (Code: A) (Priority: N/A) (Sched: Fuel Load)

Acknowledge button - yellow - palm-actuated
Reset button - black - unguarded
Test button - black - guarded

TRAINING REQUIREMENTS: None

PROCEDURE REQUIREMENTS: None

Team Approval Signature: Date:

( ) Additional page(s) attached

HED ASSESSMENT

HED No. SD2-05

EP = 9

TITLE: Annunciator Window Matrices

COMMENT: Annunciator window positions are not identified in a matrix network.

Item: N/A Ref.: SC1 Source: SCRS

IDENTIFICATION: Panel: All
Component Name: Annunciator Panels
ID or Number: N/A

DESCRIPTION OF PROBLEM:
The axes of each annunciator panel are not marked with alphanumeric characters such that a window location can be quickly identified.

RESOLUTION: (Code: A) (Priority: N/A) (Sched: Fuel Load)

An alphanumeric matrix located around the perimeter of the annunciator will be used to identify the alarms. (See HED A1-12.)

TRAINING REQUIREMENTS: None

PROCEDURE REQUIREMENTS:

Alarm response cards to be changed to include alphanumeric indexing.

Team Approval Signature: Date:

( ) Additional page(s) attached

HED ASSESSMENT

HED No. SD3-Ø1

EP = 6

TITLE: Control/Display Groupings

COMMENT: Controls and displays are not grouped by system or function.

Item: N/A Ref.: A3.1 A3.2 A3.3 Source: SCRS

IDENTIFICATION: Panel: RSP
Component Name: N/A
ID or Number: N/A

DESCRIPTION OF PROBLEM:

Same as comment above.

RESOLUTION: (Code A:) (Priority: N/A) (Sched: Fuel Load)

Grouping and hierarchal labeling has been designed for this panel. (See general discussion of enhancements.)

TRAINING REQUIREMENTS: None

PROCEDURE REQUIREMENTS: None

Team Approval Signature: Date:

( ) Additional page(s) attached

HED ASSESSMENT

HED No. SD3-Ø2

EP = 6

TITLE: Control Height

COMMENT: Some controls are too low for easy use.

Item: N/A Ref.: A3.6, A1.1, B1.1 Source: SCRS

IDENTIFICATION: Panel: 673
Component Name: See below
ID or Number: See below

DESCRIPTION OF PROBLEM:
"B Gycol temp Control" and "Vault 3 temp & fan control" are below minimum height requirements.

RESOLUTION: (Code: F) (Priority: 4) (Sched: N/A)

See HED D3-1Ø.

TRAINING REQUIREMENTS: None

PROCEDURE REQUIREMENTS: None

Team Approval Signature: Date:

( ) Additional page(s) attached

HED ASSESSMENT

HED No. SD3-Ø3

EP = 6

TITLE: Demarcation in display groupings

COMMENT: No demarcation used to group related displays.

Item: N/A Ref.: A3.4 Source: SCRS

IDENTIFICATION: Panel: 673
Component Name: N/A
ID or Number: N/A

DESCRIPTION OF PROBLEM:
Demarcation should be used when a string of six or more displays exists; no demarcation is used.

RESOLUTION: (Code: A) (Priority: N/A) (Sched: Fuel Load)

This panel has been enhanced per HED SD2-Ø2. (See general discussion of enhancements.)

TRAINING REQUIREMENTS: None

PROCEDURE REQUIREMENTS: None

Team Approval Signature: Date:

( ) Additional page(s) attached

HED ASSESSMENT

HED No. SD3-Ø4

EP =

TITLE: Improper Control Location

COMMENT: Suppression Pool purge valve control not included in mimic.

Item: N/A Ref.: A3.2 TDA Source: SCRS

IDENTIFICATION: Panel: 6Ø1 - Containment Isolation and Atmosphere Control
Component Name: Suppression Pool Purge Valve
ID or Number: Print no. 6Ø4

DESCRIPTION OF PROBLEM:
This control forms an important part of the mimic for nitrogen purge, but is located remotely, not as part of the mimic.

RESOLUTION: (Code: A) (Priority: 2) (Sched: 1st Refueling)

This control will be relocated so that it fits logically in the newly designed mimic.

TRAINING REQUIREMENTS: Mod. Package

PROCEDURE REQUIREMENTS: Mod. Package

Team Approval Signature: Date:

( ) Additional page(s) attached

HED ASSESSMENT

HED No. SD3-Ø5

EP =

TITLE: Improper Control Location

COMMENT: Steam reducer control is not grouped with associated system and controls.

Item: N/A Ref.: A3.3 TDA Source: SCRS

IDENTIFICATION: Panel: 6Ø1 - Residual Heat Removal
Component Name: Steam Reducer Switch
ID or Number: S41A

DESCRIPTION OF PROBLEM:

This control is remotely located, far away from the reducer indicating lights and other steam supply controls.

RESOLUTION: (Code: A) (Priority: 3) (Sched: Fuel Load)

The label and number on this switch did not clearly identify the purpose of the switch. It will be relabeled to make its function clear. The switch should not be grouped with the steam reducer.

TRAINING REQUIREMENTS: None

PROCEDURE REQUIREMENTS: None

Team Approval Signature: Date:

( ) Additional page(s) attached

HED ASSESSMENT

HED No. SD3-Ø6

EP =

TITLE: Improper Control Location

COMMENT: Out of Service Control is not located with similar controls.

Item: N/A Ref.: A3.2 TDA Source: SCRS

IDENTIFICATION: Panel: 6Ø1 - Residual Heat Removal
Component Name: Loop A Out of Service
ID or Number: S64A

DESCRIPTION OF PROBLEM:

Out of Service switches for Loops A and B are located at left edge of the RHR panel but the Out of Service switch for Loops B, C, and D are located with other Loops C and D controls. The switches for Loops A and B remote and not associated with the systems to which they relate.

RESOLUTION: (Code: F) (Priority: 4) (Sched: N/A)

These controls should be relocated to be grouped with their associated indications in a grouping similar to like groupings on other channels. These controls are used for status information, no operational consequences.

TRAINING REQUIREMENTS: Mod. Package

PROCEDURE REQUIREMENTS: Mod. Package

Team Approval Signature: Date:

( ) Additional page(s) attached

HED ASSESSMENT

HED No. SD3-07

EP =

TITLE: Meter Arrangements

COMMENT: RHR indicators not located above the controls to which they relate in proper groupings.

Item: N/A Ref.: A3.3 TDA Source: SCRS

IDENTIFICATION: Panel: 601
Component Name: Residual Heat Removal
ID or Number: P-202,R604A-1,R613A,R607, R606A-1,R603,704-2

DESCRIPTION OF PROBLEM:

A long row of meters intermix functions so that they are not grouped. They are not located above their related controls.

RESOLUTION: (Code: A) (Priority: 2) (Sched: 1st Refueling)

This row of meters will be rearranged so that they are in functional groups and are located above the controls to which they relate.

TRAINING REQUIREMENTS: Mod. Package

PROCEDURE REQUIREMENTS: Mod. Package

Team Approval Signature: Date:

( ) Additional page(s) attached

HED ASSESSMENT

HED No. SD3-Ø8

EP = 9

TITLE: Control Layout Consistency

COMMENT: Annunciator controls are not consistently laid out.

Item: N/A Ref.: A3.2 TDA Source: SCRS

IDENTIFICATION: Panel: 6Ø3
Component Name: Annunciator Response Controls
ID or Number: N/A

DESCRIPTION OF PROBLEM:
Annunciator controls on panel 6Ø3 are laid out in a vertical pattern, while other boards use a horizontal pattern.

RESOLUTION: (Code: D) (Priority: N/A) (Sched: Fuel Load)

Annunciator controls have been enhanced so that they are clearly distinguished from other controls. Because of the additional controls required for this panel, there is no other practical arrangement possible for the annunciator controls. They are grouped vertically rather than horizontally. This is considered adequate and because of their frequent use will not cause confusion.

TRAINING REQUIREMENTS: None

PROCEDURE REQUIREMENTS: None

Team Approval Signature: Date:

( ) Additional page(s) attached

HED ASSESSMENT

HED No. SD3-09

EP = 9

TITLE: Turbine Warmup Valves

COMMENT: Appear to be on wrong panel.

Item: N/A Ref.: A3.1 TDA Source: SCRS

IDENTIFICATION: Panel: 668
Component Name: HEATER 5&6 Drain Bypass, 4th Stage Bypass
ID or Number: 599,600 (HV02-122ABC,HV02-114)

DESCRIPTION OF PROBLEM:
Their valves appear to be directly related to the turbine warmup controllers located on Panel 670 (HI-CO2-115,HI-CO2-120). If so, this location is unnecessarily difficult to find.

RESOLUTION: (Code: A) (Priority: N/A) (Sched: Fuel Load)

These valves are not warmup valves. They are properly located. They will be enhanced and labeled to indicate their proper function.

TRAINING REQUIREMENTS: None

PROCEDURE REQUIREMENTS: None

Team Approval Signature: Date:

( ) Additional page(s) attached

HED ASSESSMENT

HED No. SD3-1Ø

EP = 9

TITLE: Status Indicator Order

COMMENT: Indicators do not match the order of the control switches located directly below.

Item: N/A Ref.: A3.2 TDA Source: SCRS

IDENTIFICATION: Panel: 668
Component Name: Dump and Drain Status Lights
ID or Number: 532-552 (print #)

DESCRIPTION OF PROBLEM:
The arrangement of lights mix separator steam drains with feed heater drains. Consequently, the feed heater drain status lights do not line up with the heater drain switches which are located directly below.

RESOLUTION: (Code: A) (Priority: N/A) (Sched: Fuel Load)

The indicator lights and the switches below them have different functions and should not be grouped together. The panel will be enhanced to separate and identify the functions of each group.

TRAINING REQUIREMENTS: None

PROCEDURE REQUIREMENTS: None

Team Approval Signatures: Date:

( ) Additional page(s) attached

HED ASSESSMENT

HED No. SD3-11

EP = 6

TITLE: Switch in Wrong Location

COMMENT: Switch is grouped with other switches which have a different function.

Item: N/A Ref.: A3.2 TDA Source: SCRS

IDENTIFICATION: Panel: 668
Component Name: Steam Drain
ID or Number: 598 (HV06-122/121)

DESCRIPTION OF PROBLEM:

This steam drain is associated with the Feed Pump Turbines but is grouped with the feed heater drains. The switch is not easily associated with the feed pump turbine switches.

RESOLUTION: (Code A) (Priority: N/A) (Sched: Fuel Load)

Resolved by enhancement to group it with the feed pump turbine. (See general description of enhancements.)

TRAINING REQUIREMENTS: None

PROCEDURE REQUIREMENTS: None

Team Approval Signature: Date:

( ) Additional page(s) attached

HED ASSESSMENT

HED No. SD3-12

EP = 6

TITLE: Order of Switches

COMMENT: Switches are not in the expected order (left to right).

Item: N/A Ref.: A3.2 TDA Source: SCRS

IDENTIFICATION: Panel: 668
Component Name: Heater Drains
ID or Number: 513-530 (print #)

DESCRIPTION OF PROBLEM:

Feed heaters are arranged from right to left, but are from left to right on panel 651.

RESOLUTION: (Code: F) (Priority: N/A) (Sched: N/A)

These switches are used to control condensate flow of drains through the shell side of feed heaters. This is a counter flow to the direction of feed flow through the tube side of the heaters. Therefore, the direction of flow is properly from left to right as the switches are presently arranged. This arrangement is correct.

TRAINING REQUIREMENTS: None

PROCEDURE REQUIREMENTS: None

Team Approval Signature: Date:

( ) Additional page(s) attached

HED ASSESSMENT

HED No. SD3-13

EP = 6

TITLE: Switch Indicating Lights

COMMENT: Lights are not in expected order.

Item: N/A Ref.: A3.2 TDA Source: SCRS

IDENTIFICATION: Panel: 668
Component: Feed Pump Turbine Stop Valves Test Switches
ID or Number: 412-417

DESCRIPTION:

Convention places Closed on left, Open on right. The valve indicating lights have Closed (GREEN) on left, Open (RED) in the middle and Test (AMBER) on right.

RESOLUTION: (Code: A) (Priority: N/A) (Sched: N/A)

The indicated controls are test pushbuttons used only during start-up at less than 400 psi system pressure.

TRAINING REQUIREMENTS: None

PROCEDURE REQUIREMENTS: None

Team Approval Signature: Date:

( ) Additional page(s) attached

HED ASSESSMENT

HED No. SD3-14

EP = 6

TITLE: Recorder Grouping

COMMENT: Recorders not grouped by functions.

Item: N/A Ref.: A3.2 TDA Source: SCRS

IDENTIFICATION: Panel: 669
Component Name: Conductivity and Temperature Recorders
ID or Number: 402-404,407

DESCRIPTION OF PROBLEM:
The circulating water temperature recorder is placed between the condensate recorders. This interrupts grouping and is not the expected top to bottom order.

RESOLUTION: (Code: F) (Priority: 4) (Sched: N/A)

Recorders should be relocated so that they can be properly grouped with panel enhancements.

TRAINING REQUIREMENTS: None

PROCEDURE REQUIREMENTS: None

Team Approval Signature: Date:

( ) Additional page(s) attached

HED ASSESSMENT

HED No. SD3-16

EP = 6

TITLE: Meter Grouping Sequence

COMMENT: Meters are not arranged from left to right or in order corresponding to controls.

Item: N/A Ref.: A3.1 A3.2 Source: SCRS

IDENTIFICATION: Panel: 653
Component Name: Moisture Separator Inlet Pressure C1, C2, Seal Steam Pressure, and Shell Pressure.
ID or Number: 604,605,626,627

DESCRIPTION OF PROBLEM:
C1 and C2 meters are not arranged from left to right in the expected order, and the order of the Steam and Shell Pressure meters does not conform to the order of system detector location points.

RESOLUTION:
C1,C2:
(Code: F) (Priority: 4) (Sched: N/A)

Seal Steam Pressure and Shell Pressure:
(Code: A) (Priority: 3) (Sched: 1st Refueling)

Meters will be swapped to be in proper order.

TRAINING REQUIREMENTS: Mod. Package

PROCEDURE REQUIREMENTS: Mod. Package

Team Approval Signature: Date:

( ) Additional page(s) attached

HED ASSESSMENT

HED No. SD4-Ø1

EP = 9

TITLE: Control Indication Light Colors

COMMENT: Indicating light lens above switches are incorrect color.

Item: N/A Ref.: A4.2 Source: SCRS

IDENTIFICATION: Panel: 668
Component Name: Emergency Governor Controls
ID or Number: 418,419,420

DESCRIPTION:
Indicating light lenses for Normal and Locked Out are Green and Red: convention requires these be White and Amber. Lights for Trip and Reset are Green and Red.

POSSIBLE SOLUTIONS: (Code A)

Change lens colors to conform to convention.
See attached.

RESOLUTION: (Code: A) (Priority: N/A) (Sched: N/A)

Lenses for Normal and Locked Out have been corrected. Lenses for Trip & Reset conform.

TRAINING REQUIREMENTS: None

PROCEDURE REQUIREMENTS: None

Team Approval Signature: Date:

( ) Additional page(s) attached

HED ASSESSMENT

HED No. SD4-Ø2

EP = 9

TITLE: Pushbutton Colors

COMMENT: Colors used for pushbuttons are not consistent.

Item: N/A Ref.: A4.2 TDA Source: SCRS

IDENTIFICATION: Panel: All
Component Name: Guarded and Unguarded Circular Pushbuttons
ID or Number: N/A

DESCRIPTION:

Pushbuttons use colors of red, yellow, green and black throughout the control room. The use of color is not consistent with function.

RESOLUTION: (Code: A) (Priority: N/A) (Sched: Fuel Load)

See attached.

TRAINING REQUIREMENTS: None

PROCEDURE REQUIREMENTS: None

Team Approval Signature: Date:

(1) Additional page(s) attached

RESOLUTION

Pushbutton Color Codes

Pushbuttons throughout the control room will be colored using the following color codes:

FUNCTION	COLOR
1. Emergency Trip, Emergency Actuation	RED
2. Reset	WHITE
3. Acknowledge Alarm, Bypass, Block	YELLOW
4. Stop, Shut (not emergency)	GREEN
5. Test	BLACK

HED ASSESSMENT

HED No. SD4-Ø3

EP = 6

TITLE: Indicator Light Color Convention

COMMENT: Colors to be used on indicator lights associated with controls are not defined.

Item: N/A Ref.: A4.1 TDA Source: SCRS

IDENTIFICATION: Panel: All
Component Name: GE ET-16 Indicating Lights
ID or Number: N/A

DESCRIPTION:

Generally the uses of colors for indicator lights are consistent with a few exceptions.

RESOLUTION: (Code: A) (Priority: 2) (Sched: 1st Refueling)

Verify indicator lights consistent with convention. See attached.

TRAINING REQUIREMENTS: None

PROCEDURE REQUIREMENTS: None

Team Approval Signature: Date:

( ) Additional page(s) attached

RESOLUTION

Indicator Light Color Codes

Indicator lights will use the following color codes:

	FUNCTION	COLOR
1.	Stopped, Shut, Off, Breaker Open, Rod Out	GREEN
2.	Start, Open, On, Breaker Closed, Rod Out	RED
3.	Automatic Mode, Power Available, Condition Attained, Support System Available, System Ready (in normal sense), Permissive	WHITE
4.	Manual Mode, Abnormal Mode or Condition, Armed, Unlocked or Locked Out (in abnormal sense), Remote, Overload	AMBER

HED ASSESSMENT

HED No. SD5-Ø1

EP = 12

TITLE: Operation Limit Labels

COMMENT: No labeling of operational limits exists.

Item: N/A Ref.: A5.2 Source: SCRS

IDENTIFICATION: Panel: 673,RSP,OOC-655
Component Name: All
ID or Number: See below

DESCRIPTION OF PROBLEM:

No labels are used to indicate operational limits or warnings of controls/displays.

RESOLUTION: (Code:A) (Priority: N/A) (Sched: Fuel Load)

See HED I2-Ø1.

TRAINING REQUIREMENTS: None

PROCEDURE REQUIREMENTS: None

Team Approval Signature: Date:

( ) Additional page(s) attached

HED ASSESSMENT

HED No. SD5-Ø2

EP = 8

TITLE: Hierarchal Labeling

COMMENT: No hierarchal labeling exists.

Item: N/A Ref.: A5.7 Source: SCRS

IDENTIFICATION: Panel: 673,RSP,ØØC-655
Component Name: N/A
ID or Number: N/A

DESCRIPTION OF PROBLEM:

Same as comment above.

RESOLUTION: (Code: A) (Priority: N/A) (Sched: Fuel Load)

Enhancements include hierarchal labeling. (See general discussion of enhancements.)

TRAINING REQUIREMENTS: None

PROCEDURE REQUIREMENTS: None

Team Approval Signature: Date:

( ) Additional page(s) attached

HED ASSESSMENT

HED No. SD5-Ø3

EP = 6

TITLE: Label Wording

COMMENT: Labels have excessive wording and are crowded.

Item: N/A Ref.: A5.1Ø Source: SCRS

IDENTIFICATION: Panel: 673,RSP
Component Name: N/A
ID or Number: See below

DESCRIPTION OF PROBLEM:

Labels are crowded and use excessive wording. Confusion could result during operation 673 (temp/press indicators).

RESOLUTION: (Code: A) (Priority: N/A) (Sched: Fuel Load)

All components are relabeled. (See general discussion of enhancements.)

TRAINING REQUIREMENTS: None

PROCEDURE REQUIREMENTS: None

Team Approval Signature: Date:

( ) Additional page(s) attached

HED ASSESSMENT

HED No. SD5-Ø4

EP =

TITLE: Confusing Terminology

COMMENT: The exact meaning of "containment" is not clear from use on labels.

Item: N/A Ref.: A5.1Ø TDA Source: SCRS

IDENTIFICATION: Panel: 6Ø1 - Containment Isolation and Atmosphere Control
Component Name: N/A
ID or Number: N/A

DESCRIPTION OF PROBLEM:

The word containment is used in several places but is not consistently used. The enclosure that houses the Drywell and Suppression Pool is what other type plants call containment, however, the functions of containment actuation is more closely associated with the Drywell/Suppression Pool boundary.

RESOLUTION: (Code: A) (Priority: N/A) (Sched: Fuel Load)

A terminology list has been developed which clarifies the meaning of containment and is applied uniformly on all panels.

TRAINING REQUIREMENTS: None

PROCEDURE REQUIREMENTS: None

Team Approval Signature: Date:

( ) Additional page(s) attached

HED ASSESSMENT

HED No. SD5-Ø5

EP = 6

TITLE: Power Supply Division Terminology

COMMENT: Inconsistency in method of identifying power supply divisions.

Item: N/A Ref.: A5.5, A5.1Ø, TDA Source: SCRS

IDENTIFICATION: Panel: Various
Component Name: N/A
ID or Number: See below

DESCRIPTION OF PROBLEM:
Separate power supplies are sometimes identified as DIV 1 and DIV 2, but some are identified as A and B. In addition, some are four divisions 1,2,3 and 4, where 1 and 3, and 2 and 4 go together. Some are in 6 divisions. They become confusing and are not consistent.

RESOLUTION: (Code: A) (Priority: N/A) (Sched: Fuel Load)

Electrical divisions will be labeled using numerical designations vice letters; mechanical systems will be designated per equipment identification scheme.

TRAINING REQUIREMENTS: None

PROCEDURE REQUIREMENTS: None

Team Approval Signature: Date:

( ) Additional page(s) attached

HED ASSESSMENT

HED No. SD7-Ø1

EP = 6

TITLE: Panel Location

COMMENT: Panel removed from primary operating area.

Item: N/A Ref.: A7.3 Source: SCRS

IDENTIFICATION: Panel: 673
Component Name: N/A
ID or Number: N/A

DESCRIPTION OF PROBLEM:

The panel is located among Unit 2 panels, rather far from the Unit 1 operating area.

RESOLUTION: (Code: A) (Priority: N/A) (Sched: N/A)

The Chief Operator is responsible for the operation of the electrical and Off Gas panels. His desk faces these panels and he has direct access to the panel without obstructions. The distance is not excessive. This is considered not to be a discrepancy.

TRAINING REQUIREMENTS: None

PROCEDURE REQUIREMENTS: None

Team Approval Signature: Date:

( ) Additional page(s) attached

HED ASSESSMENT

HED No. I1-Ø1

EP = 3

TITLE: Controller Operation

COMMENT: Insufficient hand space provided.

Item: 4.1.1 Ref.: B1.5 Source: CRS

IDENTIFICATION: Panel: 6Ø3,652,647,648
Component Name: See below
ID or Number: See below

DESCRIPTION OF PROBLEM:

Insufficient hand space provided for hand support in the following cases: RFP speed controllers 1A;1B;1C (panel 6Ø3)
Main steam to 1A air ejector (panel 652)
Pump/discharge flow (panels 647,648)

RESOLUTION: (Code: A) (Priority: 4) (Sched: N/A)

These are the primary types of controllers used throughout the control room. They use a thumb operated wheel to adjust the set point scale immediately beside it. Team members operated the controllers at all the stations where they are used. The characteristics of the adjustment are a firm motion that can be performed with either the finger or thumb, and the adjustment is relatively coarse. Consequently, it is not necessary to rest the hand to move the set point or to obtain the desired setting. We found a variety of acceptable positions for the hand while making adjustments. This is considered not to be a discrepancy.

TRAINING PROCEDURES: None

PROCEDURE REQUIREMENTS: None

Team Approval Signature: Date:

( ) Additional page(s) attached

HED ASSESSMENT

HED No. I2-Ø1

EP = 12

TITLE: Indicating Devices - Zone Markings

COMMENT: Indicating devices have no zone markings.

Item: 4.2.1 Ref.: B2.1 Source: CRS

IDENTIFICATION: Panel: All panels except 653
Component Name: All indicating except those noted below
ID or Number: See attached print

DESCRIPTION OF PROBLEM:

With the exception of turbine speed, oil tank level, and generator hydrogen purity indicators on panel 653, all other indicating devices have no markings to indicate safe/unsafe, normal/abnormal, expected/unexpected range of operation.

RESOLUTION: (Code: A) (Priority: N/A) (Sched: Fuel Load)

An Administrative procedure will be written such that operators can make scale zoning modifications as operating experience is gained.

TRAINING REQUIREMENTS: None

PROCEDURE REQUIREMENTS: Write procedure.

Team Approval Signature: Date:

( ) Additional page(s) attached

HED ASSESSMENT

HED No. I2-Ø2

EP = 9

TITLE: Recorders/Unit Specification

COMMENT: Recorders have no process units specified.

Item: 4.2.2 Ref.: B2.3 Source: CRS

IDENTIFICATION: Panel: 600,601,603,00C-624,00C-667
Component Name: Indicating recorders
ID or Number: See attached prints

DESCRIPTION OF PROBLEM:

There are no process units specified on the recorders on the panels.

RESOLUTION: (Code: A) (Priority: N/A) (Sched: Fuel Load)

Not on recorders at time of survey; all will be confirmed as construction is complete and systems turned over.

TRAINING PROCEDURES: None

PROCEDURE REQUIREMENTS: None

Team Approval Signature: Date:

( ) Additional page(s) attached

HED ASSESSMENT

HED No. I2-Ø3

EP = 6

TITLE: Indicator Scales

COMMENT: Indicators are not scaled properly.

Item: 4.2.3 Ref.: B2.3 Source: CRS

IDENTIFICATION: Panel: 647,648,670,602,653,696
Component Name: Indicating devices
ID or Number: see below

DESCRIPTION OF PROBLEM:
Indicating devices are not scaled in units that relate to the operation of the system:

a. Pump suction pressure indicators (panels 647,648)
b. Main generator rotor temp (panel 670)
c. Recirc pump speed and demand speed (panel 602)
d. Low pressure turbine exit pressure indicators (panel 653)
e. Turbine speed (panel 653)
f. Reaction chamber temperature control indicator (Recombiner 696)

RESOLUTION: (Code: See Below) (Priority: N/A) (Sched: Fuel Load)

a. Scale will be renumbered in standard increments. Correct RCIC indicator to be consistent with HPCI indicator. Code A
b. Enhancements will emphasize the centigrade scale. System measures degrees Centigrade, therefore indicator is scaled properly. See general discussion of enhancements. Code A
c. The minimum speed of this pump is 28% and is indicated by a red line. The scale covers the range of 18% to 102% and is considered to be satisfactory. Code B
d. Place horizontal line at zero point between engineering unit identifiers. Code B
e. Turbine speed recorder indicates RPM; it should be percent. Will be changed. Code A
f. Not included in CRDR.

TRAINING PROCEDURES: None

PROCEDURE REQUIREMENTS: None

Team Approval Signature: Date:

( ) Additional page(s) attached

HED ASSESSMENT

HED No. I2-Ø4

EP = 6

TITLE: Indicator Units

COMMENT: Indicators have no specified units.

Item: 4.2.3 Ref.: B2.3 Source: CRS

IDENTIFICATION: Panel: 6Ø2,6Ø3,653
Component Name: Indicating devices
ID or Number: See below

DESCRIPTION OF PROBLEM:

Indicators have no specified units:
Recirc. flow recorder (6Ø2)
Turbine oil reservoir (653)
Heat flux indicators (6Ø3)

RESOLUTION: (Code: See Below) (Priority: N/A) (Sched: N/A)

6Ø3 - Heat Flux indicators are used for qualitative comparative indication where absolute engineering units have no operational significance. Computer backup provided detailed engineering information. (Code F)

6Ø2 - Corrected during construction. (Code A)

653 - Corrected during construction. (Code A)

TRAINING PROCEDURES: None

PROCEDURE REQUIREMENTS: None

Team Approval Signature: Date:

( ) Additional page(s) attached

HED ASSESSMENT

HED No. I2-05

EP = 6

TITLE: Indicator Visibility

COMMENT: Pointers obscure unit graduations on indicators.

Item: 4.2.4 - 4.2.6 Ref.: B2.5 Source: CRS

IDENTIFICATION: Panel: 670,647,600,653,602,603,654,661,00C-660
Component Name: Indicating devices
ID or Number: See below

DESCRIPTION OF PROBLEM:

Pointers obscure unit graduations on Bailey recorders (all), the generator watts recorder (670), turbine vibration recorder (647), SJAE discharge recorder (lower scale) (600), turbine speed/control and bypass valve position recorder (653), cleanup filter demineralizer inlet pH recorder (602), IRM/APRM recorders (603), and the circular meters of panels 654, 661, and 00C-660 (EP - 4).

RESOLUTION: (Code: B) (Priority: N/A) (Sched: N/A)

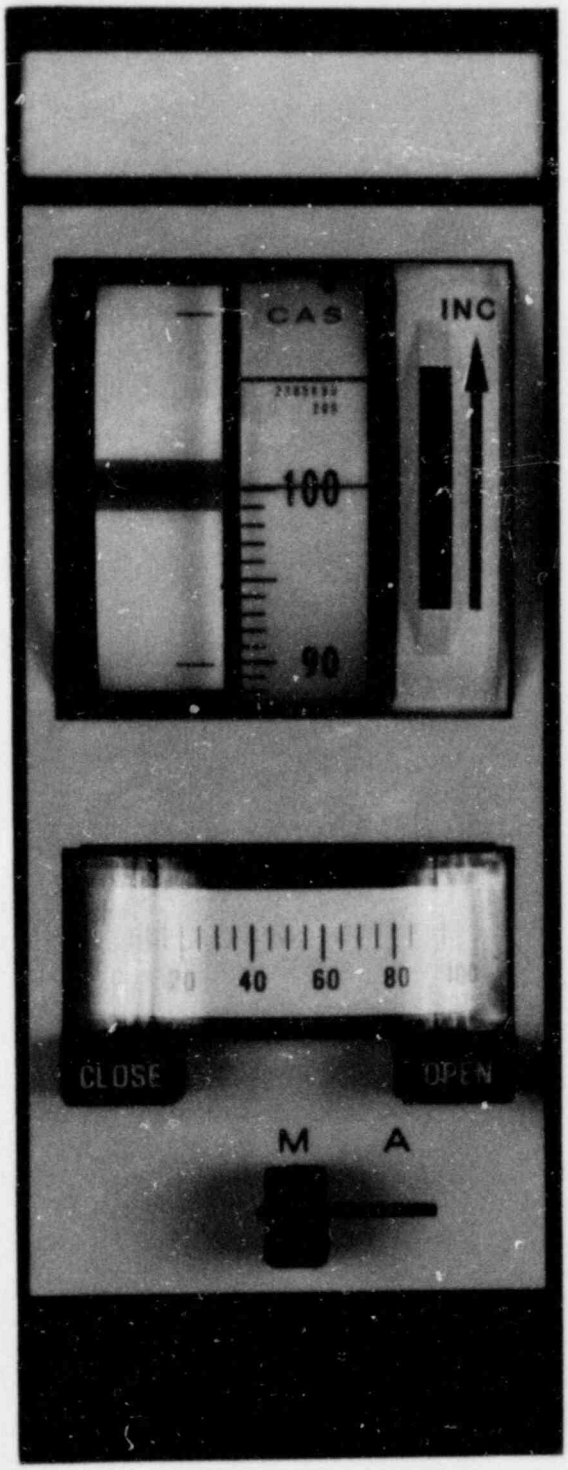
All indicated devices were re-reviewed by team members. None were identified where the total graticule was obscured or inhibited accurate reading or setting of the controller (see attached). This is not considered a discrepancy.

TRAINING REQUIREMENTS: None

PROCEDURE REQUIREMENTS: None

Team Approval Signature: Date:

( ) Additional page(s) attached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HED ASSESSMENT

HED No. I2-Ø6

EP = 4

TITLE: Control Arrangement

COMMENT: Pushbuttons are not positioned in the expected manner.

Item: 4.2.7 Ref.: B2.7 Source: CRS

IDENTIFICATION: Panel: 654
Component Name: Generator load adjust pushbuttons
ID or Number: 90-G101A, 90-G101B

DESCRIPTION OF PROBLEM:

Generator load adjust pushbuttons have increase on the left and decrease on the right. This is opposite of standard convention and the arrangement of similar pushbuttons on panel 653.

RESOLUTION: (Code: A) (Priority: 3) (Sched: 1st Refueling)

Change pushbuttons to be consistent with 653 (i.e. Decrease on left, Increase on right).

TRAINING REQUIREMENTS: None

PROCEDURE REQUIREMENTS: None

Team Approval Signature: Date:

( ) Additional page(s) attached

HED ASSESSMENT

HED No. I2-Ø7

EP = 4

TITLE: Scale Consistency

COMMENT: Indicators do not have identical scales to facilitate comparative reading.

Item: 4.2.8 Ref.: B2.8 Source: CRS
4.2.10 B2.10

IDENTIFICATION: Panel: 668,654,602,655,652,600
Component Name: See below
ID or Number: See below

DESCRIPTION OF PROBLEM:

Drain cooler drain flow and third stage heaters drain flow indicators (668), V/102-2 and V/101-2 (654), RWCU dump flow and inlet flow (602), cooling tower makeup and blow down flow recorder (655), 1A condensate pump ammeter and 1B and 1C ammeters (652), SJAE discharge recorders (600).

RESOLUTION: (Code: A) (Priority: N/A) (Sched: Fuel Load)

See attached. (RESOLUTION)

TRAINING REQUIREMENTS: None

PROCEDURE REQUIREMENTS: None

Team Approval Signature: Date:

( ) Additional page(s) attached

RESOLUTION

a. The comparative aspects are qualitative and not quantitative. Since each recorder would indicate different qualitative value, as a result of sensor location, making each scale the same would not facilitate comparison either. Each recorder scale should remain the same.

b. Meter 101-2 on 654 is missing scale numbers. These numbers will be added. Code A

c. Normal operating flow of dump indication is 0-150 gpm. To expand scale to 0-400 would result in lost resolution for normal range. Comparison is of a qualitative nature rather than quantitative values. Control is based on temperature rather than flow. This is <u>not</u> a discrepancy.

d. These two meters cannot be compared directly. One uses a 1000 multiplier, the other 100 multiplier. To expand the smaller to the size of the larger would not allow sufficient discrimination on the blowdown scale. Given the distinctly different ranges, it is better from a human factors viewpoint to have the scales distinctly different in numbers as well as multipliers. Code A

e. This has been corrected. Code A

f. Logarithmic scale provides gross indication, while linear scale provides a fine reading by use of range selector switch. Both are used in conjunction with each other. Any off scale readings on linear are alarmed. Range selection is a controlled, deliberate operation. Code A

HED ASSESSMENT

HED No. I2-08

EP = 4

TITLE: Indicator Alignment

COMMENT: Indicators are not aligned to facilitate comparative reading.

Item: 4.2.9 Ref.: B2.10 Source: CRS
4.2.10

IDENTIFICATION: Panel: 670,654,602,00C-681
Component Name: See below
ID or Number: See below

DESCRIPTION OF PROBLEM:

Generator cooling system temperature, metal temperature, and thrust bearing temp. (670), 11 and 12 unit auxiliary bus circular meters (654), RWCU 1A and 1B filter flow scales (602), heating and ventilating indicators (00C-681).

RESOLUTION: (Code: See below) (Priority: See Below) (Sched: See below)

602 - Corrected by design change. (Code: A) (Priority: 3) (Sched: N/A)

670 - Not a problem since concern is with trending information, not discrete values. (Code: F) (Priority: 4) (Sched: N/A)

654 - Present labeling is misleading. Meters to be relabeled to properly indicate their function. (See general discussion of enhancements.) (Code: A) (Priority: N/A) (Sched: Fuel Load)

00C-681 - Indicators will be rearranged to facilitate comparative reading. (Code: A) (Priority: 3) (Sched: 1st Refueling)

TRAINING PROCEDURES: None

PROCEDURE REQUIREMENTS: None

Team Approval Signature: Date:

( ) Additional page(s) attached

HED ASSESSMENT

HED No. I2-Ø9

EP = 4

TITLE: Missing Scale Selector

COMMENT: There is no apparent scale selector switch.

Item: 4.2.11 Ref.: B2.11 Source: CRS

IDENTIFICATION: Panel: 6Ø2
Component Name: Clean-up filter demineralizer inlet pH recorder
ID or Number: AR23-17Ø

DESCRIPTION OF PROBLEM:

The cleanup filter demineralizer inlet pH recorder has two scales, but no selector switch apparent, and it is not clear which scale is to be used by the operator.

RESOLUTION: (Code: A) (Priority: N/A) (Sched: N/A)

This is a single scale recorder, therefore, no selector switch is needed. Investigation has shown only one scale, therefore second scale has been removed.

TRAINING REQUIREMENTS: None

PROCEDURE REQUIREMENTS: None

Team Approval Signature: Date:

( ) Additional page(s) attached

HED ASSESSMENT

HED No. I2-1Ø

EP = 6

TITLE: Intermediate Scale Graduations

COMMENT: Excessive number of intermediate graduations between numbered markings.

Item: 4.2.12 Ref.: B2.12 Source: CRS

IDENTIFICATION: Panel: See attachment.
Component Name: See attachment.
or Number: See attachment.

DESCRIPTION OF PROBLEM:

The following indicating devices have more intermediate graduations than are recommended: (see attached sheet)

RESOLUTION: (Code: A) (Priority: N/A) (Sched: Fuel Load)

Scales reviewed and will be revised to be consistent with a standardized scale specification.

TRAINING REQUIREMENTS: None

PROCEDURE REQUIREMENTS: None

Team Approval Signature: Date:

3 Additional pages attached

IDENTIFICATION

Panel 670:
Millivolt meter, Generator Cooling System temperature, Metal temperature, Main Steam temperature, Thrust Bearing temperature

Panel 668:
RFP Turbine Lube Oil temperature, Thrust Bearing temperature

Panel 669:
Condenser shells and hotwell conductivity

Panel 601:
RHR loop flows

Panel 600:
Area Radiation Monitor

Panel 607:
Flux probing monitor % power scale

Panel 614:
All temperature recorders

Panel 647 & 648:
Pump discharge pressure, Turbine supply pressure, Suppression pool level

Panel 00C-624:
Area radiation monitor recorder

Panel 602:
RWCU heater inlet pressure, RWCU 1A and 1B filter flow

Panel 655:
Instrument air pressure, Service air pressure, Turbine building cooling water pressure and temperature, Reactor building cooling water temperature

IDENTIFICATION

Panel 652:
SJAE Indicators

Panel 653:
A,B,C low pressure turbine stage 8 exit pressure, A,B EHC fluid pump amperes

Panel 00C-600:
Safeguard transformer megavars, Station auxiliary switchgear megawatts, Start up bus megawatts.

Panel 654:
All transformer ammeters within the mimic, W/G101, A/X102, V/102-2

Emergency Shutdown Panel:
Both suppression pool levels (Unit 1,2), ESW discharge pressure.

HED ASSESSMENT

HED No. I2-11

EP = 3

TITLE: Scale Subdivisions

COMMENT: Indicators are scaled with incorrect decimal multiples.

Item: 4.2.13 Ref.: B2.13 Source: CRS

IDENTIFICATION: Panel: See attached
Component Name: See attached
ID or Number: See attached

DESCRIPTION OF PROBLEM:

The following indicating devices are scaled with subdivisions in decimal multiples other than the recomended 1, 2, or 5. (See attached sheet)

RESOLUTION: (Code: A) Priority: N/A) (Sched: Fuel Load)

A detailed specification for analog indicator gauge faces has been developed and will be used throughout the control room to correct indicators as appropriate.

TRAINING REQUIREMENTS: None

PROCEDURE REQUIREMENTS: None

Team Approval Signature: Date:

(1) Additional page(s) attached

Panel 670:
Generator cooling system temperature, Metal temperature, Thrust bearing temperature, Thrust bearing wear

Panel 600:
SJAE discharge recorder RR26-1R602

Panel 647 and 648:
Pump discharge pressure, Pump suction pressure, Turbine supply pressure, Suppression pool level.

Panel 603:
IRM/APRM recorders, IRM-APRM/RPM recorders, Heat flux indicators, Standby liquid control discharge pressure

Panel 00C-681:
SGTS heater and filter temperatures, A,B control room temperatures, SGTS carbon filter air temperature, Outside air temperature

Panel 681:
Nearly all indicators

Panel 653:
A,B,C,D main steam line flow, Steam chest pressure, Pressure setpoints A & B, A,B,C low pressure turbine stage 8 exit pressure, A & B EHC fluid pump amperes.

Panel 00C-667:
A,B,C,D RHRSW pump ammeters

Panel 654:
V/101-2, V/102-2, V/107

Panel 00C-693:
DC voltmeters

Panel 602:
RWCU heater inlet pressure, RWCU 1A and 1B filter flow

Panel 607:
Flux probing monitor % power scale

Panel 655:
Instrument air pressure, Service air pressure, Turbine building cooling water pressure and temperature, Reactor building cooling water temperature

Panel 00C-660:
Safeguard transformer megavars, Station auxiliary switchgear megawatts, Startup bus megawatts

Remote Shutdown Panel:
Suppression pool level (both units), ESW discharge pressure.

HED ASSESSMENT

HED No. I2-12

EP = 6

TITLE: Non-linear Scales

COMMENT: Indicating devices use non-linear, non-logarithmic scales.

Item: 4.2.14 Ref.: B2.11 B2.13 Source: CRS

IDENTIFICATION: Panel: See attached
Component Name: See attached
ID or Number: See attached

DESCRIPTION OF PROBLEM:

The following indicators have non-linear, non-logarithmic scales over some or all of their range: (see attached sheet)

RESOLUTION: (Code:) (Priority:) (Sched:)

See attached

TRAINING REQUIREMENTS:

Explain the design approach for selecting scale ranges and the meaning of a non-linear zero at the bottom (where used).

PROCEDURE REQUIREMENTS: None

Team Approval Signature: Date:

(1) Additional page(s) attached

IDENTIFICATION

Panel 670:
Vibration phase angle

Panel 601:
All ammeters

Panel 614:
Recirculation drive and generator bearing temperatures
Recirculation pump temperature
RHR water temperature
HPCI turbine and pump temperatures
ADS safety/relief valve temperatures

Panel 603:
CRD water pump motor ammeters 1A and 1B
CRD system, cooling water, and drive flows
RFPT turning gear ammeters 1A, 1B, 1C

Panel 00C-681:
A, B control room temperature
Outside air temperature
Ammeters

Panel 681:
A through H drywell cooling inlet and discharge air temperatures (Photo #29)
Recirculation pump cooling inlet and outlet flow
Recirculation filter temperatures
Drywell chiller ammeters

Panel 653:
Generator hydrogen purity
Ammeters

Panel 00C-667:
A, B, C, D RHRSW pump ammeters
RHR heat exchanger cooling water flows

Panel 654:
Ammeters and kilovolt meters

Emergency Shutdown Panel:
RCIC pump discharge flow, both units

RESOLUTION

a. Ammeters: All meters are alike. They show a linear range with a normal mid-scale reading. Each scale has a zero mark at the bottom to indicate de-energized. (Code: F) (Priority: 4) (Sched: No Change)

b. Panel 00C-681: These temperature meters receive signals directly from non-linear thermocouples and cannot be made linear. The non-linear scale is the same for all three indications and is satisfactory for this use because they are used for comparative readings. (Code: F) (Priority: 4) (Sched: No change)

c. Panel 00C-667: The RHR heat exchanger cooling water flow indications will be changed to use the same scale. (Code: A) Priority: 2) (Sched: 1st Refueling)

d. Emergency Shutdown Panel: The RCIC pump discharge flows will be changed to use the same scale. (Code: A) (Priority: 2) (Sched: 1st Refueling)

e. All Other Meters Listed: All these meters were reviewed by the team and found to be satisfactory. (See general discussion of class solutions for displays.) (Code: F) Priority: 4) (Sched: No change)

HED ASSESSMENT

HED No. I2-13

EP = 4

TITLE: Incorrect Numeral Orientation

COMMENT: Numerals are not oriented in an upright position.

Item: 4.2.15 Ref.: B2.15 Source: CRS

IDENTIFICATION: Panel: 607
Component Name: Flux probing monitor
ID or Number: Flux probing monitor

DESCRIPTION OF PROBLEM:

Percent power and volt scales of the flux probing monitor do not have vertically oriented numerals.

RESOLUTION: (Code: B) (Priority: N/A) (Sched: N/A)

Degree off vertical not sufficient to cause operational difficulty. This is not considered a discrepancy.

TRAINING REQUIREMENTS: None

PROCEDURE REQUIREMENTS: None

Team Approval Signature: Date:

( ) Additional page(s) attached

HED ASSESSMENT

HED No. I2-14

EP = 4

TITLE: Scale Differentiation

COMMENT: There is no differentiation between psi and vacuum scales.

Item: 4.2.17 Ref.: B2.18 Source: CRS

IDENTIFICATION: Panel: 647, 648
Component Name: Pump Suction Pressure Indicators
ID or Number: PI150 - IR604 and PI156 - IR606

DESCRIPTION OF PROBLEM:

There is no clear differentiation between psi and vacuum scales on the pump suction pressure indicators.

RESOLUTION: (Code: A) (Priority: N/A) (Sched: Fuel Load)

Place a horizontal line at zero point between engineering unit identifiers. (Same as I2-03)

TRAINING REQUIREMENTS: None

PROCEDURE REQUIREMENTS: None

Team Approval Signature: Date:

( ) Additional page(s) attached

HED ASSESSMENT

HED No. I3-Ø1

EP = 8

TITLE: Recorder Point Select Capability

COMMENT: Multipoint recorders have no point select capability.

Item: 4.3.1 Ref.: B3.6 Source: CRS

IDENTIFICATION: Panel: 614,670,668,669,ØØC624
Component Name: Multipoint Recorders
ID or Number: See attached print

DESCRIPTION OF PROBLEM:

Same as comment above.

RESOLUTION: (Code: B) (Priority: N/A) (Sched: N/A)

The indicated recorders, while not having a positionable 'print select' capability, do have the ability to continuous print/monitor the point at which it is currently displaying. This is accomplished with a two position switch inside the recorder door when placed in the 'indicate' position.

TRAINING REQUIREMENTS: None

PROCEDURE REQUIREMENTS: None

Team Approval Signature: Date:

( ) Additional page(s) attached

HED ASSESSMENT

HED No. I3-02

EP = 4

TITLE: Incorrect Chart Paper

COMMENT: Chart paper does not have correct scales.

Item: 4.3.2 Ref.: B3.7 Source: CRS

IDENTIFICATION: Panel: 600,603,00C-624,00C-667
Component Name: Chart Recorders
ID or Number: See below

DESCRIPTION OF PROBLEM:

Service water, Radwaste cryogenic, Reactor building closed cooling water, H_2-O_2 recombiner ventilation recorders (600); Bailey recorders (00C-624); RFP turbine control valve condition, steam and feedwater flow (603); and all recorders on 00C-667 have incorrectly scaled chart paper.

RESOLUTION: (Code: A) (Priority: N/A) (Sched: Fuel Load)

This HED was written during construction. All recorders will be provided with correct paper. New paper is stocked using that identification number so that the correct paper is used.

TRAINING REQUIREMENTS: None

PROCEDURE REQUIREMENTS: None

Team Approval Signature: Date:

( ) Additional page(s) attached

HED ASSESSMENT

HED No. I3-Ø3

EP = 4

TITLE: Recorder Pen Color

COMMENT: Recorders have inconsistent or incorrect pen colors.

Item: 4.3.3 Ref.: B3.1Ø Source: CRS
4.3.5
note No. 4.3.4 in Summary Report

IDENTIFICATION: Panel: ØØC-667, 6Ø3
Component Name: Chart Recorders
ID or Number: See below

DESCRIPTION OF PROBLEM:

Pen colors are reversed on top two recorders; bottom two recorders both use black (ØØC-667). Also, the Leeds & Northrup recorders on panel 6Ø3 use green, blue, and red pointers while the label identifies red, black, and green.

RESOLUTION: (Code: A) (Priority: N/A) (Sched: Fuel Load)

667 - Bottom (lower) recorders are single pen, therefore, black pens are acceptable.

- Upper recorders will be checked for consistency with recorder pen color convention and will be corrected.

3 per recorder PEN 3 - TOP = GREEN
PEN 2 - MID = BLUE
PEN 1 - LOW = RED

2 per recorder PEN 2 - TOP = RED
PEN 1 - LOW = BLACK

6Ø3 - Label on recorder will be changed to indicate 'RED, BLUE, GREEN'.

TRAINING REQUIREMENTS: None

PROCEDURE REQUIREMENTS: None

Team Approval Signature: Date:

( ) Additional page(s) attached

HED ASSESSMENT

HED No. I3-Ø4

EP = 12

TITLE: Recorder Zone Markings

COMMENT: No zone markings appear on recorders.

Item: 4.3.6 Ref.: B3.15 Source: CRS

IDENTIFICATION: Panel: All
Component Name: Chart Recorders
ID or Number: N/A

DESCRIPTION OF PROBLEM:

None of the chart recorders appear to have zone markings indicating normal/abnormal, safe/unsafe, or expected/unexpected range of operation.

RESOLUTION: (Code: A) (Priority: N/A) (Sched: Fuel Load)

See HED I2-Ø1

TRAINING REQUIREMENTS: None

PROCEDURE REQUIREMENTS: None

Team Approval Signature: Date:

( ) Additional page(s) attached

HED ASSESSMENT

HED No. I4-Ø1

EP = 6

TITLE: Indicator Light Failure

COMMENT: A failed bulb cannot be distinguished from a normal condition.

Item: 4.4.1 Ref.: B4.2 Source: CRS
4.4.2

IDENTIFICATION: Panel: See attached
Component Name: See attached
ID or Number: See attached

DESCRIPTION OF PROBLEM:

For the following indicating lights it is not possible to distinguish between a failed bulb and a normal light off condition (see attached sheet).

RESOLUTION: (Code: A) (Priority: N/A) (Sched: N/A)

See attachment. (RESOLUTION)

TRAINING REQUIREMENTS: None

PROCEDURE REQUIREMENTS: None

Team Approval Signature: Date:

(1) Additional page(s) attached

IDENTIFICATION

RFPT zero speed lights, panel 6Ø3

RFPT emergency governor trip lights and RFPT main bearing oil pump test lights, panel 668

ADS solenoid pilot valve B lights, panel 626

Generator ammeter range select switch indicating light, panel 654

Startup and trickle heat power on light, panel 696

Yellow alarm lights, panel ØØC-696

RESOLUTION

603 - RPFT zero speed - no means to test, but at zero speed an alarm sounds if turning gear failed to engage; if bulb is not lit - it's burned out.

668 - These bulbs are only used in a test procedure during which any bad bulbs would be identified.

626 - This light used in conjunction with square indicator above and acoustic monitor.
There are redundant sources of indication:
- o 'Has Lifted' light (two bulbs)
- o Annunciator Alarm
- o White light-if Electric or Manual indication

654 - The indicating light illuminates when 'low range' is selected. Switch position provides positive indication, therefore if bulb is not illuminated in 'low range' position it has failed.

696 - Not included in CRDR.

HED ASSESSMENT

HED No. I4-Ø2

EP = 8

TITLE: Lamp Test Feature

COMMENT: No lamp test feature exists.

Item: 4.4.3 Ref.: E4.4 Source: CRS

IDENTIFICATION: Panel: All
Component Name: N/A
ID or Number: N/A

DESCRIPTION OF PROBLEM:
There appears to be no available lamp test feature to diagnose failed indicator lights.

RESOLUTION: (Code: D) (Priority: N/A) (Sched: N/A)

An overall lamp test is not necessary due to the following conditions:

- o Safety Systems
  Normal position full open/closed valves with red or green light with redundant system indication.
- o Non-Safety
  2 categories:
  - Full/Open/Closed - red or green light always lit; one light always lit - failure indicated immediately.
  - Intermediate position under normal position - secondary indication available to alert to a failed bulb via process indication.
- o Breakers
  Two position only - red or green indications; one light always lit.
- o White and amber indicating lights (ECCS initiation status) have Annunciator alarm redundancy.
- o Those other than the above are testable sockets.

TRAINING REQUIREMENTS: None

PROCEDURE REQUIREMENTS: None

Team approval Signature: Date:

( ) Additional page(s) attached

HED ASSESSMENT

HED No. I4-Ø3

EP = 4

TITLE: Bulb Replacement

COMMENT: Indicating light bulb replacement is difficult.

Item: 4.4.4 Ref.: B4.5 Source: CRS

IDENTIFICATION: Panel: ØØC-693
Component Name: Response Spectrum Analyzer
ID or Number: Response Spectrum Analyzer

DESCRIPTION OF PROBLEM:

The panel instrument insert must be pulled out and the bulb replaced from behind on the Response Spectrum Analyzer. This makes replacement difficult.

RESOLUTION: (Code: F) (Priority: N/A) (Sched: N/A)

This is specialized equipment not maintained or operated by operations. If a seismic event occurs, an audio alarm sounds in addition to the light, therefore, a failed bulb is not the only indication. Bulb replacement is a deliberate action performed by special technicians.

TRAINING REQUIREMENTS: None

PROCEDURE REQUIREMENTS: None

Team Approval Signature: Date:

( ) Additional page(s) attached

HED ASSESSMENT

HED No. I4-Ø4

EP = 6

TITLE: Indicating Light Alignment

COMMENT: Sets of lights are not aligned to facilitate comparison.

Item: 4.4.5 Ref.: B4.6 Source: CRS

IDENTIFICATION: Panel: ØØC-681
Component Name: N/A
ID or Number: N/A

DESCRIPTION OF PROBLEM:

Comparison between related system elements is difficult as the indicating light sets are not in alignment and some components are mixed. Further confusion results due to partial mirror imaging.

RESOLUTION: (Code: D) (Priority: N/A) (Sched: Fuel Load)

The arrangement of controls and associated lights on the benchboard are partially mirror imaged for the control room fans and their associated chiller units. However, the arrangement is orderly and consistent in pattern. This section will be enhanced and labeled to make relationships clear. There is no difficulty in comparing indicating light sets as enhanced. The partial mirror imaging is considered satisfactory in this configuration.

TRAINING REQUIREMENTS: None

PROCEDURE REQUIREMENTS: None

Team Approval Signature: Date:

( ) Additional page(s) attached

HED ASSESSMENT

HED No. I4-Ø5

EP = 4

TITLE: Indicating Lights Reversed

COMMENT: The indicating lights are reversed for switch HVØ2-113C.

Item: 4.4.6 Ref.: B4.6 Source: CRS

IDENTIFICATION: Panel: 668
Component Name: Indicating Lights
ID or Number: HVØ2-113C

DESCRIPTION OF PROBLEM:

Same as comment above.

RESOLUTION: (Code: A) (Priority: N/A) (Sched: N/A)

Corrected - lights in proper configuration.

TRAINING REQUIREMENTS: None

PROCEDURE REQUIREMENTS: None

Team Approval Signature: Date:

( ) Additional page(s) attached

HED ASSESSMENT

HED No. I4-Ø6

EP = 4

TITLE: Indicator Light Alignment

COMMENT: Sets of indicating lights are not in alignment.

Item: 4.4.7 Ref.: B4.6 Source: CRS

IDENTIFICATION: Panel: 6Ø3, Remote Shutdown
Component Name: Indicating Lights
ID or Number: See attached print

DESCRIPTION OF PROBLEM:

1A and 1B level out of service lights are not above their selector switches (6Ø3) and RHR loop shutdown cooling suction valve 2A and 2B lights are not aligned to facilitate comparison (Remote Shutdown).

RESOLUTION: (Code: A) (Priority: N/A) (Sched: Fuel Load)

Resolved through system enhancement.

6Ø3 - The lights are information only and not controlled by adjacent switches. The relationship between switch and lights has been emphasized by enhancements.

RSP - Resolved through enhancement mimic flow.

(See general discussion of enhancements.)

TRAINING REQUIREMENTS: None

PROCEDURE REQUIREMENTS: None

Team Approval Signature: Date:

( ) Additional page(s) attached

HED ASSESSMENT

HED No. I5-Ø1

EP = 6

TITLE: Control Movement

COMMENT: Switches do not move in the expected direction (right = start/open, left = stop/close).

Item: 4.5.1 Ref.: B5.1 Source: CRS

IDENTIFICATION: Panel: 651,654,6Ø7,Emergency Shutdown
Component Name: Control switches
ID or Number: See below

DESCRIPTION OF PROBLEM:

Reactor feed pump recirc. valve switches (651), Main steam line safety/relief valve switches (Emergency Shutdown), Manual valve control switch (6Ø7), Exciter voltage regulator transfer switch (654), Condensate filter-demineralizer switches (651).

RESOLUTION: (Code: A) (Priority: See attached) (Sched: See attached)

See attached.

TRAINING REQURIEMENTS: None

PROCEDURE REQUIREMENTS: None

Team Approval Signature: Date:

( ) Additional page(s) attached

RESOLUTION

a. 651 - Reactor Feed Pump Recirc controls - corrected on switch backing plate - word 'MANUAL' is incorrect terminology and will be changed to read 'OPEN'. Priority: 3; Sched: 1st Refueling.

b. RSP - Change has been made to correct deficiency. Priority: 1; Sched: Fuel Load

c. 6Ø7 - The red and green lights will be swapped to conform to convention. (Red on right, green on left.) Note labels below lights will be swapped to correctly identify open/closed indication. Priority: 2 Sched: 1st Refueling

d. 651 - Spring return to center switch. To conform to convention 'on' position will be to right; stand-by to left. Priority: 3; Sched: 1st Refueling

e. 654 - Exciter voltage regulator transfer switch is a knurled pointer with MANUAL & AUTO positions in a consistent configuration and not a discrepancy. (See I5-Ø2) Priority: N/A; Sched: N/A

HED ASSESSMENT

HED No. I5-Ø2

EP = 6

TITLE: Position Labels Placement

COMMENT: Position labels not consistently placed relative to switch.

Item: 4.5.1 Ref.: B5.1 Source: CRS

IDENTIFICATION: Panel: All
Component Name: N/A
ID or Number: N/A

DESCRIPTION OF PROBLEM:

Position labels are generally placed consistently relative to each other, but are not consistently placed with regard to the switch - the label "open" is often placed over the switch or to its right.

RESOLUTION: (Code: B) (Priority: N/A) (Sched: N/A)

Several combinations and arrangements of switches as a function of use exist. General conventions and configurations of position markings do exist. Exact position for a specific condition varies as a result of switch use. As a rule, OFF-CLOSE are to the left of OPEN or ON. CLOSE-AUTO-OPEN and AUTO-MANUAL are consistently arranged. Standby is usually between CLOSE and OPEN as is AUTO.

TRAINING REQUIREMENTS: None

PROCEDURE REQUIREMENTS: None

Team Approval Signature: Date:

( ) Additional page(s) attached

HED ASSESSMENT

HED No. I5-Ø3

EP = 6

TITLE: Switch Positions

COMMENT: Switch positions are not clearly marked.

Item: 4.5.2 Ref.: B5.2 Source: CRS

IDENTIFICATION: Panel: 6Ø1,654,653,651,ØØC-65Ø
Component Name: N/A
ID or Number: N/A

DESCRIPTION OF PROBLEM:

- P/Bs for inboard and outboard valve control logic and testable check valve (6Ø1)
- Generator ammeter range switch (654), 22Økv breaker synchro. check relay selector switch (654), Steam seal evaporator extract steam test switch (653), Condensate Filter demineralization control switches (651), siren tone generator tone selector switch (ØØC-65Ø)

RESOLUTION: (Code: A) (Priority: See below) (Sched: See below)

a. 6Ø1 - on HV52-IF ØØ6 A & B 'OPEN-CLOSE' escutcheon will be changed to read 'TEST.' Priority: 2; Sched: 1st refuel
b. 651 - Condensate filter demin (See I5-Ø1).
c. 653 - The handle positions are installed per design and are spring return to a center position. To clarify switch setting two positions will be indicated on the switch backing plate NORMAL and CLOSE. Priority: 3; Sched: 1st refueling
d. 654 - Generator Ammeter Range - a 2 position switch low on left, high on right, which is acceptable and not a discrepancy. Relay Selector Switch is a two position keyswitch NORMAL/BYPASS, an escutcheon backing plate has been added to indicate positions. Priority: N/A; Sched: N/A
e. ØØC-65Ø - Paint arrow on handle white to better indicate position. Priority: N/A; Sched: Fuel Load

TRAINING REQUIREMENTS: None

PROCEDURE REQUIREMENTS: None

Team Approval Signature: Date:

( ) Additional page(s) attached

HED ASSESSMENT

HED No. I5-Ø5

EP = 12

TITLE: Controls Below/Above Normal Reach Distances

COMMENT: Control switches are below/above normal reach distances.

Item: 4.5.4 Ref.: B5.3 Source: CRS

IDENTIFICATION: Panel: 6ØØ,67Ø,648,6Ø7,661,668,6Ø1,ØØC-693, ØØC-667, Remote Shutdown
Component Name: See attached prints
ID or Number: See attached prints

DESCRIPTION OF PROBLEM:

Indicated control switches are below normal reach distances. The RHR head spray inboard isolation valve switch is too high on the Remote Shutdown Panel.

RESOLUTION: (Code: F) (Priority: 4) (Sched: N/A)

See HED D3-1Ø.

TRAINING REQUIREMENTS: None

PROCEDURE REQUIREMENTS: None

Team Approval Signature: Date:

( ) Additional page(s) attached

HED ASSESSMENT

HED No. I5-Ø6

EP = 6

TITLE: Control Near Console Edge

COMMENT: Controls too near edge of console and can potentially result in inadvertent operation.

Item: 4.5.5 Ref.: B5.4 Source: CRS

IDENTIFICATION: Panel: 6Ø2,6Ø3
Component Name: 1A Aux Lube Oil Pump (6Ø2), 1C RFPT Turning Gear Motor
ID or Number: See above

DESCRIPTION OF PROBLEM:

1A auxiliary lube oil pump control (6Ø2), 1C RFPT turning gear motor switch (6Ø3) are located near the edge of the benchboards, but are not protected against inadvertent activation.

RESOLUTION: (Code: A) (Priority: 3) (Sched: 1st Refueling)

Install a hand rail at edge of console where controls are too close to edge. Hand rail should extend no more than three inches from console edge.

6Ø3 - 1C RPFT Turn Gear mtr stopped running.
Switch #IC3 1Ø6

6Ø2 - 1A & 1B Auxiliary Lube Oil Pump Control
1A & 1B Recirc Loop Generator Drive Motor

TRAINING REQUIREMENTS: None

PROCEDURE REQUIREMENTS: None

Team Approval Signature: Date:
( ) Additional page(s) attached

HED ASSESSMENT

HED No. I5-07

EP = 9

TITLE: Control Movement Difficulty

COMMENT: Westinghouse "pull- to- stop" switches difficult to operate.

Item: 4.5.6 Ref.: B5.5 Source: CRS

IDENTIFICATION: Panel: 652
Component Name: Westinghouse 'pull-to-stop' switches
ID or Number: See attached print

DESCRIPTION OF PROBLEM:

Same as comment above.

RESOLUTION: (Code: A) (Priority: N/A) (Sched: N/A)

Team members manipulated referenced controls. For these controls a compound motion (i.e., pulling and turning) is not the way they are used. Each motion is separate for specific reasons. None of the controls were found to be difficult to operate. This is not considered a discrepancy.

TRAINING REQUIREMENTS: None

PROCEDURE REQUIREMENTS: None

Team Approval Signature: Date:

( ) Additional page(s) attached

HED ASSESSMENT

HED No. I5-Ø8

EP = 6

TITLE: Position Detents

COMMENT: Rotary switches do not detent into each position.

Item: 4.5.7 Ref.: B5.7 Source: CRS

IDENTIFICATION: Panel: ØØC-681, other panels with similar switches
Component Name: CR-2940 type thumbswitches
ID or Number: N/A

DESCRIPTION OF PROBLEM:

Some small rotary switches such as those on ØØC-681 do not detent effectively in each position.

RESOLUTION: (Code: A) (Priority: N/A) (Sched: N/A)

Type CR-2940 has detents for each position. The switches have been manipulated by team members and found to have detents. These switches have been used at Peach Bottom for 10 years with no problem. This is not considered a discrepancy.

TRAINING REQUIREMENTS: None

PROCEDURE REQUIRLMENTS: None

Team Approval Signature: Date:

( ) Additional page(s) attached

HED ASSESSMENT

HED No. I5-Ø9

EP = 6

TITLE: Control Manipulation

COMMENT: Switches are difficult to manipulate.

Item: 4.5.8 Ref.: B5.9 Source: CRS

IDENTIFICATION: Panel: 655,668,ØØC-667
Component Name: Control switches (GE type)
ID or Number: See attached prints

DESCRIPTION OF PROBLEM:

Switches are located too close together to manipulate comfortably: Loop A and B service water and fuel pool pump switches (655); Reactor and turbine building cooling water switches (655); All switch arrays (668); Adjacent J-Handle key lock switches (ØØC-667).

RESOLUTION: (Code: B) (Priority: N/A) (Sched: N/A)

Although switches may be close, their operation is infrequent, deliberate and individually manipulated. Team members manipulated identified controls and found them adequate.

TRAINING REQUIREMENTS: None

PROCEDURE REQUIREMENTS: None

Team Approval Signature: Date:

( ) Additional page(s) attached

HED ASSESSMENT

HED No. I5-10

EP = 8

TITLE: Shape coding

COMMENT: No physical distinction between switches for pumps, valves, etc.

Item: 4.5.9 Ref.: B5.10 Source: CRS

IDENTIFICATION: Panel: 601,655
Component Name: Control switches (J-handles, T-handles, oval handels, etc.)
ID or Number: N/A

DESCRIPTION OF PROBLEM:

Same as comment above.

RESOLUTION: (Code: A) (Priority: 3) (Sched: 1st Refueling)

Existing convention for handle shapes versus application should be updated to include T-handles which are not presently mentioned. Controls will be checked against conventions and changed where deviations occurs to conform to convention.

TRAINING REQUIREMENTS: None

PROCEDURE REQUIREMENTS: None

Team Approval Signature: Date:

( ) Additional page(s) attached

HED ASSESSMENT

HED No. I5-11

EP = 4

TITLE: Control Handle Shapes Inconsistent

COMMENT: Controls are not shape coded consistently/conventionally.

Item: 4.5.10 Ref.: B5.10 Source: CRS

IDENTIFICATION: Panel: 651,652,653
Component Name: See below
ID or Number: See below

DESCRIPTION OF PROBLEM:

Panel 653 pump switches are not J-handles as on other panels, also No. 3 and 4 control valves below seat drain switches are not the same type. Panel 651 pump and open-close valve switches are different types. Panel 652 1A and 1B SJAE first stage valve selector switches are different.

RESOLUTION: (Code: A) (Priority: 3) (Sched: 1st Refueling)

All control handles will be reviewed and changed per the updated convention. (See I5-10.)

TRAINING REQUIREMENTS: None

PROCEDURE REQUIREMENTS: None

Team Approval Signature: Date:

( ) Additional page(s) attached

HED ASSESSMENT

HED No. I5-12

EP = 4

TITLE: Position Visibility

COMMENT: Switch knobs appear to obstruct position labels.

Item: 4.5.11 Ref.: B5.11 Source: CRS
4.5.12

IDENTIFICATION: Panel: 603,681,602
Component Name: See below
ID or Number: See below

DESCRIPTION OF PROBLEM:

Both RFPT control signal failure reset (603), and A & B reactor building recirculation fan and filter switch knobs (681) appear to obstruct the position setting labels. Rotary switches for 1A and 1B scoop tube brake are raised such that position settings are obscured (602).

RESOLUTION: (Code: A) (Priority: N/A) (Sched: N/A)

603 - RPFT - Signal Fail Lockout Relay - The flag is visible indicating position - the normal position is vertical facilitating visibility. The tripped position is left of center. This is not a discrepancy.
681 - Five position switch, the white pointer is clearly visible, the only obstruction is when the switch is moved and the operator's hand is on the control. This is not considered a discrepancy.
602 - 1A/1B scoop tube is clearly visible and not considered a discrepancy.

TRAINING REQUIREMENTS: None

PROCEDURE REQUIREMENTS: None

Team Approval Signature: Date:

( ) Additional page(s) attached

HED ASSESSMENT

HED No. SI1-Ø1

EP = 6

TITLE: Scale Differentiation

COMMENT: Dual scale indicator difficult to read.

Item: N/A Ref.: SB1.1 SB1.2 Source: SCRS

IDENTIFICATION: Panel: 654
Component Name: GE circular analog indicators
ID or Number: See below

DESCRIPTION OF PROBLEM:

Dual scale generator phase is difficult to read as it has an A,B,C amp scale indicator.

RESOLUTION: (Code: A) (Priority: 3) (Sched: 1st Refueling)

Indicator scale face will be improved using different colored scales and correlating scale color to selector switch position.

TRAINING REQUIREMENTS: None

PROCEDURE REQUIREMENTS: None

Team Approval Signature: Date:

( ) Additional page(s) attached

HED ASSESSMENT

HED No. SI1-Ø2

EP = 9

TITLE: Scale Readability

COMMENT: Small scale numerals inhibit scale readability.

Item: N/A Ref.: SB1.1 Source: SCRS

IDENTIFICATION: Panel: 67Ø
Component Name: GE Turbine Test panel analog indicators
ID or Number: All analog indicators

DESCRIPTION OF PROBLEM:

Turbine control test panel and on shaft voltage test device have small numerals on scales. Difficult to read from operator station.

RESOLUTION: (Code: B) (Priority: N/A) (Sched: N/A)

These indicators are used during testing. The operator is close to the displays during test, facilitating readability. No change is considered necessary.

TRAINING REQUIREMENTS: None

PROCEDURE REQUIREMENTS: None

Team Approval Signature: Date:

( ) Additional page(s) attached

HED ASSESSMENT

HED No. SI1-Ø3

EP = 6

TITLE: Scale Units

COMMENT: Process units not specified.

Item: N/A Ref.: SB1.4 Source: SCRS

IDENTIFICATION: Panel: 6Ø2
Component Name: Chart recorder
ID or Number: CRSH23-1R6Ø1/1R6Ø3

DESCRIPTION OF PROBLEM:

The cleanup inlet and outlet conductivity scales have no process units specified. (These recorders appear not to be installed completely.)

RESOLUTION: (Code: A) (Priority: N/A) (Sched: Fuel Load)

Process units for these recorders have been specified and will be verified.

- o INFLUENT IR6Ø1 .Ø5-1Ø umhos/cm
- o EFFLUENT IR6Ø3 .Ø5-1.Ø umhos/cm

TRAINING REQUIREMENTS: None

PROCEDURE REQUIREMENTS: None

Team Approval Signature: Date:

( ) Additional page(s) attached

HED ASSESSMENT

HED No. SI1-Ø4

EP = 6

TITLE: Scale Unit Readability

COMMENT: Drum counters difficult to read.

Item: N/A Ref.: SB1.6 Source: SCRS

IDENTIFICATION: Panel: 6Ø2
Component Name: Drywell floor & equip DR SUMP drum counter
ID or Number: FQ1S61-112/132

DESCRIPTION OF PROBLEM:

Small numerals on drum counter displays make it difficult to read them from the normal operator position.

RESOLUTION: (Code: B) (Priority: N/A) (Sched: N/A)

A redundant system located on ØØC-624 has been installed providing primary drywell leakage indication. The Drywell Floor and Drywell Equipment DR Sump drum counters are used as backups for verification of leakage, and the small numerals are not considered a problem.

TRAINING REQUIREMENTS: None

PROCEDURE REQUIREMENTS: None

Team Approval Signature: Date:

( ) Additional page(s) attached

HED ASSESSMENT

HED No. SI1-05

EP = 6

TITLE: Multiple and Logarithmic Scales

COMMENT: Use of multiple and logarithmic scales excessive.

Item: N/A Ref.: SB1.2 Source: SCRS

IDENTIFICATION: Panel: 602,655,00C-624,669,607,600,654,667
Component Name: Chart recorders
ID or Number: See attached prints

DESCRIPTION OF PROBLEM:

Many recorders use multiple or logarithmic scales - these should be minimized. See attached prints.

RESOLUTION: (Code: See below) (Priority: See below) (Sched: See below)

Log scales are used on radiation recorders. This is the appropriate scale to use for radiation which is required to cover an extremely wide range. (Code: A) (Priority: N/A) (Sched: N/A)

The use of multiple scale recorders has been minimized. Where used, the team found them to be appropriate in order to compare trends in different parameters. (Code: F) (Pri: 4) (Sched: N/A)

TRAINING REQUIREMENTS: None

PROCEDURE REQUIREMENTS: None

Team Approval Signature: Date:

( ) Additional page(s) attached

HED ASSESSMENT

HED No. SI1-06

SP = 12

TITLE: Regulation Guide 1.97 Instruments

COMMENT: Post accident monitoring indication not clearly identified.

Item: N/A Ref.: B6.1 and Reg. Guide 1.97 Source: SCRS

IDENTIFICATION: Panel: 652,670,603,600,602,626,601,647,667,624 & 648
Component Name: Post Accident Monitoring Instrumentation
ID or Number: See attached

DESCRIPTION OF PROBLEM:

Instruments that meet Reg. Guide 1.97 requirements are spread throughout the control room. They should be distinctly marked so that the operator can quickly identify them in post accident conditions.

RESOLUTION: (Code: A) (Priority: N/A) (Sched: Fuel Load)

Reg. Guide 1.97 indicators will be highlighted as part of the overall control panel enhancement effort. (See general discussion of enhancements.)

TRAINING REQUIREMENTS: None

PROCEDURE REQUIREMENTS: None

Team Approval Signature: Date:

( ) Additional page(s) attached

LIMERICK REG GUIDE 1.97 INSTRUMENTS

Variable	Indicator	Indicator Location
Suppression Pool Water Level	LI52-140 A & B	C626
Suppression Pool Water Temperature	T141-101,103	P626
Condensate Storage Tank Level	LR08-102,202	C652
Core Spray System Flow	FI52-1R601 A & B	C601
Drywell Pressure	PI57-121	C601
Main Steam Line Isol. Valve Leakage Control System	PI40-151 B,F,K,P & PI40-1R656	C626
Drywell Atmosphere Temp.	TR57-122	C601
Primary Containment & Drywell Pressure	PI42-101, PR57-101 PR57-101(PEN 1)	C601
Reactor Coolant System Level	XR42-1R623 H & B (NOTE 2 & 5)	C601
Reactor Coolant System Pressure	PT42-103 A & B (NOTE 2 & 3)	C601
LPCI System Flow	FI51-1R03 A,B,C,D (NOTE 2)	C601
RHR System Flow	FI51-1R03 A,B,C,D (NOTE 2)	C601
Drywell Spray Flow	FI51-1R03 A,B,C,D (NOTE 2)	C601
Suppression Chamber Spray Flow	FI51-1R03 A,B,C,D (NOTE 2)	C601
RCIC Flow	FI49-1R600-1	C648
RHR SW System Flow (Cooling H O to ESF)	FI51-1R602 A & B (Non-linear indicator)	C667

Variable	Indicator	Indicator Location
RHR System, RHR SW Temp. (Cooling water to ESF comp.)	TI51-105 A & B	C601
ESW Flow (Cooling water to ESF System)	FI11-013 A & B	C667
Cooling Water System, Cooling Water Temp, to ESF System	TI11-007 A & B	C667
RHR Heat Exchanger Outlet Temperature	TI51-127 A & B	C601
HPCI Flow	DFI55-1R600-1 (NOTE 2)	C647
Radwaste System, High Radioactive Liquid Tank Level (Equipment Drain Collection Tank)	LI62-010	00C303
Radwaste System, High Radioactive Liquid Tank Level (Floor Drain Collection Tank)	LI63-001	00C303
Radwaste System, High Radioactive Liquid Tank Level (Chemical Waste Collection Tank)	LI64-001	OBC304
Containment O_2 & H_2 Concentration	O AI57-150-1,187-1 H AI57-151-1,188-1	C600
Drywell Floor Drain & Equip. Drain Sumps	LI61-115,135,161,162	P626
Cond & FW System Main Feedwater Flow	FRC32-1R607 FIC32-1R604 A, B, C	C603
Main Steam Bypass Valve Position	ZI01-105 A, B, C, D, E, F, G, H, I	C670
Condenser Hotwell Level	LR05-101	C652
Condenser Pressure	ERFDS CRT	Later

SI1-Ø6

Variable	Indicator	Indicator Location
Circulating Water Pump Discharge Pressure	PIØ9-117 A, B, C, D	C652
Reactor Recirculation Flow	FR43-1R614	C6Ø2
Primary Containment Inst. Gas	NA	ERFDS CRT
CRD Hydraulic Changing Water Pressure	PIS46-IN6ØØ	C6Ø3
RCS Soluble Boron Concentration	----	----
SLCS Flow	----	----
SLCS Storage Tank Level	ERFDS is being considered.	----
Type C: Prim. Containment Area Radiation (Cat. 3)	RIX-26-191 A thru D	RIX in Panel OOC691
Type E: Prim. Containment Area Radiation - High Range (Cat. 1)	RR-26-171 A & B	RR 1OC6ØØ
	RMMS Display/Printer	RMMS Display Devices in CR Consoles
Type C: Containment Effluents Radioactivity - Noble Gases (from identified release points) Cat. 3	a) RIX-26-Ø76 b) RR-26-Ø76 c) RMMS Display Radiology/Meteorology Monitor System (located near Panel OOC675, behind Unit 1 Vertical Boards)	a) OOC691 b) ØØC624 c) Control Room Consoles
Type E: Noble gases and vent flow rate Commen plant vent for all releases (including SGTS)		
Particulates and Halogens - all identified release points sampling with analysis capability.		

SI1-06

Variable	Indicator	Indicator Location
Reactor Building or Secondary	Local Indicating	Local for station
Containment Area Radiation	Station, RMMS Display	Control room for RMMS
Radiation Exposure Rate	Station, RMMS Display	Control room for RMMS

HED ASSESSMENT

HED No. SI2-Ø1

EP = 6

TITLE: Recorder Color Contrast

COMMENT: Contrast between green and blue ink is poor.

Item: N/A Ref.: SB2.2 Source: SCRS

IDENTIFICATION: Panel: ØØC-655
Component Name: Chart Recorder
ID or Number: FRØ9-1Ø1

DESCRIPTION OF PROBLEM:

The blue and green inks used on the cooling tower blowdown recorder are difficult to distinguish from each other.

RESOLUTION: (Code: A) (Priority: N/A) (Sched: N/A)

This situation is due to infrequent use of pens or pens that are drying out. The recorder pens are felt-tipped and contrast is acceptable under normal situations. This discrepancy is due to the construction status of the control room.

TRAINING REQUIREMENTS: None

PROCEDURE REQUIREMENTS: None

Team Approval Signature: Date:

( ) Additional page(s) attached

HED ASSESSMENT

HED No. SI2-Ø2

EP = 8

TITLE: Recorder Display

COMMENT: Recorders do not clearly display information.

Item: N/A Ref.: SB2.1 SB2.2 Source: SCRS

IDENTIFICATION: Panel: 603,668
Component Name: Chart Recorders
ID or Number: 603(all recorders), 668(TRS19-114)

DESCRIPTION OF PROBLEM:

Multi-channel recorders do not clearly display the channel being plotted (603). RFP turbine lube oil and thrust bearing temperature recorders (668).

RESOLUTION: (Code: A) (priority: N/A) (Sched: N/A)

A clear window with a drum display on each recorder indicates the channel being printed. This is not a discrepancy.

TRAINING REQUIREMENTS: None

PROCEDURE REQUIREMENTS: None

Team Approval Signature: Date:

( ) Additional page(s) attached

HED ASSESSMENT

HED No. SI2-Ø3

EP = 4

TITLE: Scale Subdivisions

COMMENT: Some scales have non-standard subdivisions.

Item: N/A Ref.: B2.13 Source: SCRS

IDENTIFICATION: Panel: RSP
Component Name: Linear Analog Indicators
ID or Number: See below

DESCRIPTION OF PROBLEM:
Suppression pool level scaled Ø-15-3Ø, etc.
Reactor level scaled +5Ø, Ø, -5Ø, etc.
Should be scaled in multiples of 1, 2, or 5. Note: Suppression Pool tagged for change.

RESOLUTION: (Code: A) (Priority: N/A) (Sched: Fuel Load)

See HED I2-11.

TRAINING REQUIREMENTS: None

PROCEDURE REQUIREMENTS: None

Team Approval Signature: Date:

( ) Additional page(s) attached

HED ASSESSMENT

HED No. SI2-Ø5

EP = 12

TITLE: Indicator Zone Markings

COMMENT: No zones marked on indicators.

Item: N/A Ref.: B2.1 B3.15 Source: SCRS

IDENTIFICATION: Panel: 673,RSP
Component Name: Linear Analog Indicators
ID or Number: See attached print

DESCRIPTION OF PROBLEM:

Indicators are not marked to show normal/abnormal, safe/unsafe ranges of operations.

RESOLUTION: (Code: A) (Priority: N/A) (Sched: Fuel Load)

See HED I2-Ø1.

TRAINING REQUIREMENTS: None

PROCEDURE REQUIREMENTS: None

Team Approval Signature: Date:

( ) Additional page(s) attached

HED ASSESSMENT

HED No. SI2-Ø6

EP = 4

TITLE: Scale Comparison

COMMENT: Comparative reading of scales hampered by varying scales.

Item: N/A Ref.: B2.1Ø Source: SCRS

IDENTIFICATION: Panel: 673
Component Name: Linear Analog Indicators
ID or Number: TI7Ø-1Ø8A & B, PI7Ø-111A & B, TI79-3Ø3A, PI79-3Ø4A

DESCRIPTION OF PROBLEM:

Have scales beginning at 6Ø or at Ø for pressure and temperature. Appears difficult to compare readings. Operational normal readings must be investigated further.

RESOLUTION: (Code: A) (Priority: 4) (Sched: N/A)

Scale differences are due to different parameters being indicated (i.e. Pressure and Temperature). Normal range is 1/2 to 2/3 scale range hence the 6Ø starting point for temperature. This is not a discrepancy.

TRAINING REQUIREMENTS: None

PROCEDURE REQUIREMENTS: None

Team Approval Signature: Date:

( ) Additional page(s) attached

HED ASSESSMENT

HED No. SI2-Ø7

EP = 6

TITLE: Indicator Failure

COMMENT: Failure mode is not obvious on all indicators.

Item: N/A Ref.: B2.17 Source: SCRS

IDENTIFICATION: Panel: 673
Component Name: Linear Analog Indicators
ID or Number: Same as SI2-Ø6 and CI69-155

DESCRIPTION OF PROBLEM:

Several indicators have no obvious failure indication, this compounded by scale ranges beginning at 6Ø versus Ø for temp indicators and the conductivity indicator.

RESOLUTION: (Code: A) (Priority: N/A) (Sched: Fuel Load)

All operational linear analog indicators fail off scale low. Operators will be trained in this characteristic of failure mode.

TRAINING REQUIREMENTS:

Training Operators as indicated above.

PROCEDURE REQUIREMENTS: None

Team Approval Signature: Date:

( ) Additional page(s) attached

HED ASSESSMENT

HED No. SI2-Ø8

EP = 6

TITLE: Controller Indicator Direction

COMMENT: Drum rotation opposite thumbwheel motion

Item: N/A Ref.: B2.7 Source: SCRS

IDENTIFICATION: Panel: Those panels containing Bailey controllers
Component Name: Bailey Controller
ID or Number: See attached photo.

DESCRIPTION OF PROBLEM:

Rotation of the drum with number is opposite the motion of the controlling thumbwheel. To increase, thumbwheel motion is up as it should be. The drum rotates down as the numbers increase. This does not follow control movement and operator expectations.

RESOLUTION: (Code: B) (Priority: N/A) (Sched: Fuel Load)

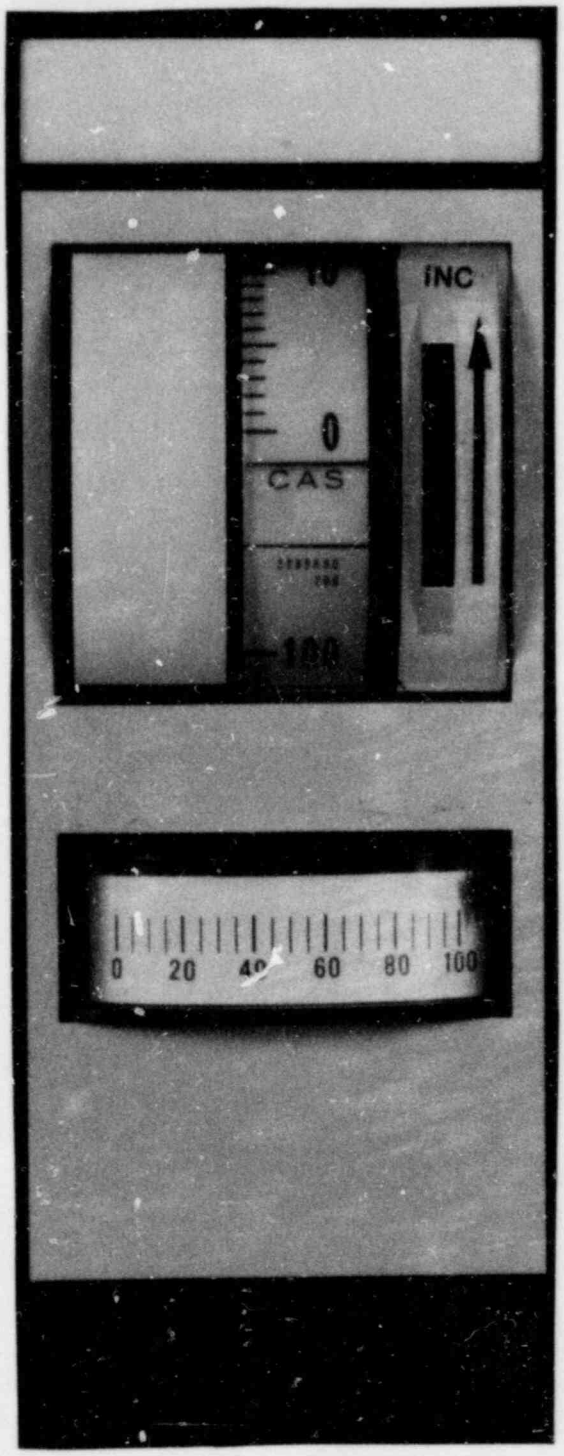
The fundamental increase motion of the thumbwheel corresponds with a numerical increase on the drum (upward thumb motion causes increase in numerical values). The fact that the drum rotates counter to thumbwheel direction is not considered a significant detriment to operation of controller. To aid operators an arrow indicating 'INCREASE' will be placed next to the thumbwheel.

TRAINING REQUIREMENTS: None

PROCEDURE REQUIREMENTS: None

Team Approval Signature: Date:

( ) Additional page(s) attached


INC
0
CAS
0 20 40 60 80 100

HED ASSESSMENT

HED No. SI2-09

EP = 6

TITLE: Controller Open/Close Pushbuttons

COMMENT: Open/Close pushbutton arrangement inconsistent

Item: N/A Ref.: B2.7 Source: SCRS

IDENTIFICATION: Panel: 670
Component Name: Bailey Controller
ID or Number: TIC 10-124 (See photo), HI-CO2-115

DESCRIPTION OF PROBLEM:

In these two cases, the manual 'Open-Close' pushbuttons are arranged with open on the left and close on the right. Assuming the scale indicates 0 - 100% and 100% is open and 0% closed, this arrangement is wrong. In addition, the arrangement is inconsistent with another position indication of 'closed on the left and open on the right.'

RESOLUTION: (Code: A) (Priority: N/A) (Sched: N/A)

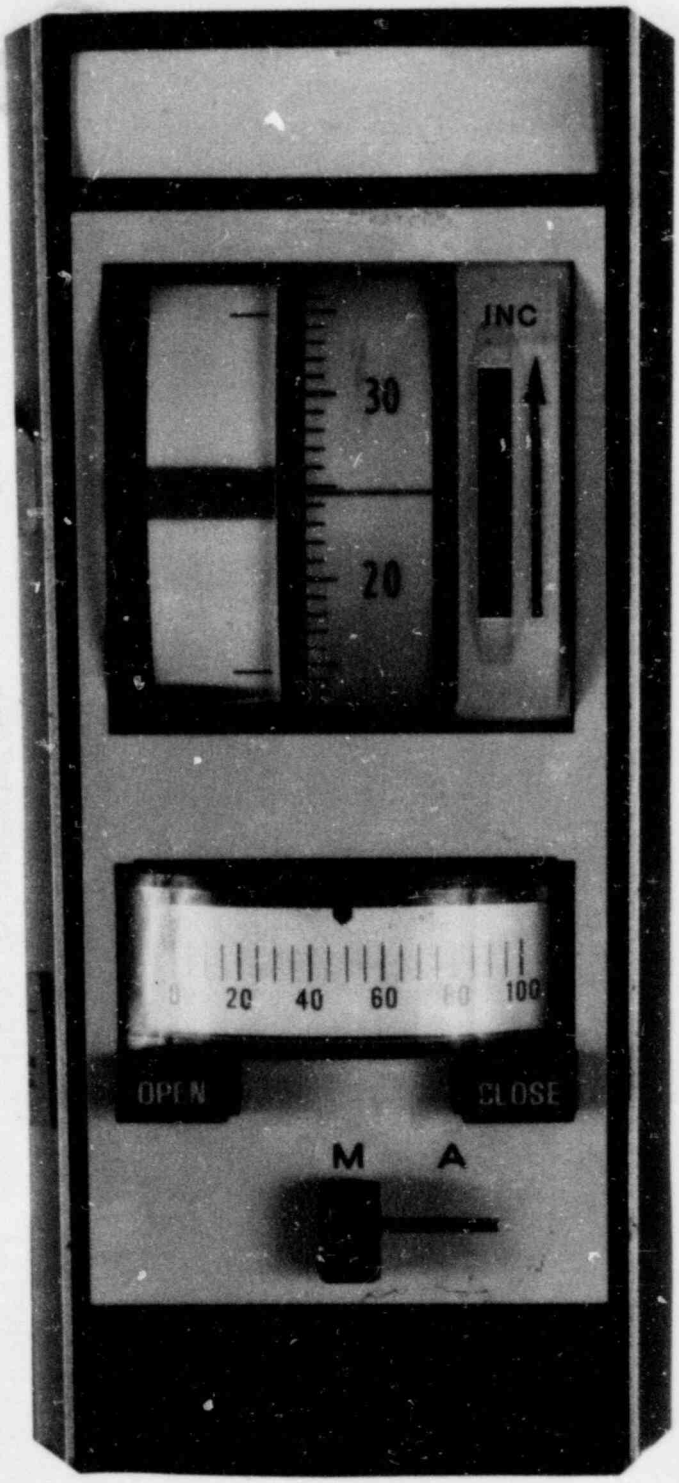
Pushbuttons positions have been corrected and are in the correct configuration.

TRAINING REQUIREMENTS: None

PROCEDURE REQUIREMENTS: None

Team Approval Signature: Date:

( ) Additional page(s) attached


INC
30
20
0
20
40
60
80
100
OPEN
CLOSE
M
A

HED ASSESSMENT

HED No. SI2-10

EP = 8

TITLE: Recorder Power Failure

COMMENT: Recorder fail "as is" on loss of recorder power.

Item: N/A Ref.: SB2.1 Source: SCRS

IDENTIFICATION: Panel: All with Recorders
Component Name: Pen Recorders
ID or Number: N/A

DESCRIPTION:

Failure of recorder power is not alarmed or indicated. Due to slow chart advance rates, cessation of chart motion is not a good indicator or loss of power.

RESOLUTION: (Code: A) (Priority: 3) (Sched: 1st Refueling)

Install a small power-available light on all recorders.

TRAINING REQUIREMENTS: Mod. Package

PROCEDURE REQUIREMENTS: Mod. Package

Team Approval Signature: Date:

( ) Additional page(s) attached

HED ASSESSMENT

HED No. SI2-11

EP = 3

TITLE: Scale Subdi .ions

COMMENT: Indicators are scaled with incorrect decimal multiples.

Item: N/A Ref.: B2.13 Source: SCRS

IDENTIFICATION: Panel: ØØC-655
Component Name: Schuylkill Blowdown Makeup Pump Discharge A & B and Backup Service Air Receiver Scales Scales
ID or Number: N/A

DESCRIPTION:

Listed indicating devices are scaled with subdivisions in decimal multiples other than recommended 1, 2, or 5.

RESOLUTION: (Code: A) (Priority: N/A) (Sched: Fuel Load)

See HED I2-11.

TRAINING REQUIREMENTS: None

PROCEDURE REQUIREMENTS: None

Team Approval Signature: Date:

( ) Additional page(s) attached

HED ASSESSMENT

HED No. SI3-Ø1

EP = 12

TITLE: Alarm Point Identification

COMMENT: No alarm point identified on recorder.

Item: N/A Ref.: B3.3 Source: SCRS

IDENTIFICATION: Panel: 673
Component Name: Chart Recorders
ID or Number: See attached print

DESCRIPTION OF PROBLEM:
Charcoal system vault temps recorder doesn't identify the alarm point. Other recorders appeared to have red tape on recorder glass to indicate alarm point. This seems too temporary to be a standard practice.

RESOLUTION: (Code: A) (Priority: N/A) (Sched: Fuel Load)

See HED I2-Ø1.

TRAINING REQUIREMENTS: None

PROCEDURE REQUIREMENTS: None

Team Approval Signature: Date:

( ) Additional page(s) attached

HED ASSESSMENT

HED No. SI3-Ø2

EP = 6

TITLE: Chart Paper Scale

COMMENT: Incorrect chart paper

Item: N/A Ref.: B3.2 Source: SCRS

IDENTIFICATION: Panel: 673
Component Name: Chart Recorder
ID or Number: TR7Ø-124

DESCRIPTION OF PROBLEM:
Charcoal system vault temps recorder uses paper with different scale than on recorder.

RESOLUTION: (Code: A) (Priority: N/A) (Sched: Fuel Load)

This HED was written during construction.
All recorders will be provided with correct paper.
See HED I3-Ø2.

TRAINING REQUIREMENTS: None

PROCEDURE REQUIREMENTS: None

Team Approval Signature: Date:

( ) Additional page(s) attached

HED ASSESSMENT

HED No. SI4-01

EP = 4

TITLE: Key Switches

COMMENT: Excessive use of key switches

Item: N/A Ref.: SB4.2 Source: SCRS

IDENTIFICATION: Panel: 603,626
Component Name: Key switches
ID or Number: See attached prints

DESCRIPTION OF PROBLEM:

There appears to be an excessive numbers of key switches - particularly on the stop check valves (603).

RESOLUTION: (Code: A) (Priority: N/A) (Sched: N/A)

a. The Standby Liquid control system on panel 603 uses key switches to prevent accidental injection of boron during shutdown. This is a legitimate use of key switches.

b. The MSIV Leak Control system on panel 626 is a normally de-energized system. However, it requires periodic testing while the reactor is at power. Since this system is connected to the main steam lines, key switches are appropriate to prevent high pressure steam from entering lines intended for low pressures.

TRAINING REQUIREMENTS: None

PROCEDURE REQUIREMENTS: None

Team Approval Signature: Date:

( ) Additional page(s) attached

HED ASSESSMENT

HED No. SI4-Ø2

EP = 6

TITLE: Pushbutton Barriers

COMMENT: No barriers used with contiguous pushbuttons.

Item: N/A Ref.: SB4.1 Source: SCRS

IDENTIFICATION: Panel: ØØC-626
Component Name: Temp. monitor control
ID or Number: See attached print

DESCRIPTION OF PROBLEM:

Suppression pool temperature pushbuttons are small and contiguous, but lack barriers between them to prevent accidental activation.

RESOLUTION: (Code: A) (Priority: N/A) (Sched: N/A)

The suppression pool temperature monitoring system provides a keyboard to select different temperature indications. The keyboard is similar to a normal desk calculator and appears suitable for that purpose. There is no significant consequence of inproper operation by pressing a wrong button. There is a 'clear' button for errors.

TRAINING REQUIREMENTS: None

PROCEDURE REQUIREMENTS: None

Team Approval Signature: Date:

( ) Additional page(s) attached

HED ASSESSMENT

HED No. SI4-Ø3

EP = 4

TITLE: Indicator Light Failure

COMMENT: No obvious method of diagnosing failed indicator lights.

Item: N/A Ref.: B4.4 Source: SCRS

IDENTIFICATION: Panel: 673
Component Name: Indicating lights
ID or Number: All

DESCRIPTION OF PROBLEM:
Same as comment above.

RESOLUTION: (Code: A) (Priority: N/A) (Sched: N/A)

All indicator lights have dual-bulbs for redundancy. A failed bulb would not result in a loss of indication, but would appear dim, thereby indicating the need to replace failed bulbs.

TRAINING REQUIREMENTS: None

PROCEDURE REQUIREMENTS: None

Team Approval Signature: Date:

( ) Additional page(s) attached

HED ASSESSMENT

HED No. SI4-Ø4

EP = 6

TITLE: Indicator Light Failure

COMMENT: A failed bulb cannot be distinguished from a normal condition.

Item: N/A Ref.: B4.2 Source: SCRS

IDENTIFICATION: Panel: RSP
Component Name: See below
ID or Number: N/A

DESCRIPTION:

RCIC turbine trip
RCIC turbine bearing oil pressure low
RCIC high and low pressure bearing oil temperature high
RHR heat exchanger outlet radiation high
RHR service water loop return radiation high

* Bulbs are new, blue tag-tested, preop tested and safety tested. Normally this panel is deenergized until control is transfered. Failure within lst refueling cycle is highly unlikely. This RSP room is controlled and locked at all times by supervisors.

RESOLUTION: (Code: A) (Priority: 1) (Sched: lst Refueling)

The five lights indicated should be replaced with testable sockets. These lights are tested prior to operation. They are not on unless there is an emergency, so they would not burn out.

TRAINING REQUIREMENTS: None

PROCEDURE REQUIREMENTS:

Testable sockets on RSP should be tested after transfer and stabilization are completed.

Team Approval Signature: Date:

( ) Additional page(s) attached

HED ASSESSMENT

HED No. SI5-Ø1

EP = 4

TITLE: Label Obstruction

COMMENT: Actuation of high controls obstructs labels.

Item: N/A Ref.: B5.11 Source: SCRS

IDENTIFICATION: Panel: RSP
Component Name: N/A
ID or Number: See attached print

DESCRIPTION OF PROBLEM:

Operator hand obscures labels when activating high controls.

RESOLUTION: (Code: A) (Priority: N/A) (Sched: Fuel Load)

The placement labeling of this panel will rectify this discrepancy. (See general discussion of enhancements.)

TRAINING REQUIREMENTS: See attached.

PROCEDURE REQUIREMENTS: None

Team Approval Signature: Date:

( ) Additional page(s) attached

HED ASSESSMENT

HED No. SI5-Ø2

EP = 6

TITLE: Control Height

COMMENT: Valve control too high.

Item: N/A Ref.: B5.3 Source: SCRS

IDENTIFICATION: Panel: RSP
Component Name: See below
ID or Number: See below

DESCRIPTION OF PROBLEM:

RHR Headspray Inboard Isolation valve appears high for normal usage.

RESOLUTION: (Code: B) (Priority: 4) (Sched: N/A)

Although this control is high, it is infrequently used and when used would be in a very deliberate, controlled situation. It is not considered a significant operation problem. (See HED D1-Ø1.)

TRAINING REQUIREMENTS: None

PROCEDURE REQUIREMENTS: None

Team Approval Signature: Date:

( ) Additional page(s) attached

HED ASSESSMENT

HED No. SI5-Ø3

EP = 6

TITLE: Control Actuation Consistency

COMMENT: Control does not move in consistent/expected direction.

Item: N/A Ref.: B5.1 Source: SCRS

IDENTIFICATION: Panel: RSP
Component Name: See below
ID or Number: See below

DESCRIPTION OF PROBLEM:

All valves on RSP move close/open except the Main Steam Relief Valve which moves open/close.

RESOLUTION: (Code: A) (Priority: 1) (Sched: Fuel Load)

The switch was correctly installed (electrically); escutcheon plate has been replaced with one having proper "open-close" indication.

TRAINING REQUIREMENTS: None

PROCEDURE REQUIREMENTS: None

Team Approval Signature: Date:

( ) Additional page(s) attached

HED ASSESSMENT

HED No. SI5-Ø4

EP = 6

TITLE: Control Movement

COMMENT: Switch does not move in expected direction.

Item: N/A Ref.: B5.1 Source: SCRS

IDENTIFICATION: Panel: 673
Component Name: See below
ID or Number: HSS69-133

DESCRIPTION OF PROBLEM:

Recombiner heater select switch moves "A - OFF - B - A&B" instead of "A - B - A&B - OFF."

RESOLUTION: (Code: F) (Priority: N/A) (Sched: N/A)

This is against convention for a very specific safety reason. If A or B fails the switch is configured such that it does not permit travel through the failed heater position to turn the other heater on. Tag-out procedures would prevent movement through failed heater position. This is not a discrepancy.

TRAINING REQUIREMENTS: None

PROCEDURE REQUIREMENTS: None

Team Approval Signature: Date:

( ) Additional page(s) attached

HED ASSESSMENT

HED No. SI5-05

EP = 12

TITLE: Control Manipulation Fatiguing

COMMENT: Pushbuttons induce excessive fatigue.

Item: N/A Ref.: B5.5 Source: SCRS

IDENTIFICATION: Panel: 603
Component Name: Control rod insert, withdrawal, continuous insert and continuous withdrawal buttons.
ID or Number: N/A

DESCRIPTION:

Pushbuttons require single finger operation for extended periods of time inducing excessive fatigue.

RESOLUTION: (Code: A) (Priority: N/A) (Sched: Fuel Load)

Replace with palm actuated pushbuttons.

TRAINING REQUIREMENTS: None

PROCEDURE REQUIREMENTS: None

Team Approval Signature: Date:

( ) Additional page(s) attached

HED ASSESSMENT

HED No. SI5-Ø6

EP = 9

TITLE: Switch Positions

COMMENT: Switch positions are not clearly marked.

Item: N/A Ref.: B5.2 B5.11 Source: SCRS

IDENTIFICATION: Panel: ØØC-655
Component Name: N/A
ID or Number: HV15-117/217

DESCRIPTION:

Backup service air distribution valves.

RESOLUTION: (Code: A) (Priority: N/A) (Sched: N/A)

This is a four position control - Unit 1, CLOSE, UNIT 2, UNITS 1 & 2. The black backing plate is clearly marked. There is backup indicating light directly above the control. This is not a discrepancy.

TRAINING REQUIREMENTS: None

PROCEDURE REQUIREMENTS: None

Team Approval Signature: Date:

( ) Additional page(s) attached

HED ASSESSMENT

HED No. SI5-Ø7

EP = 4

TITLE: Position Visibility

COMMENT: Oval handles appear to obstruct switch positions on backing plate.

Item: N/A Ref.: B5.11 Source: SCRS

IDENTIFICATION: Panel: ØØC-655
Component Name: See below.
ID or Number: HV15-117/217

DESCRIPTION:

Oval handle appears to obscure settings on Backup Service Air Control.

RESOLUTION: (Code: A) (Priority: N/A) (Sched: N/A)

See HED SI5-Ø6

TRAINING REQUIREMENTS: None

PROCEDURE REQUIREMENTS: None

Team Approval Signature: Date:

( ) Additional page(s) attached

HED ASSESSMENT

HED No. SI5-Ø8

EP = 6

TITLE: Control Near Console Edge

COMMENT: Controls too near edge of console and can potentially result in inadvertent operation.

Item: 4.5.5 Ref.: B5.4 Source: SCRS

IDENTIFICATION: Panel: ØØC-655
Component Name: See below.
ID or Number: See below.

DESCRIPTION:

Back-up service air compression, back-up service distribution valves, and C-Schuykill make-up pump are located near edge of the benchboards, but are not protected against inadvertent actuation.

RESOLUTION: (Code: A) (Priority: 3) (Sched: 1st Refueling)

A guard/hand rail will be installed to protect against inadvertant actuation. (See HED I5-Ø6 and SI6-Ø1.)

TRAINING REQUIREMENTS: None

PROCEDURE REQUIREMENTS: None

Team Approval Signature: Date:

( ) Additional page(s) attached

HED ASSESSMENT

HED No. SI6-Ø1

EP = 9

TITLE: Inadver Activation

COMMENT: Low swi and valves not guarded against inadvertent activation.

Item: N/A .: B6.2 Source: SCRS

IDENTIFICATION: Panel: R.
Component Name: Lar[illegible]aled pistol grip transfer switches
ID or Number: See print

DESCRIPTION OF PROBLEM:

Controls mounted excessively low on RSP may be accidentally bumped by operator (saw it happen twice while there).

RESOLUTION: (Code: A) (Priority: 2) (Sched: 1st Refueling)

Install a flat stainless steel guardrail, approximately 1/8" x 2" along the length of panel at 38 inches from floor. The rail should be mounted 3" away from the panel face to prevent inadvertent control activation.

TRAINING REQUIREMENTS: None

PROCEDURE REQUIREMENTS: None

The accidental bumping of transfer switches observed was by construction personnel, panel was de-energized. This RSP is in a controlled access room.

Team Approval Signature: Date:

( ) Additional page(s) attached

HED ASSESSMENT

HED No. P1-01

EP =

TITLE: Procedures and Training

COMMENT: Update procedures and training to reflect enhancements on panels.

Item: N/A Ref.: N/A Source: SCRS

IDENTIFICATION: Panel: All
Component Name: N/A
ID or Number: N/A

DESCRIPTION:
Enhancements have relabeled most controls and displays as a result of implementing hierarchy labeling. Procedures must be updated to reflect new labels. Training must be informed of new nomenclature and of enhancement approach.

RESOLUTION: (Code: A) (Priority: N/A) (Sched: Fuel Load)

Operations will be provided with the manual of standard nomenclature and abbreviations used in the enhanced control room. Also, a list of names that have been changed substantially from the original control room labeling will be provided. Training will be provided with the manual of standard nomenclature and a description of the enhancement conventions used.

TRAINING REQUIREMENTS:

Provide nomenclature and enhancement convention.

PROCEDURE REQUIREMENTS:

Provide nomenclature and list of major changes in labels.

Team Approval Signature: Date:

( ) Additional page(s) attached

HEDs HELD FOR FURTHER REVIEW

HED ASSESSMENT

HED No. A1-11

EP = 3

TITLE: Annunciator Tile Color Contrast

COMMENT: Low contrast between amber and white tiles (bulbs)

Item: 5.14 Ref.: C2.8 C3 Source: CRS

IDENTIFICATION: Panel: All
Component Name: Annunciator System
ID or Number: N/A

DESCRIPTION OF PROBLEM:

Alarms have been prioritized through the use of red and amber bulbs. There appears to be little contrast between the amber and white tiles when illuminated.

MITIGATING CONSIDERATIONS:

POSSIBLE SOLUTIONS:

Remove amber bulbs; use only red and white bulbs. This, used in conjunction with prioritizing windows and matrix identifers, will facilitate window indentification.

RESOLUTION: (Code) (Priority) (Sched:)

TRAINING REQUIREMENTS:

PROCEDURE REQUIREMENTS:

Approval Signature: Date:

( ) Additional page(s) attached

HED ASSESSMENT

HED No. I5-Ø4

EP = 9

TITLE: Emergency Switch Position Markings

COMMENT: Emergency pushbutton switches have no obvious position markings for disarmed/armed position.

Item: 4.5.3 Ref.: B5.2 Source: CRS

IDENTIFICATION: Panel: Various
Component Name: Emergency pushbutton switches
ID or Number: N/A

DESCRIPTION OF PROBLEM:

Emergency pushbutton switches have a small red line on side of collars indicating position; this line is not readily apparent to the operator.

MITIGATING CONSIDERATIONS:

POSSIBLE SOLUTIONS:

See attached.

RESOLUTION: (Code) (Priority) (Sched:)

TRAINING REQUIREMENTS:

PROCEDURE REQUIREMENTS:

Approval Signature: Date:

( ) Additional page(s) attached

HED ASSESSMENT

HED No. SI2-04

EP = 6

TITLE: Indicator Glare

COMMENT: Glare from ambient lighting exists on higher indicators.

Item: N/A Ref.: B2.2 Source: SCRS

IDENTIFICATION: Panel: RSP
Component Name: Linear Analog Indicators
ID or Number: See attached print.

DESCRIPTION OF PROBLEM:

Same as above.

RESOLUTION: (Code: ?) (Priority:) (Sched:)

Permanent lighting not installed at time of surveying. A drop ceiling with diffused lighting is planned. It will be checked after permanent lighting is installed.

TRAINING REQUIREMENTS:

PROCEDURE REQUIREMENTS:

Team Approval Signature: Date:

( ) Additional page(s) attached

HED ASSESSMENT

HED No. SD3-15

EP = 9

TITLE: Control Location

COMMENT: Manual Initiation pushbutton is not located near signal lock-in control.

Item: N/A Ref.: A3.1 TDA Source: SCRS

IDENTIFICATION: Panel: 647,648
Component Name: Manual Initiation, Signal Lock-in
ID or Number: 464,463,(647): 426,459,(648)

DESCRIPTION OF PROBLEM:

These controls appear to be related in the initiation of HP Injection and in Reactor Coolant Isolation Cooling, but they are separated and grouped with isolation and turbine trip controls.

MITIGATING CONSIDERATIONS:

POSSIBLE SOLUTIONS: (Code A)

The pushbutton will be relocated to be with its functional group.

RESOLUTION: (Code) (Priority) (Sched:)

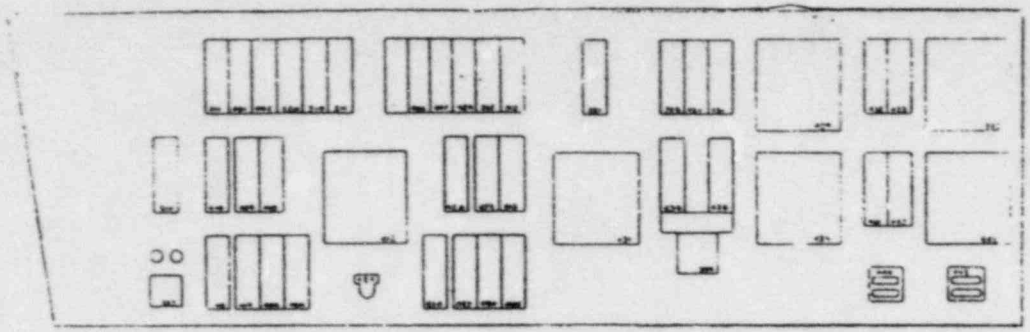
TRAINING REQUIREMENTS:

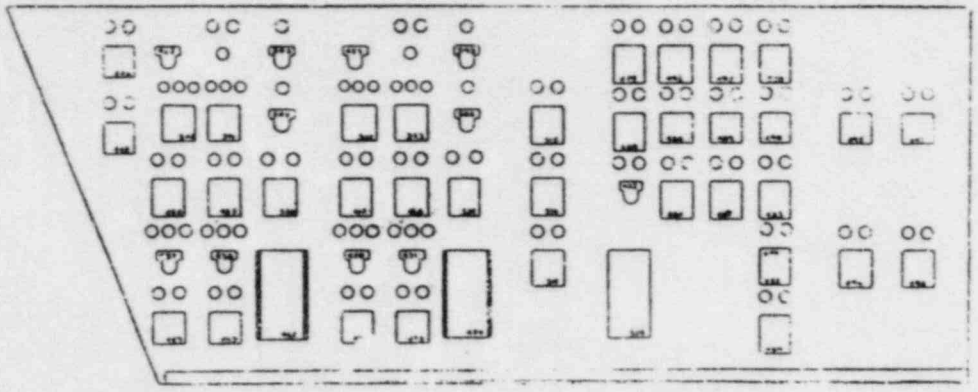
PROCEDURE REQUIREMENTS:

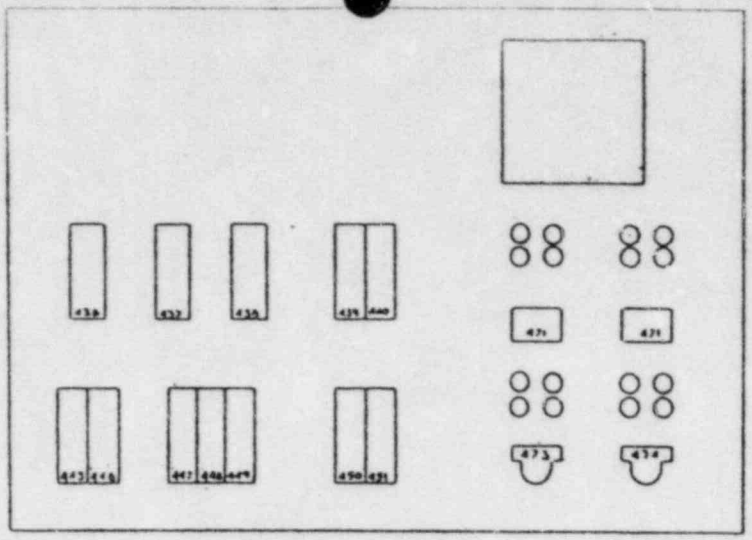
Approval Signature: Date:

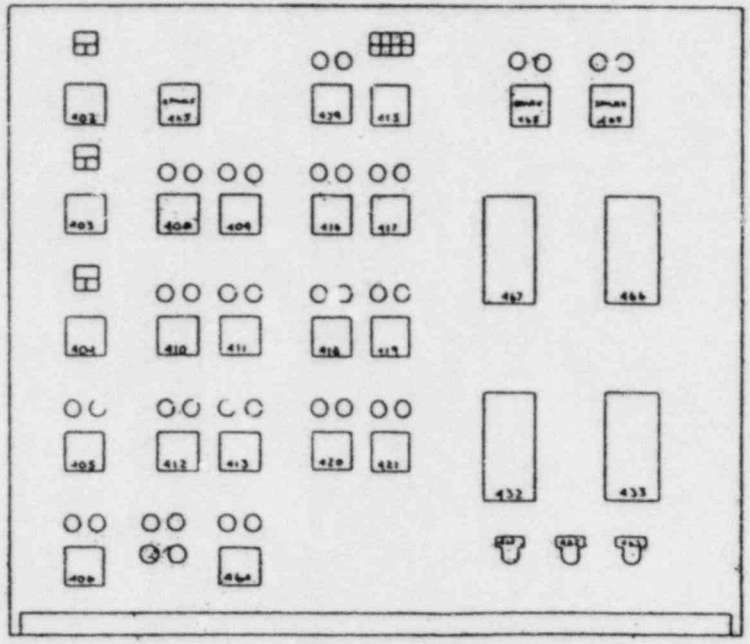
( ) Additional page(s) attached

SELECTED PANEL PRINTS









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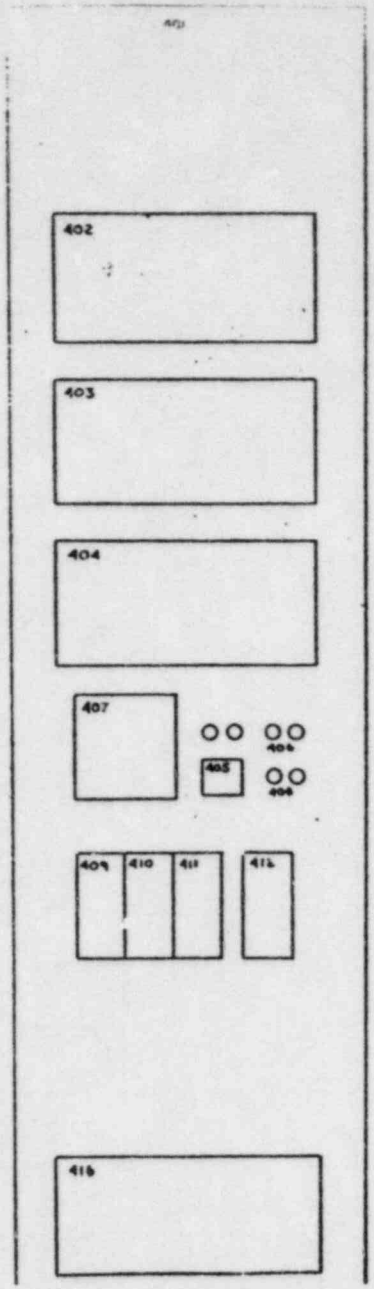

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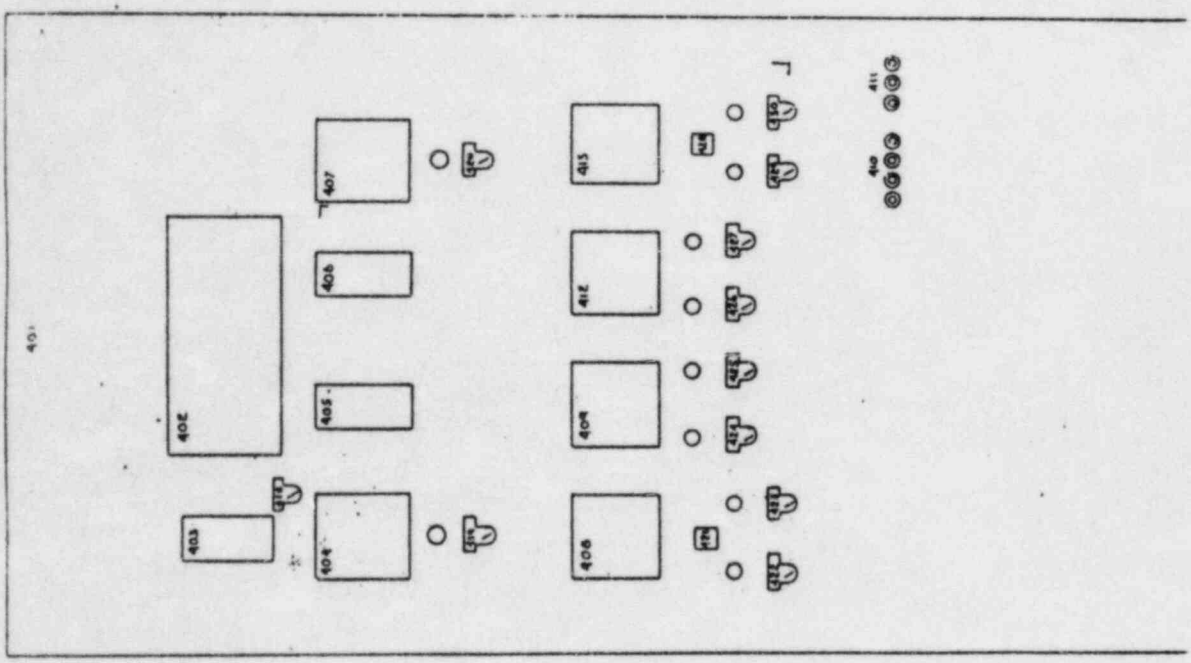
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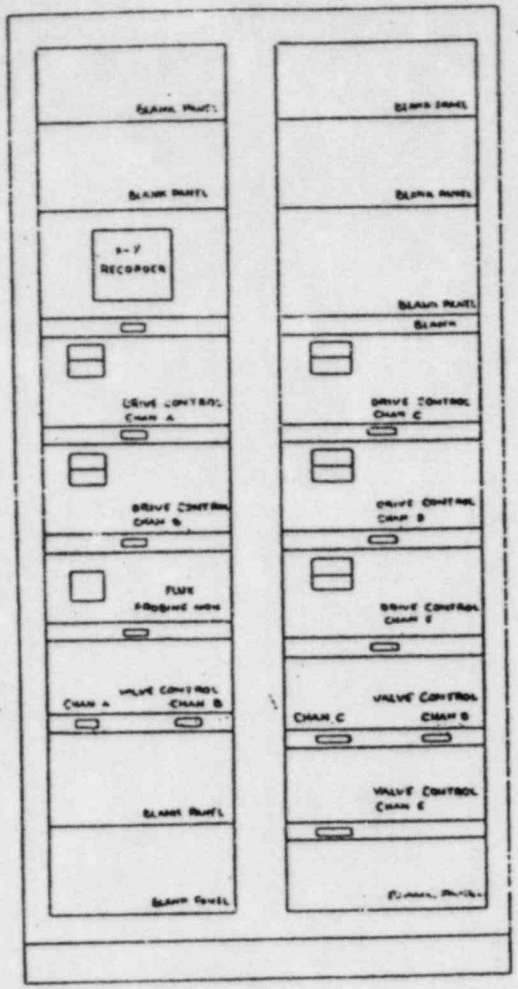
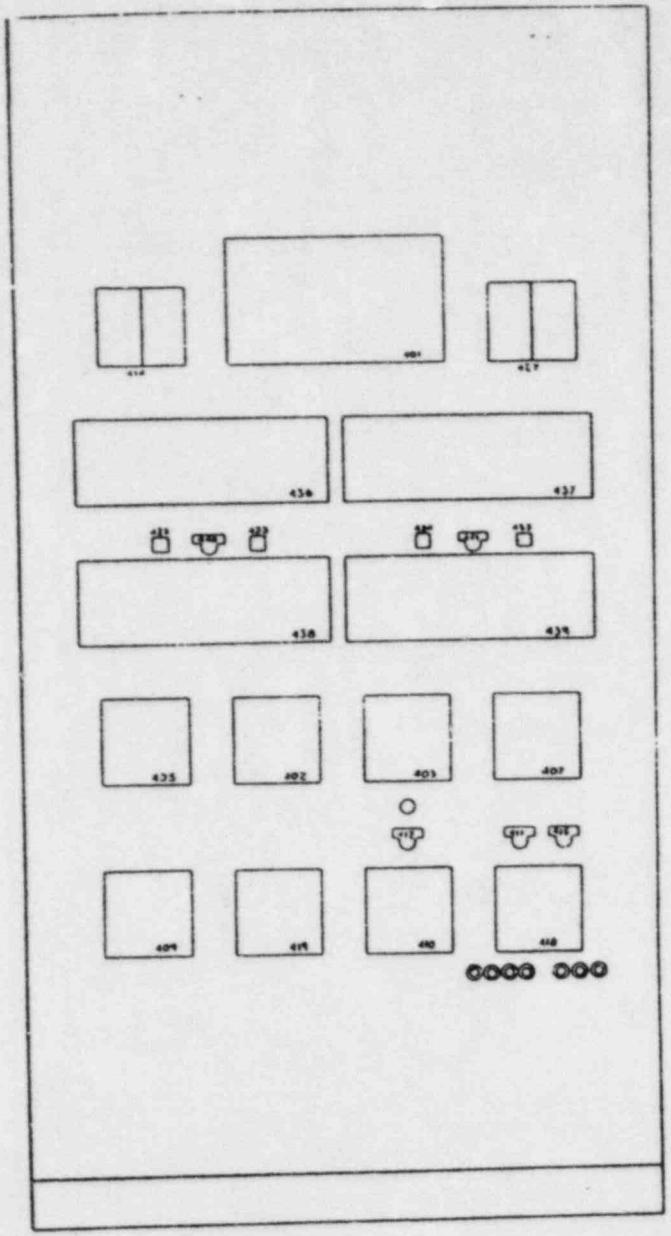
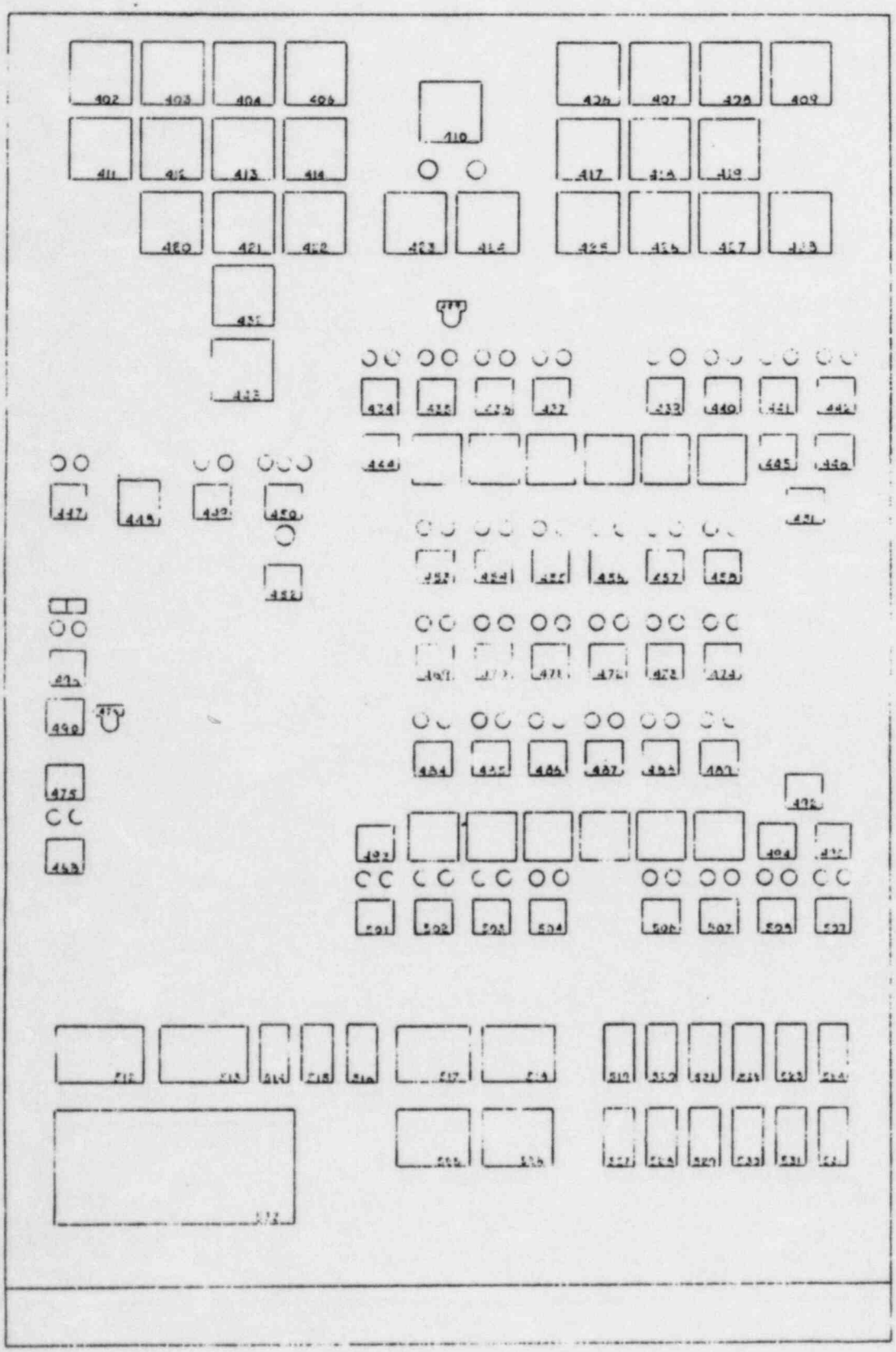
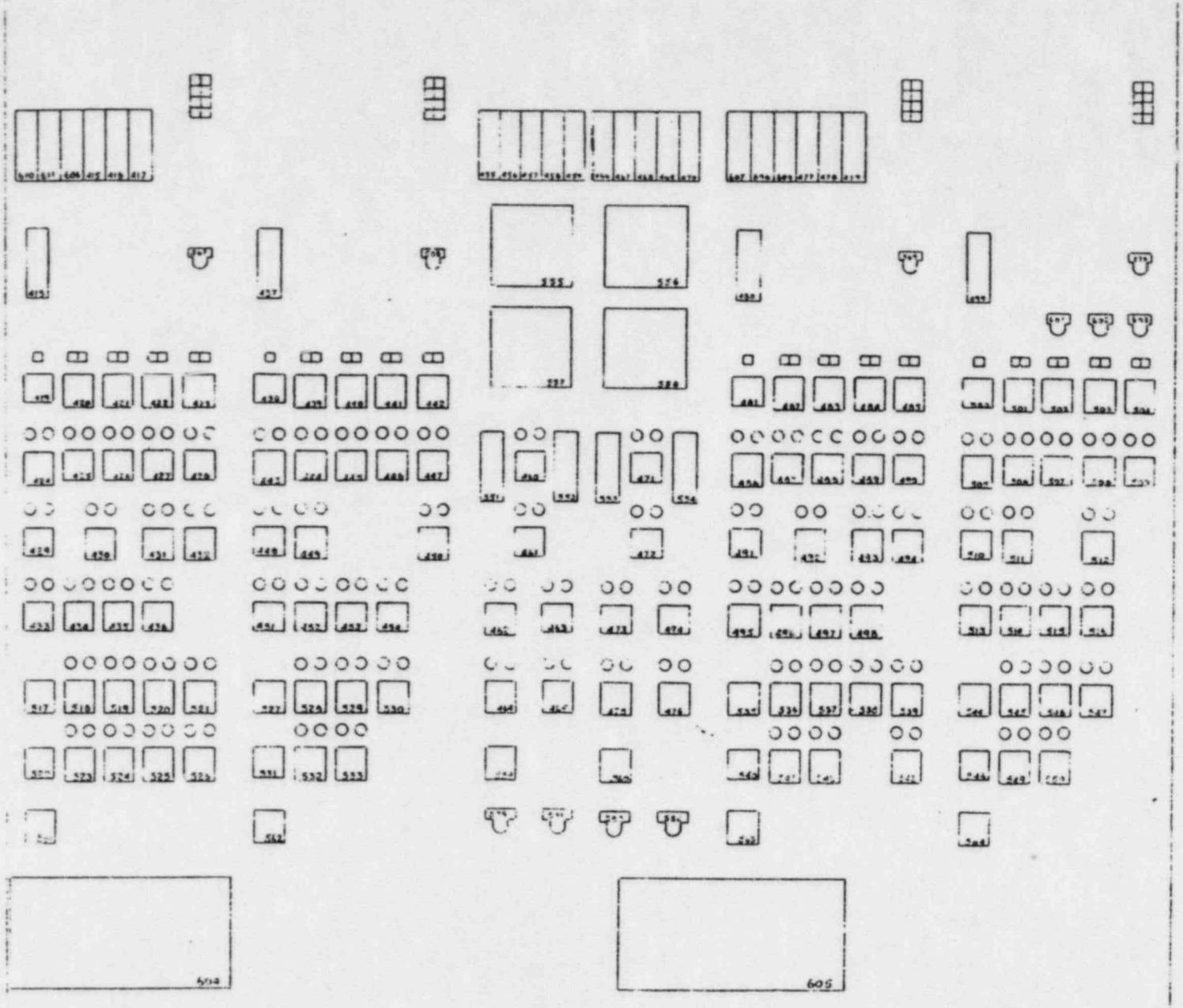
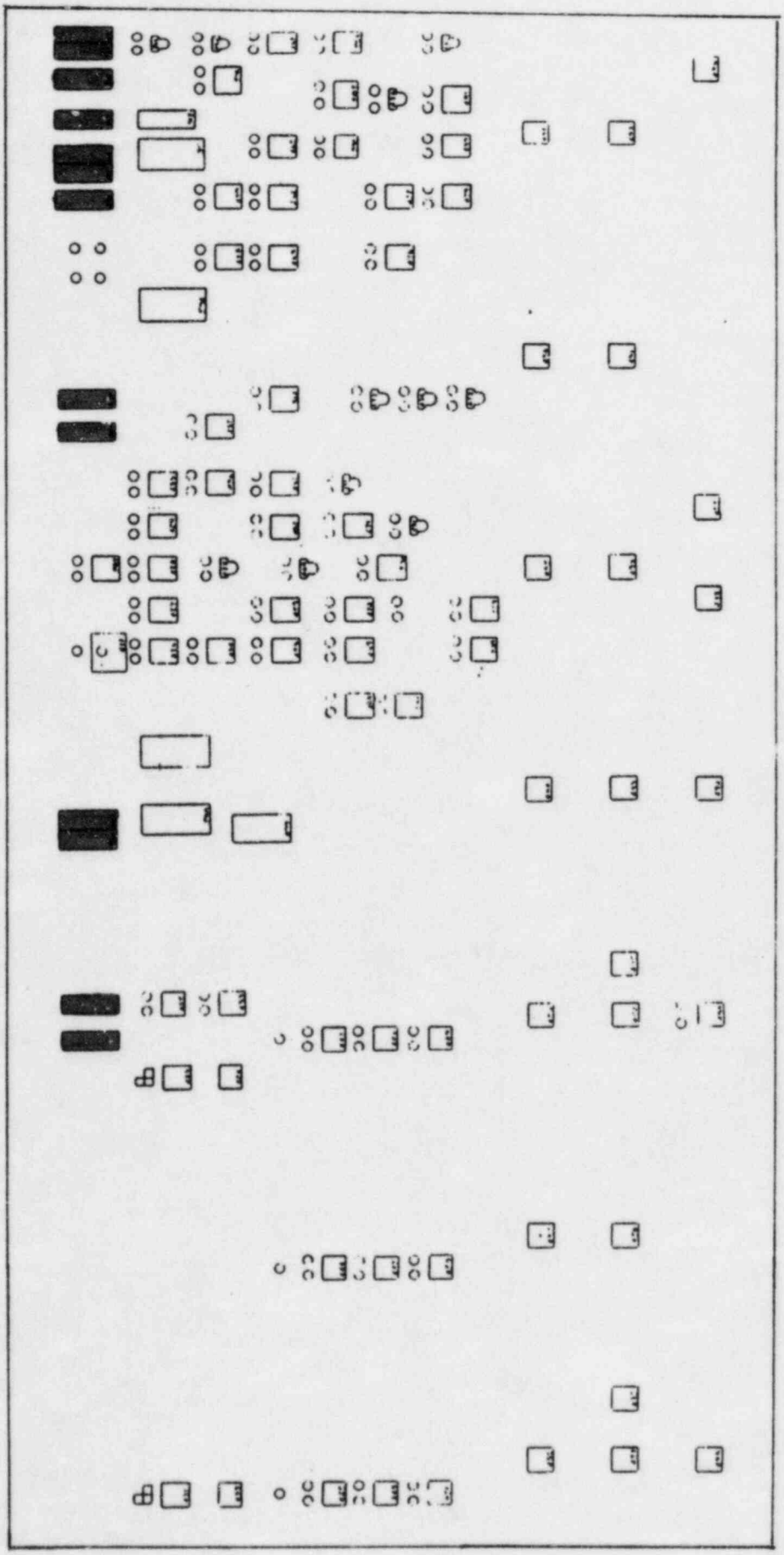

BLANK PANEL
BLANK PANEL
X-Y RECORDER
DRIVE CONTROL CHAN A
DRIVE CONTROL CHAN B
FLUX PROBING HOH
VALVE CONTROL CHAN A
VALVE CONTROL CHAN B
BLANK PANEL
BLANK PANEL
BLANK PANEL
BLANK PANEL
DRIVE CONTROL CHAN C
DRIVE CONTROL CHAN D
DRIVE CONTROL CHAN E
VALVE CONTROL CHAN C
VALVE CONTROL CHAN D
VALVE CONTROL CHAN E









HED SI2-04 REMOTE SHUTDOWN

APPENDIX B

BWROG SUMMARY REPORT