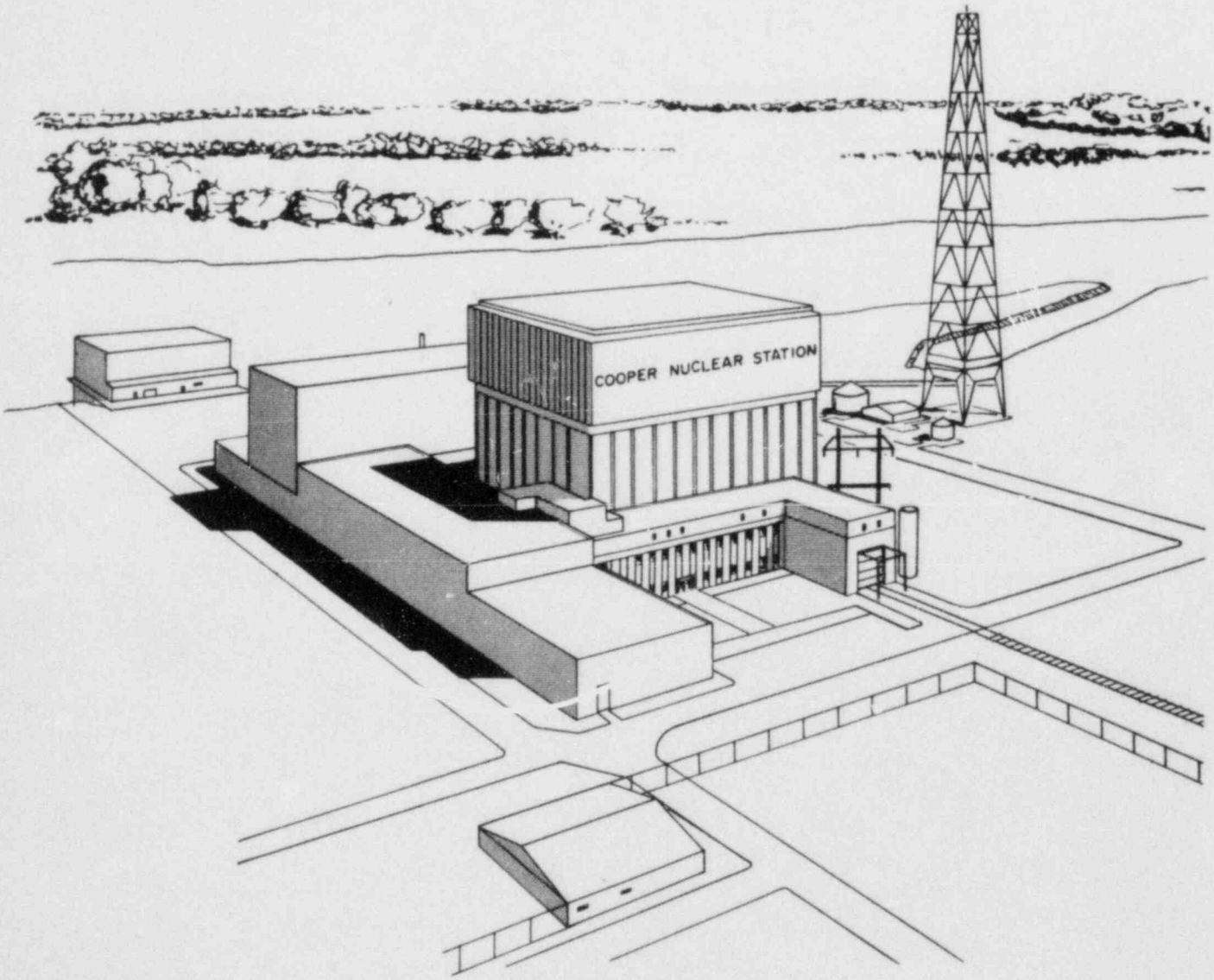
Cooper Nuclear Station

Detailed Control Room Design Review

SUMMARY REPORT



Nebraska Public Power District

Nebraska Public Power District

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February 4, 1985

Office of Nuclear Reactor Regulation
Operating Reactors Branch No. 2
Division of Licensing
U.S. Nuclear Regulatory Commission
Washington, D.C. 20555

Attention: Mr. Domenic B. Vassallo, Chief

Dear Mr. Vassallo:

Subject: NUREG-0737, Supplement 1 - Detailed Control Room Design Review (DCRDR) Summary Report

In accordance with the requirements of NUREG-0737, Supplement 1, Nebraska Public Power District herein submits the Detailed Control Room Design Review (DCRDR) Summary Report for Cooper Nuclear Station. This DCRDR Summary Report does not address the recommendations of the NRC's DCRDR In-Progress Audit Team, since NPPD is not yet in receipt of the staff's written report for that audit. District response pertinent to the above will be generated under a separate cover as a supplement to the subject DCRDR Summary Report.

It should be noted that the scheduled dates for implementation provided herein are considered estimated dates in accordance with our April 15, 1983, response to NUREG-0737 Supplement 1. As defined in Attachment 8 to that document, our NRC Project Manager will be kept informed of all substantive changes in the implementation schedule. Changes in the implementation schedule are anticipated as the integration effort proceeds for all Supplement 1 projects; specifically, Regulatory Guide 1.97. Changes are also anticipated when integrating Equipment Qualification, the ATWS rule, and Generic Letter 84-23 (Reactor Vessel Water Level Instrumentation in BWR's).

Enclosed are eight copies for the staff's use. Should you have any questions or require additional information, please contact me.

Sincerely,

Jay M. Pilant
Technical Staff Manager
Nuclear Power Group

JMP/lrb:emz4/2
Enclosures

SUMMARY

This document summarizes the Detailed Control Room Design Review (DCRDR) for the Nebraska Public Power District's Cooper Nuclear Station (CNS). The report documents the results of the review in three major sections: Methodology, General Findings, and Schedule For Implementation Of Corrective Actions. The Methodology section includes the Review Process, Control Room Survey, Function and Task Analysis, Operating Experience Review, and Assessment.

During the DCRDR assessment, Human Engineering Discrepancies (HEDs) were identified. HEDs with relatively simple corrections were designated for enhancement. HEDs assigned for correction by modification were prioritized according to their importance to plant safety, and corrective actions were formulated based on their safety significance.

The following presents a synopsis of HED sources and their distribution,

HED Source	Number of Enhancements	Number of Modifications	Safety Importance Priority (For Modifications Only) I(High)	II(Medium)	III(Low or None)
Control Room Survey	101	75	2	44	29
Task Analysis	33	44	8	27	9
Operating Exp. Review	3	13	0	7	6
Total	137	132	10	78	44

A schedule for the HED corrective actions was developed on the basis of the HED classification, safety importance and implementation leadtime. For the enhancements HEDs, corrections will be started during the present plant outage and are scheduled for completion by the next refueling outage. The HED modifications are assigned for implementation by the end of the 1st, 2nd, 3rd, and 4th refueling. The control room enhancements and modifications will be validated and integrated with other ongoing CNS NUREG-0737 related programs.

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1.0 INTRODUCTION

1.1 GENERAL COMMENTS

This report describes the Detailed Control Room Design Review (DCRDR) for Nebraska Public Power District's (NPPD) Cooper Nuclear Station (CNS). The DCRDR was conducted from August 1983 through November 1984 to fulfill the requirements of NUREG-0660 (Reference 1), NUREG-0737 (Reference 2), and the NRC Generic Letter 82-33 (Supplement 1 to NUREG-0737, Reference 3).

The review was performed in accordance with: 1) The DCRDR program plan submitted by NPPD to the NRC in March 1984 (Reference 4), and 2) The NRC response to the program plan of May 1984 (Reference 5). This program represents a vigorous effort to comply with the NRC, BWROG, and INPO guidelines of References 6-11.

The scope of the DCRDR consisted of:

- Updating the BWROG Control Room Survey (CRS) checklists and completing the checklist supplement panel by panel.

- Performance of Function and Task Analysis (F&TA) on CNS symptom-based Emergency Operating Procedures (EOPs) through the identification of information and controls needs/ characteristics for each of the operator tasks per the EOPs. This included branching into normal operating procedures to a point of plant stability or re-entry into the EOPs.

- On-site inventory of the information and controls available in the control room to alert, inform, and enable the operator to control and mitigate a malfunction or an abnormal event through the use of the EOPs.

- Performance of a supplementary experience review of LERs and scram reports to update the 1981 original review.

- Incorporating operators' experience using questionnaires developed by the BWROG and follow-up interviews.

- Quantitative resolution and screening of the Human Engineering Observation (HEOs) resulting from the CRS and operator experience review and identification of the Human Engineering Discrepancies (HEDs)

- Comparison of the suitability of the CR inventory against the Information and Controls needs/characteristics developed in the F&TA, and identification of the F&TA HEDs.

- Assessment of the HEDs into enhancements and modifications categories based on the degree of simplicity of the correction, and prioritization of the modifications according to their safety importance. The assessment process included a dedicated week of decision making by a multidisciplinary team (operations manager, senior reactor operator, operator supervisor, system engineer, program manager and human factors specialist) to discuss, analyze, evaluate, and decide on both specific HEDs and the overall HED effect on the control room.

- Separation of the HEDs modifications into those for correction by the redesign of panels and relocation of controls, by placement on CNS Safety Parameter Display System (SPDS) or on Plant Monitoring Information System (PMIS), or by procedures' modifications.

- Development of an implementation schedule for the HEDs enhancements and modifications based on their category, safety importance, pre-implementation leadtime, and on their interface with other safety-related programs scheduled for correction at CNS.

This report describes the methodology and procedure used in each of the review phases. It identifies the team review structure/responsibilities and provides documentation for each review method.

1.2 PLANT DESCRIPTION AND CONTROL ROOM LAYOUT

Cooper Nuclear Station (CNS) is approximately 2 1/2 miles south of the Town of Brownville, Nebraska. The unit is designed to deliver a net electrical output of 778 MWe. General Electric (GE) Company furnished the nuclear steam supply system and Westinghouse Electrical Corporation furnished the turbine generator set. The plant has a Boiling Water Reactor Type 4 (BWR/4), and a Mark I primary containment.

The CNS control room, typical of GE plants, includes the area panels (front and back panels) and the fire panel. The panels are well organized with free space available for future CRTs or SPDS. Figure 1 illustrates the panel layout in the control room.

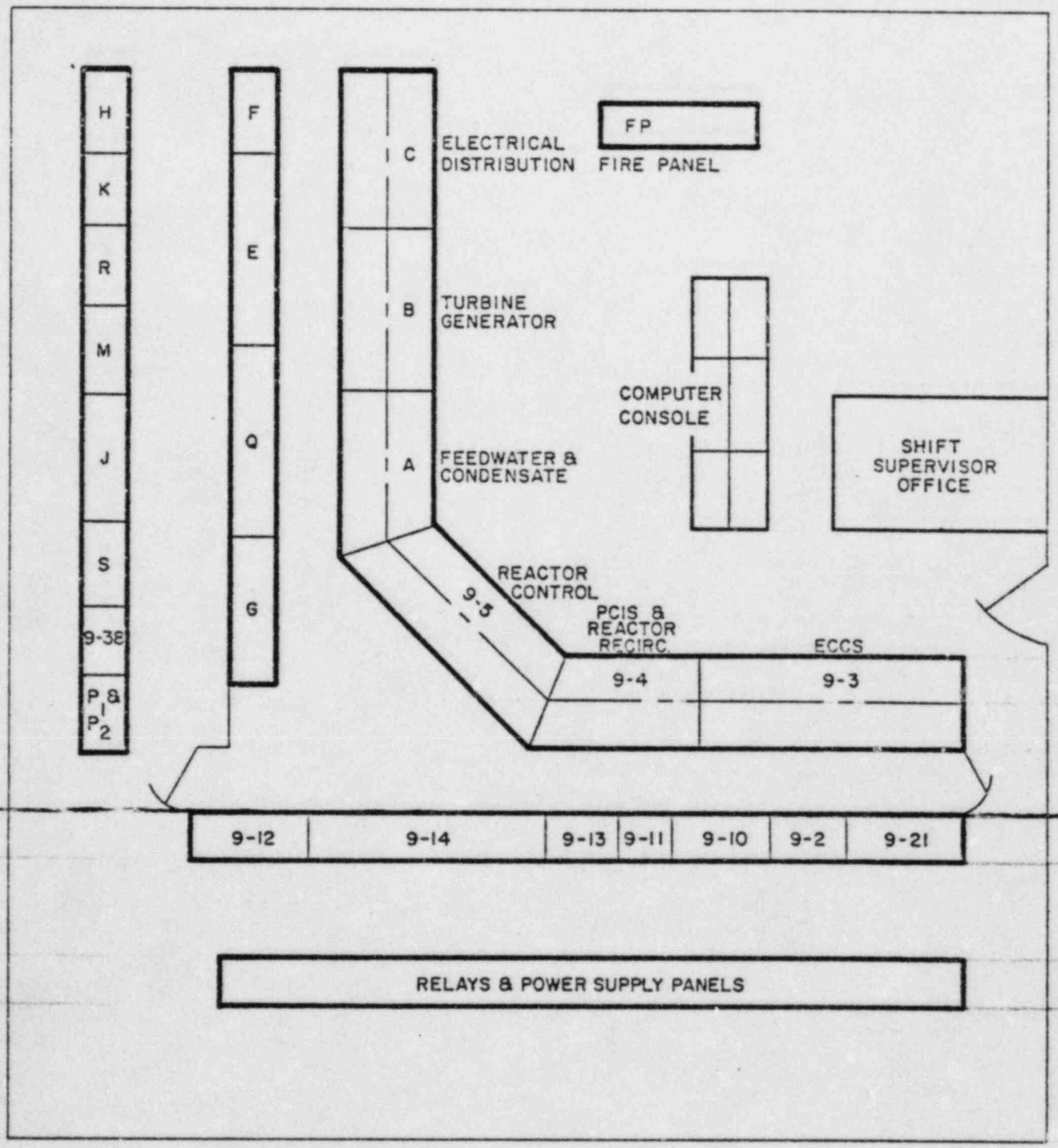


FIG. 1 C.N.S. CONTROL ROOM LAYOUT

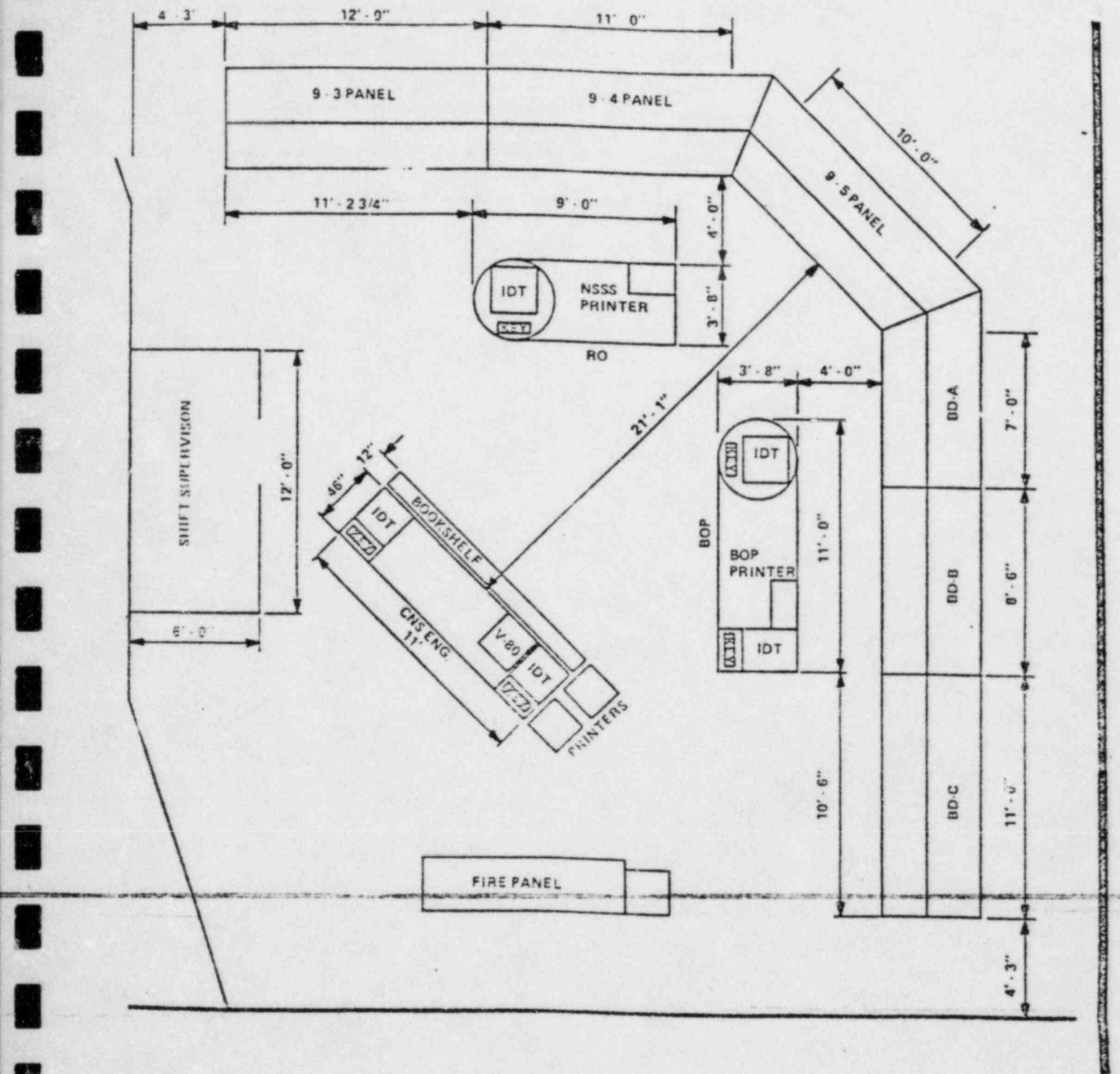


FIG. 1A PROPOSED CNS CONTROL ROOM LAYOUT

1.3 INTEGRATION WITH OTHER NUREG-0737 RELATED PROGRAMS

NPPD has submitted its plan (Reference 14) for implementing NUREG-0737 related programs including:

- Safety Parameter Display System (SPDS)
- Detailed Control Room Design Review (DCRDR)
- Regulatory Guide 1.97
- Upgraded Emergency Operating Procedures (EOPs)
- Emergency Response Facilities (ERF)

An updated implementation schedule of these programs is given in Table I.

As part of the integration process, the DCRDR task analysis utilized the CNS latest revision of the EOPs (Revision 3 of the procedures) to identify the needs/characteristics of the information and controls necessary for EOPs implementation. A follow-up program of integrating other NUREG-0737 related programs is scheduled in 1985 and 1986.

TABLE I

Implementation Schedule*
NUREG-0737 Related Programs

PROGRAM	MILESTONE	DATE	STATUS
SPDS	Submittal of Safety Analysis	March 1984	Complete
	SPDS Operable (completion of 1000-hour field test)	Feb. 1986	Estimated
	Operators trained	Feb. 1986	Estimated
	Pre-Implementation Review by NRC (Verification & Validation Review)		
	o Start o Completion	Nov. 1984 NRC Action	Complete
DCRDR	Submittal of Program Plan	March 1984	Complete
	Submittal of Summary Report	Jan. 1985	Estimated
Regulatory Guide 1.97	Submittal of Assessment Report	March 1984	Complete
	Implement Requirements	(Revised Report will be provided January 1985)	
Upgrade EOPs	Submittal of Generic Technical Guidelines	Dec. 1983	Complete
	Submittal of Procedures Generation Package	June 1984	Complete
	Implementation of EOPs	Sept. 1985	Estimated
ERF	TSC Fully Functional	April 1986	Estimated
	EOF Fully Functional	April 1986	Estimated
	OSC Fully Functional	-	Complete

* The controlling schedule has been previously submitted. This schedule is presented for information purpose only.

2.0 THE REVIEW TEAM

The Program Plan (Reference 4) identified the review team members and included their resumes. It briefly discussed their responsibilities and functions. A more detailed discussion of the review team structure and the team review process is provided below.

2.1 REVIEW TEAM STRUCTURE

The review team is composed of members from CNS and GE, and a human factor consultant. Table II identifies the individuals who participated as well as their responsibilities in the DCRDR program.

The CNS members participated in planning and administrating the program, in CR survey and task analysis data collection, and in the HEDs assessment and evaluation of modifications. CNS is presently planning a follow-up program of correcting the HEDs and overall plant integration of NUREG 0737 related programs.

2.2 TEAM REVIEW PROCESS

Review team work was coordinated by the CNS Operations Manager. The review process followed the flow path identified in Figure 2 and consisted of:

- Data sources: BWROG Survey Checklist, Function & Task Analysis And Operating Experience Review
- Quantitative Resolution And Data Screening
- HED Identification
- Assessment: HED classification, Prioritization, Corrective Actions & Verifications, and Schedule for Implementation.

The conduct of the DCRDR for the survey and task analysis was performed by the core review team. After review and discussion by the core group, the results were presented to the entire team in a face-to-face meeting to review the core group's findings and assess the HEDs. The team was able to form a consensus in all deliberations after thorough discussion and follow-up investigation as required. The full team reviewed the possible solutions, considered other solutions, and assigned follow-up implementation actions for each of the HEDs.

TABLE II

TEAM STRUCTURE & TEAM MEMBERS	RESPONSIBILITIES									
	Planning & Technical Direction	Administration	Control Room Survey	Task Analysis	Operating Experience Review	HED Assessment	Evaluation of Modifications	Schedule For Implementation	Licensing Support	Program Plan & Summary Report Support
A. Core Review Team										
K. Wire (CNS)	X	X				X	X	X		X
R. Gardner (CNS)			X	X		X	X	X		
D. Shallenberger (CNS)				X						
B. Liesemeyer (CNS)				X						
M. Ward (CNS)			X							
D. Der Kamp (CNS)			X							
M. Edgerton (CNS)			X							
T. Ratzlaff (CNS)			X							
L. Cade (CNS)			X							
M. Aburomia (GE)	X		X	X		X	X	X		X
M. Weinstein (GE/HPT)	X		X	X	X	X	X	X		X
B. Supporting Personnel										
J. Hanlon (GE)		X			X	X	X	X		X
B. Brungardt (CNS)		X	X			X	X	X		
R. Boyle (CNS)						X	X	X		
D. Bitter (GE)									X	X
J. Weaver (CNS)	X								X	X

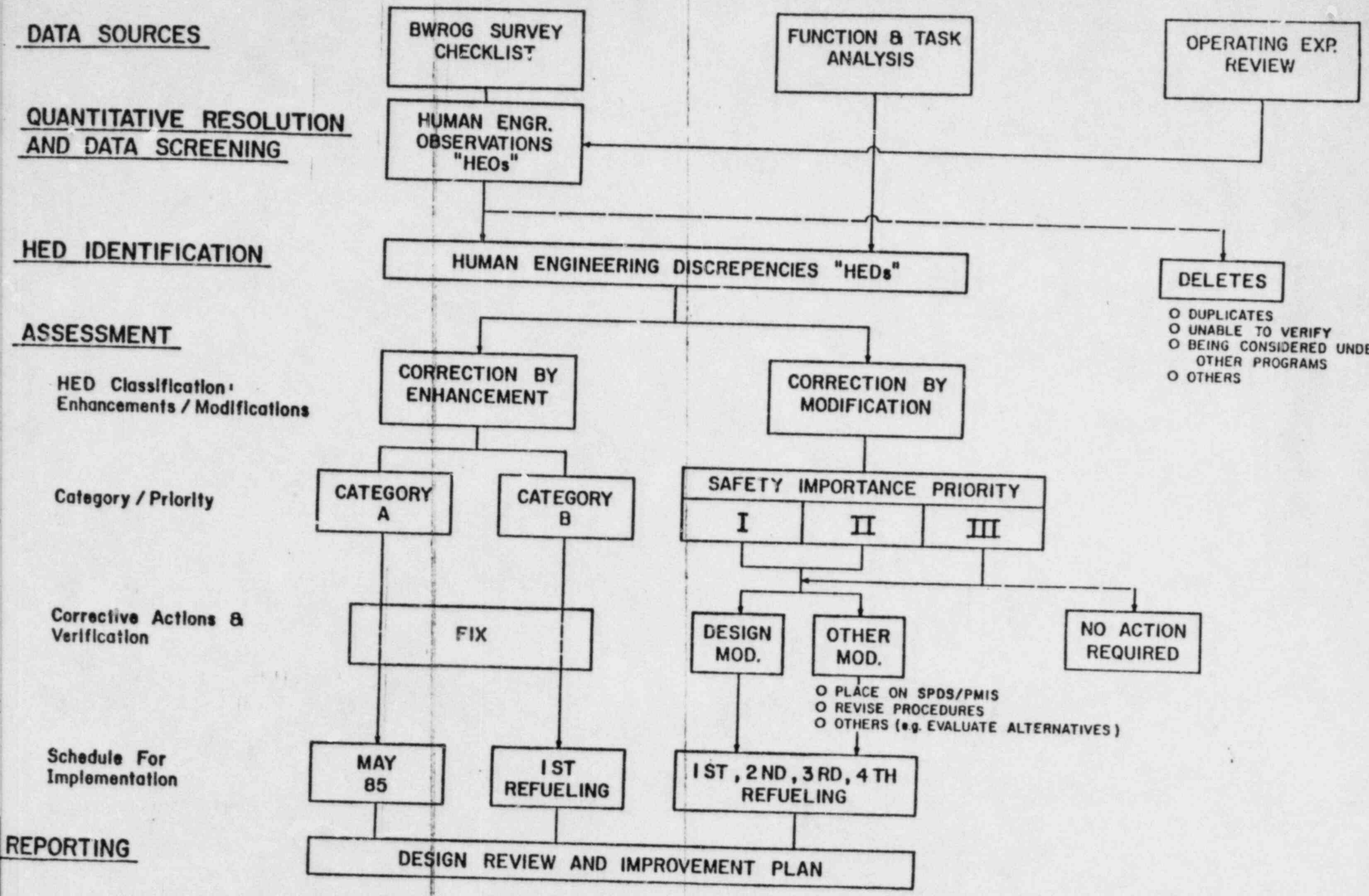


FIG. 2 CNS DETAILED CONTROL ROOM DESIGN REVIEW PROCESS

3.0 DCRDR METHODOLOGY AND RESULTS

3.1 CONTROL ROOM SURVEY (CRS)

3.1.1 CRS Checklists and Human Engineering Observations (HEOs)

Checklists developed by the BWROG were used to update and complete the existing data of CNS 1981 CRS (Reference 12). The BWROG 1981 original checklists and the 1983 checklist supplement were designed to incorporate criteria included in NUREG-0700. The checklists provided a thorough and efficient method by which direct observations and measurement of control room features were undertaken. Examples of BWROG CRS checklists are given in Appendix A, item I.

The subject areas covered in the survey, and the number of checked items for each panel (or CR subject area) are listed below:

Area Surveyed	Number Of Checked Items
Panel Layout And Design	64/Panel
Instrumentation And Hardware	78/Panel
Annunciators	35/Panel
Computers	41
Procedures	68
Control Room Environment	57
Maintenance And Surveillance	30
Training And Manning	10

The following panels in the CNS control room were evaluated using the checklist methodology:

	Panel ID	Panel Control Function
	9-3	Reactor & Containment Cooling (ECCS)
	9-4	PCIS, RWCU, Reactor Recirc., RCIC
	9-5	Reactor Control & Feedwater Control
Front	VBD-A	Feed, Condensate, Service & Circulating Water
Panels	VBD-B	Turbine/Generator & Condenser Control
	VBD-C	Electrical Distribution
	FP	Fire Panel
	VBD-H	PC Atmosphere - Vent & Drywell Inerting
	VBD-K	Gas Treatment & Venting System
	VBD-R	H&V Control
Back	VBD-M	Reactor Building Closed Cooling Water System
Panels	VBD-J&S	Sup. Chamber Press. Relief & Plant Sump Control
	VBD-P_1&P_2	Atmos. Containment Atmos. Control (ACAD)
	VBD-Q&G	Indication & Recording Systems For RMV
	9-02 & 9-21	Steam Leak Detection System & Process RM Recorders
	9-10 & 9-11	Area & Process Radiation Monitor

Table III lists the process used in surveying each of the panels in terms of updating the 1981 survey, performing the original survey or completing the checklist supplement. Control room subject areas, other than the panels, were surveyed by the original survey checklist and supplement.

TABLE III

PANEL SURVEY PROCESS

Panel I.D.	Updating 1981 Checklist	Performing Original Survey	Completing Checklist Supplement
Front Panels			
9-3	X		X
9-4	X		X
9-5	X		X
VBD-A	X		X
VBD-B	X		X
VBD-C	X		X
FP	X		X
Back Panels			
VBD-H	X		X
VBD-K	X		X
VBD-R	X		X
VBD-M	X		X
VBD-J&S	X		X
VBD-P_1&P_2		X	X
VBD-Q&G		X	X
9-02 & 9-21	X		X
9-10 & 9-11		X	X

The CRS checklists utilize evaluation criteria developed by the BWROG (Reference 10). Each checklist item is evaluated by means of two numerical ratings (Refer to Figure 3): (1) a "degree of non-compliance or a compliance factor (CF)", indicating the degree to which the panel under consideration complies with the listed human factor criteria, and (2) a "potential for error factor (PFE)" representing the relative likelihood that non-compliance with that checklist item could cause or contribute to operator error. The PFE is a predetermined value for each checklist item based on the work of BWROG, while the CF is a number assigned for each checklist item by the CRDR team during the CR survey.

The two rating factors, the degree of non-compliance and the potential for error, are measures of (but not equal to) the consequences of a deviation from human factors standards and the likelihood of error resulting from that deviation. These two factors are multiplied (Reference 10) to obtain a final Evaluation Product. These evaluation products are utilized to form a criterion for recommending a change in the CR surveyed area. Based on this criteria, any checklist item with an evaluation product greater than 1 (Refer to Figure 3) is identified as a candidate for correction. These candidates for correction are identified here as Human Engineering Observations (HEOs).

3.1.2 Screening Of HEOs

Review of the HEOs indicated that the majority of the observations deviate slightly from the human factor standards, or cause a low to none potential for error on the part of the operator. A criterion for quantitative resolution of the significant HEOs that require correction was adopted by the review team based on the checklist value of the evaluation product (EP). HEOs were screened for EP of 12,9 and 8. Referring to Figure 3, these EPs cover High/High, Medium/High and High/Medium values of the degree of noncompliance (CF)/potential for error (PFE). HEOs covered by this criterion are identified as Human

Engineering Descrepancies (HEDs). It is to be noted that the screening criterion was applied only to the survey and the operating experience review HEOs, but not to the task analysis HEOs. HEOs relating to the EOPs instrumentation and controls were considered as of potential safety importance and were classified as HEDs.

3.1.3 HED Results

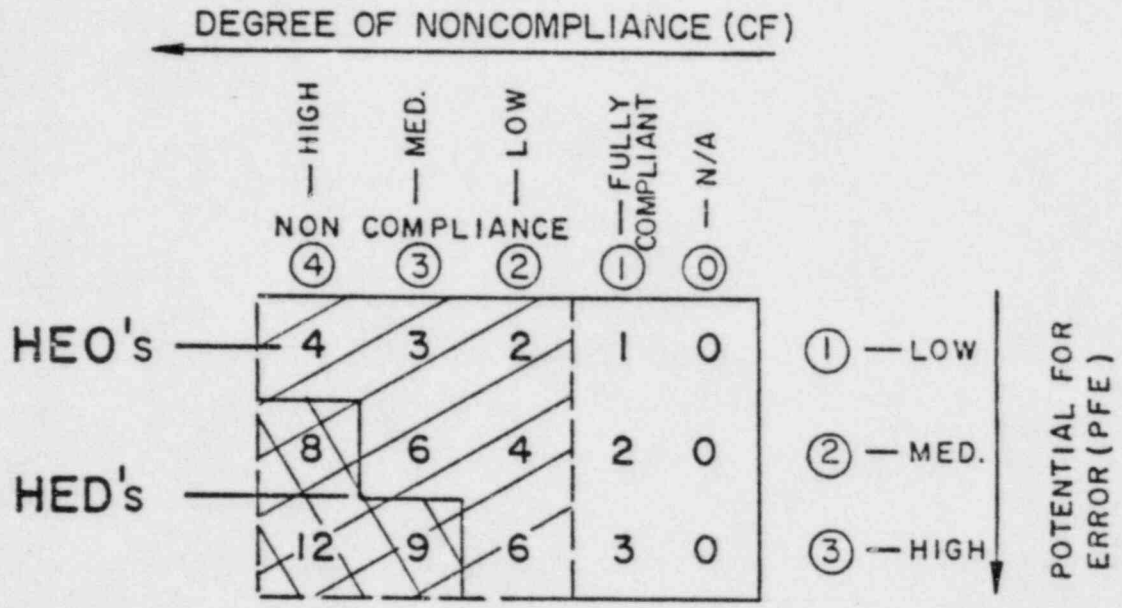
The results of the control room survey are documented in HED individual record forms and in summary forms, for the purpose of identifying the HED and to provide accountability and format for HED management. Appendix A, item II, gives a sample of the HED record form for HED No. 1S. These forms are used to assign a specific HED number, identify its source and product evaluation number, and further expand on the specific discrepancy.

The HEDs summary forms for the CRS are given in Appendix B which include, in addition to the HEDs identification, their assessment. These tables (sheets 1 to 12) provide a cross-reference among the various HEDs and their sources. A total of 176 HEDs were identified from the survey, and are listed in the summary sheets. This number corresponds to 6% of the total checked items.

o BWROG CRDR CRITERIA:

EVALUATION PRODUCT (EP) = DEGREE OF NONCOMPLIANCE (CF)

X POTENTIAL FOR ERROR (PFE)



o HEO's:

SURVEY CHECKED ITEMS WITH EP = 2 TO 12

o HED's (CNS CRITERIA):

SURVEY CHECKED ITEMS WITH HIGH EP's; 12, 9, AND 8

12 : HIGH (CF) - HIGH (PFE)

9 : MEDIUM (CF) - HIGH (PFE)

8 : HIGH (CF) - MEDIUM (PFE)

FIG. 3 CONTROL ROOM SURVEY SCREENING CRITERIA

3.2 FUNCTION AND TASK ANALYSIS (F&TA)

The task analysis methodology used in the DCRDR followed the guidelines of Reference 9 and was specifically designed to comply with the recommendations provided in the NRC review of the CNS DCRDR Program Plan (Reference 5).

3.2.1 F&TA Based On CNS Emergency Operating Procedures (EOPs)

CNS EOPs are based on the symptom-oriented procedures for BWRs, developed by the BWROG and approved by the NRC. These procedures were made plant specific through the incorporation of CNS data on emergency systems, alternate systems, and their characteristics. They include the identification of plant safety functions and the major subfunctions that the operator must control. The EOP primary functions are:

EOP-1, Reactor Pressure Vessel Control
EOP-2, Primary Containment Control
EOP-3, Secondary Containment Control
EOP-4, Radioactivity Release Control

The DCRDR task analysis utilizes the EOP procedures in the identification of plant systems and their functions during emergencies. There are over 60 systems listed in CNS EOPs, and their functions in controlling the reactor vessel, primary containment, secondary containment and radioactivity release are noted in the procedures.

In performing the DCRDR task analysis, the entry conditions to emergencies and the operator tasks to control and mitigate the emergency conditions are taken to follow the EOPs primary operator actions and any associated contingency actions (Reference 13). Each of the procedure steps, entry conditions or operator actions were listed in the 1st and 2nd columns of the task analysis data sheets used by the DCRDR team (see Appendix A, Item III). Other columns of the task analysis data sheets relate to the specification of the

information and controls needs/characteristics, control room inventory, and suitability assessment of the inventory against the identified needs.

3.2.2 Information And Controls Needs/Characteristics

The NRC task analysis guidelines (Reference 5) defined an acceptable process for conducting the F&TA as:

- Define the information necessary (e.g., parameter, value, status) for the operators to determine the need to perform the task, the control capabilities needed to perform the task and the information necessary to determine that the task has been performed successfully. (Note that no instrumentation has been identified yet; only operator needs derived from the task.)

- Analyze the operator needs (from above) to determine the characteristics of the information and control capability needed to perform the task. Information characteristics include parameter type, dynamic range, setpoints, resolution/accuracy, speed of response, units, and the need for trending, alarming, etc. Control characteristics include type (discrete or continuous, rate, gain, response requirements, transfer function, locking functions, and information feedback associated with control use).

To meet the above objectives, a human factor engineering model was developed to simulate operators needs and instrument requirements and characteristics. This model is shown in Figure 4 with key steps identified as:

EOP Phase	Control Room Needs
o Alerting	- Annunciators
o Information	- Indicating Meters - Recorders - Indicating Lights
o Initiating Actions	- Switches (Pumps, Valves and Relays) - Performing Calculations - Communication Equipment
o Controlling Actions	- Controllers

For each of the CR hardware needs, specific engineering and human factors characteristics are required for the operator to correctly identify and execute the EOP steps. The characteristics are dependent on the hardware instrument, associated operator action, and the human factor interface with the instrument. Figure 4 gives the engineering characteristics of instruments considered in the DCRDR task analysis. Specific human factors characteristics for operator interface with the instrument were determined, and are indicated in Table IV.

For each of the entry conditions and the EOPs operator actions listed in the task analysis data sheets, the needs and characteristics of information and controls were completed in advance of conducting the CR task analysis walk-through. These values were entered in the 3rd and 4th columns of the task analysis data sheets, as noted in Appendix A, Item III.

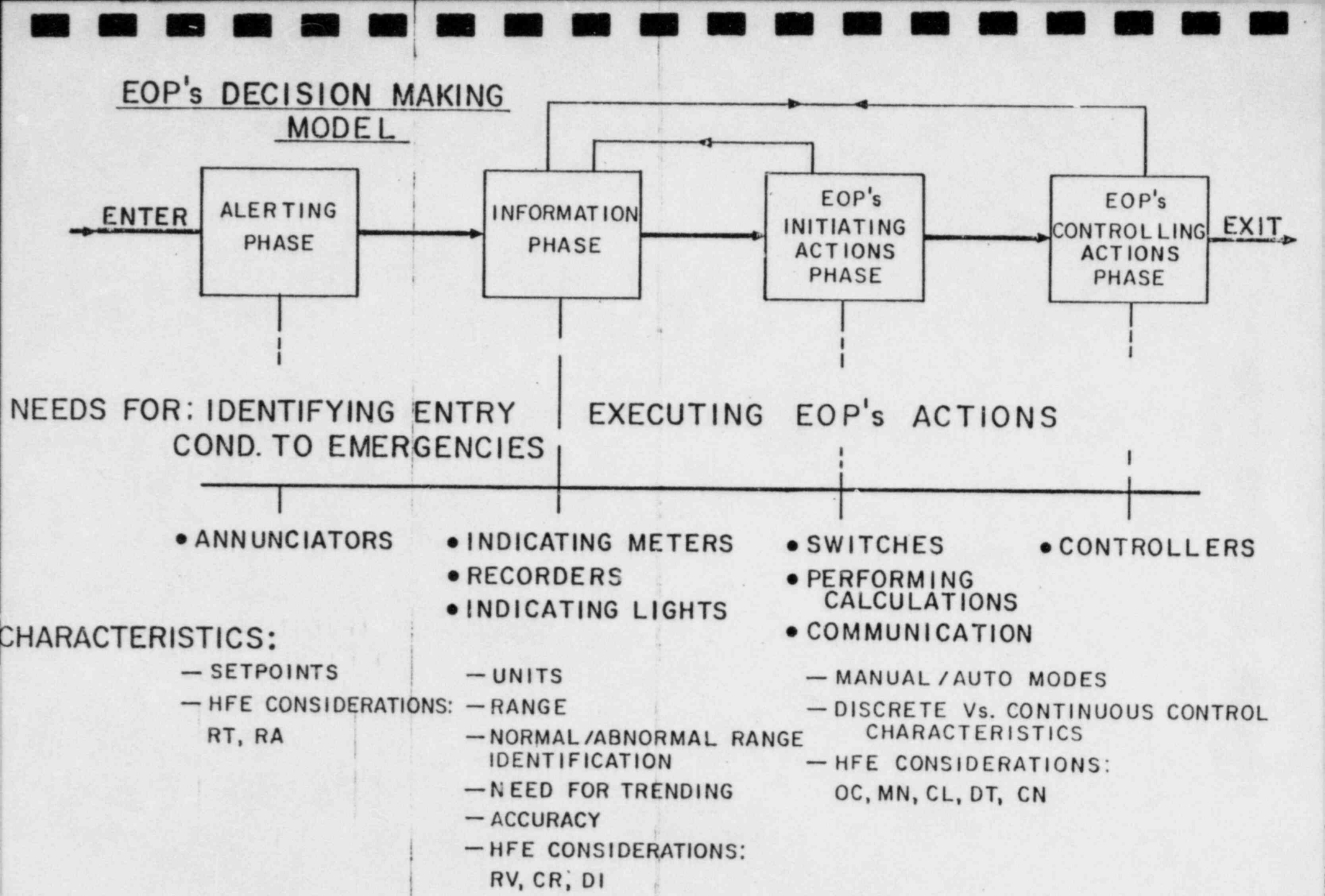


FIG. 4 DCRDR TASK ANALYSIS, INFORMATION AND CONTROLS NEEDS/CHARACTERISTICS IDENTIFICATION

TABLE IV - A

DCRDR TASK ANALYSIS

HUMAN FACTOR CHARACTERISTICS OF INFORMATION AND CONTROLS
(OPERATOR ACTION PHASE)

Operation Action Code	Description
RV -	Read Value - Procure readout of display
CR -	Check Read - Readout approximate value, direction of movement (increasing, decreasing), pointer position (above, below)
OC -	Operate Control - Rotary switches, pushbuttons, potentiometers, controllers
MN -	Maintain a parameter. Co-ordinated use of controls and display in order to obtain a desired system value
RT -	Read text - Read legend lights, tiles, or printouts
CL -	Calculate - Perform mental or written arithmetic
DT -	Determine trend - Review history of parameter
CN -	Communication - Transfer of information between operators
DI -	Determine Indicator lamp status
RA -	Respond to alarm

TABLE IV - B

DCRDR TASK ANALYSIS

HUMAN FACTOR CHARACTERISTICS OF INFORMATION AND CONTROLS

(INFORMATION AND CONTROL PHASES)

Operator Action Code	Instrument - Checked Items
RV -	Digital Meter - Parameter presented, size readability, ID
	Meter - Parameter, Direction of Movement, Range Scale intervals (1,2,5,5x,10,10x), Readability, ID
	Chart Recorder - Number of Pens, Scale, Color of ink, Range, Size of Paper, Separation of Recordings.
CR -	Meter - Parameter, Direction of Movement, Range, Limit Marks (Set Points), Readability, Scale intervals, ID
	Chart Recorder - Same as RV plus limit marks
OC -	Discrete - No. of positions, grasp, Feedback of position, accessability, vulnerability, ID, force (feel)
	Continuous (Potentiometers) direction of motion, position feedback, force (feel) grasp, accessability, vulnerability.
	Controller - Mode indication
MN -	All the above plus grouping of units for co-ordinated action, response, tune
RT -	Annunciator tiles, Readability, Information content, color flicker, brightness, (General identifiability)
	Legend Light - Readability, Information Content, Color, ID, Number of lights in cluster
	Printout - No of items on page, format readability
CL -	Can calculation be performed by system? If not, are work sheets available? Is work space available?

TABLE IV - B., Cont'd

DCRDR TASK ANALYSIS

HUMAN FACTOR CHARACTERISTICS OF INFORMATION AND CONTROLS

(INFORMATION AND CONTROL PHASES)

Operator Action Code	Instrument - Checked Items
DT -	Is a chart recorder or printout available? (A meter is a poor display for establishing a long term trend of more than 10 seconds) (see RV or CR for assessment)
CN -	Communication between whom, how. Equipment availability, quality, response time (System load)
DI -	Indicator size, brightness, color, ID., Number of indicators in cluster
RA -	Auditory - loudness, tone (can it be heard over the ambient noise)
	Visual - Brightness, flicker, color size
	(Auditory is superior to Visual for alarm)

3.2.3 CR Inventory And Its Comparison With Information and Controls Requirements

During the task analysis walk-through in the control room, the operator read the task, then walked through the task aspects at the control panel. The information and controls availability and specific characteristics were determined from the control room panels. The following specific characteristics were identified: Equipment No., Panel No., Parameter, Range Setpoint and Controls' characteristics. This data was documented in the 5th and 6th columns of the task analysis data sheets under the availability heading (Refer to Appendix A, Item III).

Verification of the suitability of the CR inventory against the Information and Controls needs/characteristic was performed during the walk-through, and the decision was recorded in the task analysis data sheet. When the suitability criteria were not met, the reason was noted and the human engineering discrepancy was documented in the "Notes" column of the task anlaysis data sheets.

3.2.4 HED Results

The results of the task analysis HEDs are documented in HEDs individual record forms and in summary forms, similar to the control room survey. Appendix B, sheets 13 to 24 give the task analysis HEDs identification and their assessment. A total number of 77 HEDs were identified from the task analysis.

3.3 OPERATING EXPERIENCE REVIEW

3.3.1 Scram Reports And LER Review

CNS scram reports covering the period from April 21, 1981 through April 19, 1984, and LERs covering the period from January 30, 1981 through April 30, 1984 were reviewed by the DCRDR team. Eighteen (18) scrams and seventy four (74) LERs were examined by the team members. Based on this examination, three (3) scrams and ten (10) LERs were identified as attributed to possible human error. Upon review of these events, it was concluded that control room-operator interface was not a contributing factor in any of the occurrences.

3.3.2 Operator Survey

An operator survey was conducted to obtain direct operator input in identifying potential control room deficiencies. The survey utilized a prepared questionnaire devised by the BWROG (Reference 10). An example of the operator interview questionnaire is shown in Appendix A, item IV. Twenty one (21) operators were asked to complete the questionnaires prior to the arrival of the survey team. Follow-up oral interviews were conducted with operators participating in groups, where the written responses were discussed and documented.

The sample of operators selected for the survey was judged to encompass a wide variety of operator opinion based on operator experience, physical size, ability and education. The human factor specialist trained in interviewing techniques participated in all the interviews.

3.3.3 HED Results

The results of the operator survey showed a wide variety of operator opinion, with many of the operators HEOs voiced during the control room survey. Sixteen (16) HEDs were identified to be independent of the CR survey and task analysis HEDs. These HEDs were added to the remaining HEDs, and were subjected to a DCRDR team assessment as noted in section 4 of this report. Appendix B, sheets 25 and 26 give a summary of operator survey HEDs and their assessment.

4.0 HED ASSESSMENT AND CORPECTIVE ACTIONS

4.1 CORRECTION BY ENHANCEMENT AND MODIFICATIONS

The HED assessment phase followed CNS DCRDR process of Figure 2. All the HEDs were sorted into two groups:

- Those that can be resolved by enhancements and are associated with HEDs of relatively simple correction.
- Those that generally require movement of instruments or panel modifications, and extend beyond the enhancements phase.

Some enhancements were judged to be relatively straightforward and do not require a long leadtime for correction (Category A), while others were considered time consuming and costly (Category B). Of all the 269 HEDs identified in this study, 137 HEDs were placed in the enhancement group with 73 HEDs of Category A and 64 HEDs of Category B. The remaining 132 HEDs were assigned for correction by modification.

4.2 PRIORITIZATION OF MODIFICATIONS ACCORDING TO SAFETY IMPORTANCE

HEDs assigned for correction by modifications were subjected to a prioritization scheme that assessed their importance to safety. This prioritization scheme enabled the team to formulate a corrective action program and assign an implementation schedule for each of the modifications HEDs. Referring to Figure 5, there are three (3) safety importance priorities,

Importance Priority I

The most serious deficiencies fall in this priority classification. A priority I deficiency may impair the operators performance under off-

normal conditions. These deficiencies often involved the unavailability of display information that the operator needs to respond directly to an emergency situation or the failure to provide the controls he needs for timely response. Not all the deficiencies in this priority are in the hardware. Some of the priority I HEDs fell within the procedures, which do not provide the instrument setpoints for plant off-normal operation.

As noted in Appendix B of the HED summary results, the majority of the priority I HEDs resulted from the DCRDR Task analysis where the control room inventory did not meet the information and controls needs/characteristics. Of the 132 HEDs assigned for correction by modification, ten (10) HEDs were given a priority I rating. These priority I HEDs are:

- Setpoints and sensor identity not provided in emergency and abnormal procedures.
- Emergency Procedures in place at time of the survey did not provide detailed contingency actions if expected results were not achieved under degraded conditions.
- SLC test tank level indication not available.
- RPV wide range water level trend recording not available.
- Wide range torus pressure indication not available.
- Alternate system for boron injection not finalized.
- Manual switches for actuating relays for reopening MSIVs not available.
- NPSH for pumps taking suction from suppression pool at various water levels not available.
- Indications and alarms for secondary containment area levels not available.
- Ranges for area temperature indications for core spray, RHRs, and HPCI do not extend to emergency limits.

Importance Priority II

This class of HEDs is made up of deficiencies that violate one or more of the human factors guidelines used in the review, but are unlikely to lead to an irreversible operator error in an off-normal situation. These deficiencies include items that could lead to operator error under normal conditions. They also include generic deficiencies that individually are not likely to degrade operator performance, but taken together, can be significant. Of the 132 HEDs assigned for correction by modification, 78 HEDs were class II Priority.

Importance Priority III

HEDs assigned for correction by modification which are unlikely to affect operator performance irreversibly under any conditions, were placed in Class III Priority. There are 44 HEDs in this class.

Classification of the importance of the HEDs involved significant human factors and engineering judgement of the criteria noted in Figure 5. The classification of deficiencies as to the safety importance, therefore, involved the review team as a whole, with the final classification of each deficiency representing the consensus of the team.

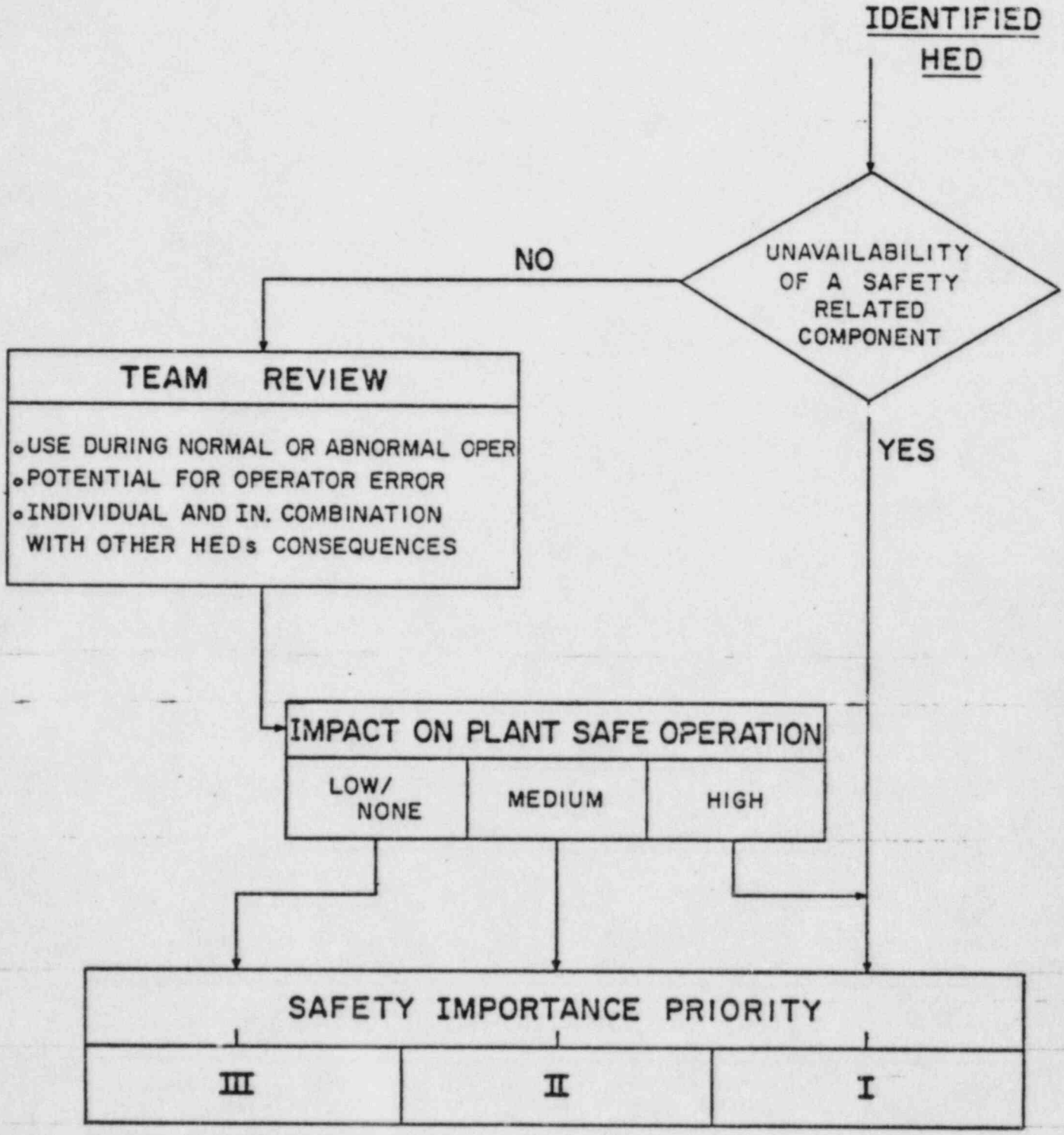


FIG. 5 PRIORITIZATION OF HEDs ACCORDING TO SAFETY IMPORTANCE

4.3 DESIGN VERSUS OTHER MODIFICATIONS CATEGORIES

HEDs assigned for correction by modifications were further classified into two (2) categories with implementation actions associated with the corrections,

Type of Modification.	Implementation Action
Design Mod.	o Fix, Correct the HED into full compliance with the guidelines.
	o Perform feasibility study before proceeding with Design Mod.
Other Mod.	o Place on SPDS or on Plant Monitoring Information System (PMIS).
	o Provide alternative for improving the HED.
	o Evaluate/Integrate with other On-going programs.
	o Revise procedures.
	o Consider use of a plant unique simulator to ensure an operator, at times of stress, can operate the CNS plant.
	o None, HED will not be corrected because of its safety insignificance and modification is not warranted.

HEDs with a "None" implementation action belonged to class III priority. The type of modification and the implementation action for each of the HEDs are listed in the HEDs summary sheets of Appendix B.

4.4 HED VERIFICATION

As part of the DCRDR assessment process HED verification was conducted to ensure that the original discrepancy was addressed. The verification process addressed the source of the HED, and its resolution for correcting the discrepancy in terms of human factors as well as engineering design. The assessment methodology addressed like discrepancies as a group (Refer to Sheets 1-12 of Appendix B) and cross referenced the HEDs to individual panels, so that class solutions will be designed. This made the verification relatively simple and effective.

Following the development of detailed design improvements for the enhancement and modifications, additional verification will be conducted. This will ensure that the resolution adequately solves the problem, and will not cause another problem either singly or in combination with another resolution.

5.0 SCHEDULE

5.1 SCHEDULE FOR IMPLEMENTATION OF ENHANCEMENTS AND MODIFICATIONS

An implementation schedule for the enhancements and modifications was developed by the DCRDR team. The implementation schedule considered the following criteria:

- o HED classification: Enhancements or Modifications
- o Safety Importance Priority of the Modifications
- o Implementation Leadtime, as estimated by the team members

Based on these criteria, an implementation schedule was assigned for each of the corrections. Appendix B gives the implementation schedule for all the enhancements and modifications, which begin in May 85, and continue in the 1st, 2nd, 3rd and 4th refueling following the May 85* date. The 4th refueling scheduled date was assigned only to the installation of a plant specific simulator training facility (HED NO. 1I, sheet No. 25 of Appendix B).

5.2 PLANNED DCRDR VALIDATION PROGRAM AND REMOTE SHUTDOWN PANEL REVIEW**

A validation of control room function is planned in 1985 following the implementation of enhancements and the development of detailed designs for the modifications. The validation program will 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 plant transients using the emergency operating procedures. The results of this validation program will be reported as an addendum to this report.

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* May 85 is contingent upon the present CNS refueling outage date.

** Specific implementation is subject to approval by the District's Board of Directors.

The CNS program plan indicated that the remote shutdown panel will be reviewed as a part of the DCRDR. Because the remote shutdown panel was not yet built at the time of the survey, the panel was not reviewed. Due to the project awareness of the human factors considerations in panel design, CNS will perform a task analysis or human factors survey of the remote shutdown panel design. The results of the review will be documented.

6.0 SUMMARY AND CONCLUSIONS

This report summarizes the methodology and results of CNS Detailed Control Room Design Review (DCRDR). The DCRDR was conducted in accordance with the CNS program plan, submitted to the NRC in March 1984 and reviewed by the NRC in May 1984.

The DCRDR methodology consists of:

- Identification of Control Room Human Engineering Discrepancies (HEDs): through the performance of control room survey, function and task analysis, and operating experience review.

- Assessment of The HEDs and Development of Corrective Actions: through the classification of HEDs into enhancements and modifications, prioritization of the modifications in accordance with their safety importance, sorting of the modifications into corrections by design, placement on the SPDS/PMIS, or by modifying the procedures.

- Development of an Implementation schedule for Correcting the HEDs: based on the classification of the corrections into enhancements or modifications, prioritization rating of the modifications, and implementation leadtime.

A summary of the enhancements and modification groups and their implementation schedule is given below,

SUMMARY

CNS CONTROL ROOM HED ENHANCEMENT/MODIFICATION

AND SCHEDULE FOR IMPLEMENTATION

	ENHANCEMENT/MODIFICATION	IMPLEMENTATION DATE
(88 ENHANCEMENTS)	o Development of CR enhancement guidelines (color coding, control switches size and shape...etc.)	
	o Relabeling of panels, controllers and display systems.	
	o Change of recording paper scale and process units identification.	(Present Outage)
	o Marking of EOP entry conditions and action levels on meters and recorders.	
	o Review of EOP procedures w.r.t. ATWS systems, primary containment hydrogen control, and SC area level alarms and indications.	
(97 ENHANCEMENTS/ MODIFICATIONS)	o Feasibility study of modifying back panels including relocation of lower controls and indicators.	
	o Replacement of recorders and meter indications.	
	o Setting-up demarcation lines for control systems groupings, and mimicing of existing arrangements.	1st Refueling
	o Implementation of CR enhancement guidelines w.r.t. color coding and control switches.	
	o Installation of Wide Range Torus Pressure Indication	

SUMMARY

CNS CONTROL ROOM HED ENHANCEMENT/MODIFICATION

AND SCHEDULE FOR IMPLEMENTATION (Cont'd)

	ENHANCEMENT/MODIFICATION	IMPLEMENTATION DATE
(48 MODIFICATIONS)	o Installation of a rail to guard against inadvertent operation of controls.	
	o Modification of alarm systems for second alarm reflashing and functional segregation of alarm tiles.	
	o Updating, indexing and standardizing of procedures.	2nd Refueling
	o Installation of redundant communication system	
	o Placement of EOPs critical parameters on SPDS/PMIS.	
	o Installation of digital indications for reactor level and reactor pressure and accident water level indication.	
(7 MODIFICATIONS)	o Implementation of back panel design modifications.	
	o Installation of secondary containment sump level indications.	
	o Placement of radioactivity release rate calculations on PMIS	3rd Refueling
	o Design improvement of DW oxygen concentration indications and installation of SC HVAC fan flow meter.	
(1 MODIFICATION)	o Installation of a plant specific simulator	4th Refueling

7.0 REFERENCES

1. NUREG-0660, "NRC Action Plan Developed as a Result of the TMI-2 Accident," May 1980, Revision 1, August 1980.

2. NUREG-0737, "Clarification of TMI Action Plan Requirements," November 1980.

3. NRC Generic Letter 82-33, Supplement 1 to NUREG-0737, "Requirements For Emergency Response Capability", December 1982.

4. "Program Plan For Detailed Control Room Design Review," Nebraska Public Power District Submittal to the NRC, March 1984.

5. "NRC Staff Comments On The Copper Nuclear Station Detailed Control Room Design Review Program Plan," May 1984.

6. NRC Generic Letter 83-18, "NRC Staff Review of the BWR Owner's Group (BWROG) Control Room Survey Program," July 1983.

7. NUREG-0700, "Guidelines For Control Room Design Reviews", September 1981.

8. NUREG-0801 Evaluation Criteria For Detailed Control Room Design Review", October 1981.

9. "Task Analysis Requirements Of Supplement 1 to NUREG-0737", May 4 Meeting of NRC With BWR Owners Group. Also "Review of Control Room Design Review Task Analysis Guidelines," Memorandum From A Ramey-Smith To V.A. Moore, NRC, April 11, 1984.

10. "BWR Owners' Group Control Room Design Review Program Summary Report, General Electric Report NEDC-30285, October 1983.

11. "Control Room Design Review Implementation Guidelines," NUTAC, INPO Report No. 83-026, July 1983.

12. "Human Factors Design Review Of Cooper Control Room", Summary Report, BWROG Control Room Improvement Committee, May 1981.

13. "Emergency Operating Procedures", CNS, July 1984.

14. "Response to NUREG 0737 Supplement I Emergency Response Capability, Cooper Nuclear Station," NRC Docket No. 50-298, DPR-46, April 15, 1983

APPENDIX A

DATA SHEETS SAMPLES

I. BWROG CONTROL ROOM SURVEY CHECKLISTS

II. HUMAN ENGINEERING DISCREPANCY RECORD

III. TASK ANALYSIS DATA SHEET

IV. OPERATOR INTERVIEW QUESTIONNAIRE

Panel _____

A PANEL LAYOUT and DESIGN

A1 For control panels:

A1.1 does the design generally meet measurement standards per the attached anthropometric diagrams (complete and attach) 4 3 2 1 0 x 2 = ____

Measure and record highest and lowest control and indicator

See page 19 for other items to note

This evaluation applies to overall panel dimensions as well as component placement

See also A3.6, B2.2, B3.14, B5.3, B6.3, B1.1

A1.2 are they of the same layout and design on multi-unit plants (not mirror image) 4 3 2 1 0 x 2 = ____

NA for single unit plant

A1.3 when panel components are permanently removed, are spaces covered to prevent debris or dust from entering panel internals and repainted to avoid visual distinctiveness 4 3 2 1 0 x 2 = ____

NA if no components have been removed

A1.4 have sharp corners and edges been eliminated? 4 3 2 1 0 x 1 = ____

A2 Are lines of demarcation, mimics (or) other graphic displays: } Any of these techniques are acceptable

A2.1 used to distinguish between commonly shared systems or components in multiple unit control rooms 4 3 2 1 0 x 2 = ____

Identify common systems

Identify dividing lines between units on shared panels

NA for single unit plants

A2.2 used to enclose related displays 4 3 2 1 0 x 3 = ____

Divide panels by system

This requires the use of mimics or demarcation lines; A 3.2 refers to components themselves

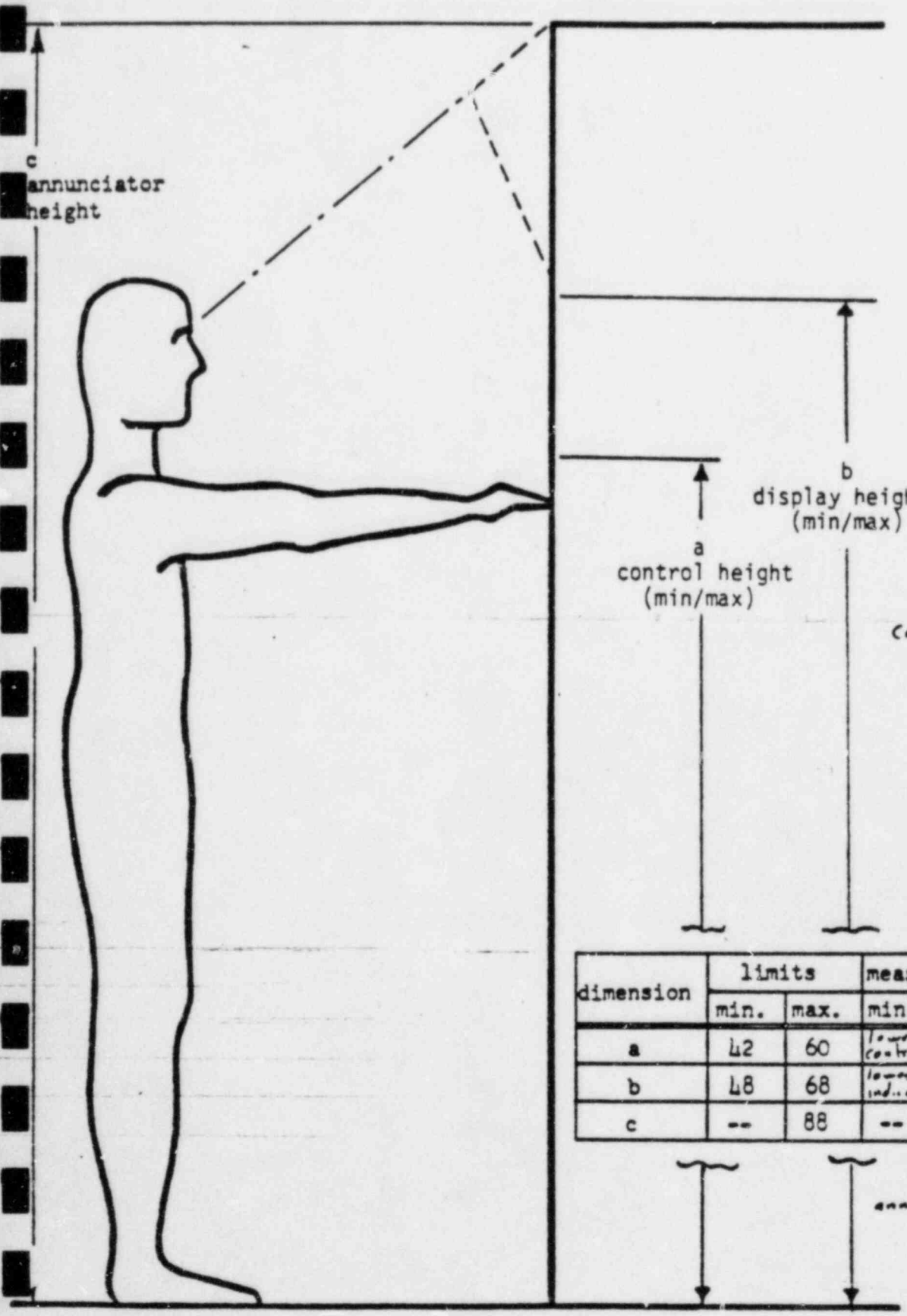
NA if no related displays or only one system

See also A 2.11, A 3.4

A PANEL LAYOUT and DESIGN (Continued)

(A1.1) Anthropometric Diagram

VERTICAL PANEL MEASUREMENT PANEL _____



Comments:
Total number of controls
Total number of indicators
Number outside of limits
Type of control/display outside of limits

dimension	limits		measurement		comments
	min.	max.	min.	max.	
a	42	60	lowest control	highest control	
b	48	68	lowest indicator	highest indicator	
c	--	88	--		

top of annunciator windows

Panel _____

A PANEL LAYOUT and DESIGN (Continued)

A2.9 clearly marked with arrows to show direction of "flow" 4 3 2 1 0 x 2 = ____

NA if no lines used
NA if no flow direction (e.g. electrical mimics)

A2.10 identified with starting and end points 4 3 2 1 0 x 2 = ____

NA if no lines used
NA if no starting/end points (e.g. electrical mimics)

A2.11 used to integrate switches, pumps, manual and remotely-operated valves, isolation paths, etc. 4 3 2 1 0 x 2 = ____

Are all components included in the organized layout? There should be no "extra" randomly placed items
This includes components on vertical panel sections.
See also A2.11

A2.12 consistent in the application of symbols for pumps, valves and other process elements (describe on Comment Form and attach)? 4 3 2 1 0 x 2 = ____

Must be consistent both within panel and with other panels
NA if no graphic symbols used
Asks only for consistency in what is present; does not require that any specific symbol be used

A3 For controls and displays:
Display = indicating lights, meters, recorders, indicators

A3.1 are they generally grouped by system (with identical lay-out for repetitive groups) 4 3 2 1 0 x 3 = ____

All components of a system should be together
Subsystem groupings should be identical (no mirror imaging)
A2.8 requires identical mimics
This only requires grouping by system; A3.2, A3.3, A3.4 address ordering within groups

A3.2 is ordering for components of similar function consistently from left-to-right or top-to-bottom 4 3 2 1 0 x 3 = ____

CORRECT:

A - B - C

1
2
3

INCORRECT:

B - C - A

2
3
1

II. HUMAN ENGINEERING DISCREPANCY RECORD

HED NO. 15

PHOTO NO. _____

- HED SOURCE:

  a. Control Room Survey (X) Product Eval. Factor 12

  b. Task Analysis ( )

  c. Operating Experience Reivew ( )

- RELATED EQUIPMENT:

  Plant System: (Reactor, Containment, Environment, etc.) _____

  Subsystem: (Pumps, Valves, controllers, etc.) _____

  Panel or Item Identifier VBD-H

- HED DESCRIPTION: Panel Layout and Design (A1.1)

  1. Several control switches located 19" off the floor

  2. Several displays located above recom. limits (81" vs 68")

     and other displays located below recom. limits (31: vs. 48")

- HED ASSESSMENT:

  Enhancement Yes ( ) No (x)

  Unavailability of Safety-Related Comp. Yes ( ) No (x)

  Priority II MOD

- REVIEW COMMENTS:

  (Interaction With Other HEDs, Integration With Other Improvement Programs, Adverse Combination With Other Resolutions, etc.)

  Conceptual design of panels will utilize tilting of the

  instruments and relocation of low controls.

- RECOMMENDATION:

  Modify

- IMPLEMENTATION:

  Perform feasibility study (1st refund after May '85)

  (Final design implementation 3rd refueling)

III. TASK ANALYSIS DATA SHEET

EC1-1

Procedure Title REACTOR PRESSURE VESSEL CONTROL (EOP-1)

Rev. No. 0 Date April 4, 1984

Peview Date AUGUST 7, 1984

Team R. GARDNER, M. WEINSTEIN, M. ABUROMIA AND BRUCE A. LIESEMEYER

Procedure Step	Entry Conditions/Operator Actions per EOP's	Controls and Information Needs/Characteristics		Availability: Device/Location	Availability: Associated Devices/ Location	Suitability	Notes
ENTRY CONDITIONS	- RPV WATER LEVEL BELOW 12.5 INCHES, OR UNKNOWN	1. A SIGNAL ALERTING OPERATOR TO LOW WL APPROACHING (OR REACHING) 12.5 in. • SIGNAL SETPOINT ABOVE OR AT 12.5 in.	RA & RT	• Alarm 3-3, "Rx Level High/Low" at 27.5 in /Panel 9-5-1 - Alarm 3-1, "Rx Vessel Low Level Trip" at 12.5 in/ Panel 9-5-2		Y	
		2. AN INDICATION CONFIRMING MAGNITUDE OF Rx WL • INDICATION RANGE VARYING FROM NWL TO A VALUE BELOW 12.5 IN WITH NORMAL/EMERGENCY REGIONS IDENTIFIED • UNITS IN INCHES • ACCURACY ± 2.4" (MARKING OF SETPOINT REQUIRED)	CR	• Level Indicators: LI-94A & B & C (0-60 inches) /Panel 9-5 • LI-91A & B, (-100 to +200), zero at TAF/Panel 9-3 • LI-86 (0-400), /Panel 9-4	• WR Level Indicators LI-85A & B (-150 to +60 in) WL Recorder+ RFC-LR/PR-97 /Panel 9-5 (Only for narrow Range Ind.)	N	• Identify the zero reference for each indication • Identify normal/emerg. ranges + Paper scale does not agree with recorder horizontal scale

IV. OPERATOR INTERVIEW QUESTIONNAIRE
(SHEET 1 TO 4)
INTRODUCTION TO QUESTIONNAIRE

Job Position [redacted]

Years of Experience [redacted] Commericial Nuclear [redacted] Fossil
[redacted] Navy Nuclear

Date of First License [redacted] RO [redacted] SRO

Education/Degrees [redacted]

Age [redacted] Sex [redacted] Height [redacted] Weight [redacted]

In response to a post-TMI NRC requirement, your utility, along with other BWR owners, is conducting an updated control room review to identify and correct design deficiencies in the operator-control room interface to minimize the potential for human error. This review is performed by a survey team composed of utility representatives, human factor specialists, and General Electric engineers using checklists prepared by the Control Room Improvements Subgroup of the BWR Owners Group.

You are asked to complete the attached questionaire basing your responses on your operational experience and knowledge of your control room and interfacing systems. You may complete this questionaire in the control room if you desire but please do so without discussing your detailed responses with other operators completing this survey. If additional space is needed, the attached Comment Form is to be used.

Following completion, a survey team representative will review your responses with you. Upon completion of all interviews, the survey team will consolidate the information obtained and apply it in their evaluation of your control room for compliance with human factor engineering principles.

The biographical information requested above will be used in compiling statistics on operating personnel physical characteristics. Current recommendations for panel design are based largely on data obtained from measurements of military personnel; there are few statistics presently available on, for example, the average height and weight of operators.

This survey provides you with a valuable opportunity for applying your knowledge and experience toward improving operating conditions in both your control room and future control room designs. Your honest and forthright opinions are not only welcomed, but needed.

QUESTIONAIRE

A. Would you recommend any changes in the following area:

A1 training YES. ON SITE SIMULATOR

A2 color coding - No

A3 control room access - No

A4 control panel layout or access YES. ALL ALARM AND INFORMATION ANNUNCIATORS SHOULD BE VISIBLE FROM THE FRONT PANELS.

A5 communication systems YES. INSTALL A MULTICHANNEL GAITRONICS WITH DESIGNATED CHANNELS.

A6 heating or ventilation - No

A7 lighting or noise levels - No

A8 data recording and log entries - YES. ELIMINATE THE DUPLICATION THAT CURRENTLY EXISTS ON CONTROL ROOM LOGS.

A9 information flow - ~~No~~ YES. ELIMINATE THE REQUIREMENT FOR OPERATORS TO REVIEW MINUTE EXCESSIVE MINOR DESIGN CHANGES, ETC.

A10 furniture, equipment or workspace - YES. OBTAIN A PORTABLE STAND OR OTHER SUCH PIECE OF EQUIPMENT WHICH COULD BE USED TO HOLD PROCEDURES. THIS WOULD ALLOW THE OPERATOR TO HAVE THE PROCEDURE READILY AVAILABLE WHILE LEAVING BOTH HANDS FREE TO PERFORM NECESSARY MANIPULATIONS.

A11 computers
No.

A12 other?

OPERATOR INTERVIEW

QUESTIONAIRE

B Are any controls difficult to operate? YES. SERVICE WATER BOOSTER PUMPS, THESE ARE STARTED FROM A BACK PANEL WHILE FLOW INDICATION AND CONTROL IS ON THE 9-3 PANEL. THIS MAKES THIS A TWO MAN OPERATION OUT OF WHAT SHOULD BE A ONE MAN OPERATION.

C Are any controls designed, positioned or labeled in a manner that causes risk of inadvertant operation? YES. FEED PUMP MINIMUM FLOW VALVE SWITCHES OPERATE REVERSE OF NORMAL SWITCHES.

D Are any recorders or indicators difficult or confusing to read? YES. CRD. DPI. 303! DRYWELL REC FLOW INDICATOR. BOTH OF THESE USE NONSTANDARD INCREMENTS MAKING THEM DIFFICULT TO USE.

E Are any important indicators located such taht they are difficult to see during normal or emergency operation? YES. TOO MANY IMPORTANT ANNUNCIATORS ON BACK PANELS AND NOT USIBLE FROM THE FRONT PANELS.

F Do you feel any control room displays are unnecessary, provide unimportant information or needlessly clutter the control panels? No.

G Based on your operational experience, does you control room lack any controls or displays needed in your response to normal or emergency situations? NOT REALLY, BUT IT WOULD BE HELPFUL TO HAVE THE LARGE DIGITAL DISPLAYS OF VITAL PARAMETERS AVAILABLE ON 9-5.

H Do you consider the annunciator system to be effective in conveying important information to you? AS PREVIOUSLY STATED, TOO MANY IMPORTANT ANNUNCIATORS ON BACK PANELS. ALSO THERE ARE AN EXCESSIVE AMOUNT OF NUISANCE ALARMS ON ITEMS SUCH AS DOORS.

OPERATOR INTERVIEW

QUESTIONAIRE

I Do you have any problems locating or using procedures or operational instructions? No.

J Have you experienced any problems using or understanding your procedures? No.

K Is there a partricular panel which you consider more difficult or confusing to operate than the others? Yes. Board M.

L General Comments:

APPENDIX B, 1. CONTROL ROOM SURVEY RESULTS AND ASSESSMENT
A. PANEL LAYOUT AND DESIGN

HED Description	Checklist Item No.	Panel ID.	Eval. Product	HED GR./ ID. No.	Enhancement Modifications	Category/ Priority	Implementation Action	Schedule For Implementation	Comments/Resolutions
Controls, displays and alarms located outside recommended zones.	A1.1 & A3.6	VBD-H	12	1/1S	Design Mod.	II	Perform Feasibility Study (FS)(1)	1st Refueling	Conceptual design of panels will utilize tilting of top instruments and relocation of lower controls.
		VBD-K	8	2S					
		VBD-M	12	3S					
		VBD-Q&G	8	4S					
		9-10&9-11	9	5S					
Related groups of controls or displays not set off by demarcation lines	A2.2	9-3	9	2/6S	Enhanc.	A	Fix	1st Refueling	
		VBD-H		7S					
		VBD-Q&G		8S					
		9-10&9-11		9S					
		VBD-P_1&P_2		10S					Integrate with HED 41T.
Flow paths and arangements not orderly or easily recognized	A2.7	9-3	9	3/11S	Enhanc.	B	Fix	1st Refueling	Integrate with HED 6S. Standardize color & shape of controls. Include in feasibility study of HED GR.1.
Air ejector air control valves are mirror imaged	A2.8 & A3.1	VBD-B	12	4/12S	Design Mod.	II	Fix	2nd Refueling	
Controls and displays of similar functions not grouped in consistent order.	A3.2	Fire Pnl	12	5/13S	Design Mod.	II	Fix	1st Refueling	
		9-10&9-11	12	14S					Integrate with HED 5S.
Demarcation or sequencing within system grouping not apparent	A3.3	9-3	9	6/15S	Enhanc.	B	Fix	1st Refueling	Integrate with HEDs 6S & 11S.
		9-10&9-11		16S					Integrate with HED 9S.
		VBD-P_1&P_2		17S					Integrate with HED 41T.

(1) Feasibility study (FS) to be performed by 1st refueling after present refueling. Final design implementation expected by 3rd refueling.

HED Description	Checklist Item No.	Panel ID.	Eval. Product	HED GR./ ID. No.	Enhancement Modifications	Category/ Priority	Implementation Action	Schedule For Implementation	Comments/Resolutions
Strings and matrices of components of similar functions not differentiated by demarcation or hierarchical labeling.	A3.4	9-3	9	7/18S	Enhanc.	B	Fix	1st Refueling	Integrate with HED 6S.
Mimic has no arrows noting direction of flow	A2.9	VBD-A	8	8/19S	Enhanc.	A	Fix	85	
Controls not adjacent to related feedback indication.	A3.7	VBD-H	12	9/20S	Design Mod.	II	FS(1)	1st Refueling	Integrate with HED 1S.
No plant standard exists for color coding.	A4.1	All Panels	12	10/21S	Enhanc.	B	Fix	1st Refueling	Review and implement CR design standards.
Use of colors not consistently applied on panel.	A4.2	9-3 9-4 VBD-H VBD-M	9	11/22S 23S 24S 25S	Enhanc.	B	Fix	1st Refueling	Integrate with HED 21S. Standardize w.r.t. color, shape and size.
Parmanent labels not used to provide operational limits or warnings.	A5.2	VBD-Q&G 9-10&9-11 VBD-P_1&P_2	9	12/26S 27S 28S	Other Mod. Design Mod.	III A B	No Action Fix Fix	 85 1st Refueling	Labels require monthly review.
Labels and legend plates not used to identify system designation.	A5.3	VBD-Q&G 9-10&9-11	8 8	13/29S 30S	Enhanc.	A	Fix	85	
Labels not used to identify panel by number and function.	A5.4	9-10&9-11	8	14/31S	Enhanc.	A	Fix	85	
Labels and legend plates not easily read when stationed at panel.	A5.9	9-10&9-11	9	15/32S	ENhanc.	A	Fix	85	

HED Description	Checklist Item No.	Panel ID.	Eval. Product	HED GR./ ID. No.	Enhancement Modifications	Category/ Priority	Implementation Action	Schedule For Implementation	Comments/Resolutions
Labels not clear with respect to function or intent	A5.10	VBD-C	9	16/33S	Enhanc.	A	Fix	85	
		VBD-M		34S					
		VBD-P_1&P_2		35S		B	Fix	1st Refueling	
Labels not consistently positioned on panel.	A5.11	VBD-Q&G	9	17/36S	Enhanc.	A	Fix	85	
Labels and escutcheons not size coded in a hierarchical system	A5.7	VBD-B	8	18/37S	Enhanc.	A	Fix	85	
Extensive temporary labels used	A5.12	VBD-Q&G	8	19/38S	Other Mod.	III	No Action		Refer to HED 26S
	& A6.1	9-10&9-11	12	39S	Enhanc.	A	Fix	85	
Temporary labels not consistent in format, color or use.	A6.3	VBD-A	8	20/40S	Enhanc.	A	Fix	85	Remove temporary labels or make them consistent.
Temporary labels not periodically reviewed to make permanent or remove.	A6.7	VBD-H	8	21/41S	Enhanc.	A	Fix	85	
		VBD-Q&G		42S	Other Mod.	III	No Action		Refer to HED 26S
		VBD-P_1&P_2		43S	Enhanc.	B	Fix	1st Refueling	
Annunciator panels can be seen but not read from positions other than directly in front of panels.	A7.3	9-3	9	22/44S	Other Mod.	III	No Action		Operator has to walk to panel to silence alarm, where he can read annunciator tile.
		VBD-A		45S					
		VBD-B		46S					
		VBD-C		47S					
Association of feedback to related controls not apparent through labeling, mimics, demarcation lines.	SA3	9-3	9	23/48S	Enhanc.	II	Fix	1st Refueling	Integrate with HED GR.2.
		VBD-B		49S					
		Fire Pnl.		50S					
		9-02&9-21		51S					
		VBD-H		52S					
		VBD-K		53S					
		9-10&9-11	12	54S					

Item Description	Checklist Item No.	Panel ID.	Eval. Product	HED GR./ ID. No.	Enhancement Modifications	Category/ Priority	Implementation Action	Schedule For Implementation	Comments/Resolutions
Controllers requiring manual operation not easily reached	B1.1	VBD-R	12	24/55S	Design Mod.	II	FS(1)	1st Refueling	
		9-10&9-11	12	56S					Integrate with HED 5S.
Indicators not marked to show normal ranges of operation.	B2.1	9-3	9	25/57S	Enhanc.	A	Fix	85	Entry conditions to emergencies, as specified by CNS EOP's, will be marked on primary indicators.
		9-4	9	58S					
		9-5	9	59S					
		9-02&9-21	12	60S					
		VBD-H	9	61S					
		VBD-K	12	62S					
		VBD-M	12	63S					
		VBD-R	12	64S					
		9-10&9-11	9	65S					
		VBD-P_1&P_2	12	66S		B	Fix	1st Refueling	
Very low indicators on panel introduce parallax	B2.2	VBD-M	9	26/67S	Design Mod.	II	FS(1)	1st Refueling	Integrate with HED 3S.
Instruments not scaled in process units relating to system operation.	B2.3	VBD-J&S	9	27/68S	Enhanc.	A	Fix	85	- Replace chart paper.
		9-10&9-11		69S	Other Mod.	II	Provide Alt.		- SPDS will provide the information in operational units of Curie/hr.
		VBD-P_1&P_2		70S	Enhanc.	B	Fix	1st Refueling	
Digital readings do not correlate with backup indications.	B2.8	VBD-Q&G	8	28/71S	Design Mod.	II	Fix	2nd Refueling	
Failure mode of instruments not evident	B2.17	VBD-Q&G	9	29/72S	Enhanc.	A	Fix	85	
		VBD-P_1&P_2	9	73S	Enhanc.	B	Fix	1st Refueling	
Printed values not easily read	B3.1	VBD-B	9	30/74S	Design Mod.	II	Fix	85	Discrepancy under correction.
		9-02&9-21	9	75S				1st Refueling	
		VBD-Q&G	9	76S				1st Refueling	

Item Description	Checklist Item No.	Panel ID.	Eval. Product	HED GR./ ID. No.	Enhancement Modifications	Category/ Priority	Implementation Action	Schedule For Implementation	Comments/Resolutions
Alarm points not identified on recorders.	B3.3	9-3	12	31/77S	Enhanc.	B	Fix	1st Refueling	Place alarm setpoints on labels.
		9-4		78S					
		9-5		79S					
		VBD-A		80S					
		VBD-B		81S					
		9-02&9-21		82S					
		VBD-H		83S					
		VBD-J&S		84S					
		VBD-R		85S					
		VBD-Q&G		86S					
		VBD-P_1&P_2		87S					
Recorder scales not marked to show normal or abnormal ranges of operations.	B3.15	9-3	12	32/88S	Enhanc.	A	Fix	85	Mark EOPs entry conditions.
		VBD-A		89S					
		VBD-B		90S					
		VBD-C		91S					
		9-02&9-21		92S					
		VBD-H		93S					
		VBD-J&S		94S					
		VBD-R		95S					
		VBD-Q&G	9	96S					
		VBD-P_1&P_2	12	97S					
No positive means of diagnosing failed indicating lights available.	B4.4	All Panels	8	33/98S	Other Mod.	III	No Action		For critical systems, redundant indications are available to distinguish failed lights. For Panel 9.5, control rod positions will be identified on SPDS.

Item Description	Checklist Item No.	Panel ID.	Eval. Product	HED GR./ ID. No.	Enhancement Modifications	Category/ Priority	Implementation Action	Schedule for Implementation	Comments/Resolutions
Switch positions not clearly marked.	B5.2	VBD-Q&G	12	34/99S	Enhanc.	A	Fix	85	
Control switches above or below recommended heights.	B5.3	VBD-H	12	35/100S	Design Mod.	II	FS(1)	1st Refueling	Integrate with HED GR.1.
		VBD-J&S	9	101S					
		VBD-K		102S					
		VBD-M		103S					
		9-10&9-11		104S					
Handles near edges not protected with guards to prevent inadvertent operation	B5.4	9-3	12	36/105S	Design Mod.	II	Fix	2nd Refueling	Equip with a rail.
		9-4	12	106S					
MSL radiation monitor switch not durable.	B5.6	9-10&9-11	8	37/107S	Design Mod.	II	Fix	2nd Refueling	
Coding by size, shape or color not used to identify switch by type of function.	B5.10	VBD-A	8	38/108S	Enhanc.	B	Fix	1st Refueling	Integrate with HEDs GR's 10 & 11.
		VBD-H		109S					
		VBD-J&S		110S					
		VBD-K		111S					
		VBD-M		112S					
		VBD-R		113S					
Switches for emergency or abnormal use not consistently marked.	B6.1& B6.2	9-4	12	39/114S	Enhanc.	A	Fix	85	
		VBD-A	12	115S					
		VBD-J&S	12	116S					
		VBD-P_1&P_2		117S		B	Fix	1st Refueling	

Item Description	Checklist Item No.	Panel ID.	Eval. Product	HED GR./ ID. No.	Enhancement Modifications	Category/ Priority	Implementation Action	Schedule For Implementation	Comments/Resolutions
Indicator scales not easily read when stationed at the panel.	SB1.1	9-21	9	40/118S	Design Mod.	II	FS(1)	1st Refueling	Integrate with HEDs GR. 1.
		VBD-G	9	119S					
		9-10	12	120S					
		9-11	9	121S					
Displays reflecting only demand signal not labeled accordingly	SB1.3	9-4	9	41/122S	Enhanc	A	Fix	85	
		9-5	12	123S					
		VBD-A		124S					
		VBD-H		125S					
		VBD-K		126S					
		VBD-R		127S					
		VBD-P_1&P_2		128S		B		1st Refueling	
Process units and multipliers not specified	SB1.4	9-02	9	42/129S	Enhanc.	A	Fix	85	
		9-10	9	130S					
		VBD-P_1&P_2	9	131S		B		1st Refueling	
Recorder reading at low-end of scale not visible through recorder windows.	SB2.1	VBD-R	8	43/132S	Enhanc.	A	Fix	85	
Multi-channel recorder does not display channel being plotted.	SB2.2	VBD-A	8	44/133S	Design Mod.	II	Fix	85	Discrepancy under correction.
Procedural provisions to prevent interchanging indicating light lenses not available.	SB3	All Panels	8	45/134S	Other Mod.	III	No Action		Normal practice is to replace light lenses individually. Redundant indications available to distinguish interchanging lenses.

Item Description	Checklist Item No.	Panel ID.	Eval. Product	HED GR./ ID. No.	Enhancement Modifications	Category/ Priority	Implementation Action	Schedule for Implementation	Comments/Resolutions
Annunciators not consistently grouped by system within boxes	C1.1	9-5	8	46/135S	Other Mod.	III	No Action		Training compensates
Annunciators not grouped above related controls and displays	C1.2	VBD-Q&G	8	47/136S	Design Mod.	II	FS(1)	1st Refueling	Integrate with HED 4S.
Warning and diagnostic alarms not segregated from information and advisory alarms.	C1.3	9-5 VBD-J&S	8 8	48/137S 138S	Other Mod.	III	No Action Fix	2nd Refueling	Minor discrepancies noted during verification - No action required.
Annunciators' nomenclature, acronyms or abbreviations not standardized.	C2.1	VBD-M	8	49/139S	Enhanc.	B	Fix	1st Refueling	
Wording not consistent with input signal function.	C2.5	9-5 VBD-B	9 9	50/140S 141S	Enhanc.	B	Fix	1st Refueling	
Alarms no prioritized for required response level by legend plate color.	C2.8	VBD-A VBD-B VBD-J&S VBD-K VBD-M VBD-Q&G VBD-P_1&P_2	9 9 12 8 12 12 12	51/142S 143S 144S 145S 146S 147S 148S	Other Mod.	III	No Action		Prioritization of all alarms not necessary. RPS alarms are color coded. EOP's entry condition will be identified on SPDS.
Alarms not provided with alpha-numeric code for prompt response.	C2.9	All Panels	8	52/149S	Enhanc.	B	Fix	1st Refueling	Engrave the alarm titles by numeric/numeric code.

Item Description	Checklist Item No.	Panel ID.	Eval. Product	HED GR./ ID. No.	Enhancement Modifications	Category/ Priority	Implementation Action	Schedule For Implementation	Comments/Resolutions
Reset button not provided	C5.3	VBD-Q	8	53/150S	Design Mod.	II	Fix	1st Refueling	
Location and demarcation of annunciator response buttons is inconsistent with other panels	C5.5	VBD-H VBD-J&S VBD-M VBD-R	8	54/151S 152S 153S 154S	Design Mod.	III	FS(1)	1st Refueling	Integrate with HED GR.1
Alarms do not reflash for second alarm input	C6.3	All Panels	12	55/155S	Design Mod.	II	Fix	2nd Refueling	
No standard guide for writing annunciator procedures is in use	C7.1	All Panels	12	56/156S	Enhanc.	B	Fix	1st Refueling	
No method availab o assure placing annunciator plate in correct location during bulb replacement	C8.1	VBD-P_1&P_2	12	57/157S	Design Mod.	II	Fix	2nd Refueling	
Highly dense annunciator matrices within panel	SC1	All Pnls Fire Pnl	9 12	58/158S 159S	Other Mod.	III	No Action		Not a serious problem. Operators have adapted.
Annunciator response controls not coded for ease of recognition	SC2	VBD-C VBD-H VBD-K VBD-M VBD-S	8	59/160S 161S 162S 163S 164S	Enhanc.	A	Fix	85	

Item Description	Checklist Item No.	Panel ID.	Eval. Product	HED GR./ ID. No.	Enhancement Modifications	Category/ Priority	Implementation Action	Schedule For Implementation	Comments/Resolutions
Each volume or binder does not have an index or table of contents	E2.3	N/A	12	60/165S	Design Mod.	III	Fix	2nd Refueling	
Index tabling system within each procedure binder not convenient to use.	E2.6	N/A	9	61/166S	Design Mod.	III	Fix	2nd Refueling	Combine with HED 165S
No administrative procedure in use to assure standardization of procedure format for type style, nomenclature, as-labeled designation of components entry/exit conditions, or identification of revision.	E3	N/A	8	62/167S	Enhanc.	B	Fix	1st Refueling	Integrate with HED 156S
Setpoints and sensor identity not provided in emergency and abnormal procedures.	E4.14	N/A	9	63/168S	Other Mod.	I	Provide Alternative		CNS newly developed EOPs will address sensor identity and setpoints.
Procedures do not provide contingency actions if expected results are not achieved under degraded conditions.	E4.16	N/A	9	64/169S	Other Mod.	I	Provide Alternative		EOPs will cover this discrepancy
Applicable revision of cross - references not identified	E5.2	N/A	8	65/170S	Other Mod.	III	No Action		Only latest revisions of procedures available in the CR. Latest revisions are verified by computer

Item Description	Checklist Item No.	Panel ID.	Eval. Product	HED GR./ ID. No.	Enhancement Modifications	Category/ Priority	Implementation Action	Schedule for Implementation	Comments/Resolutions
Procedure index or table of contents not updated to show latest revision.	E6.9	N/A	12	66/171S	Design Mod.	III	Fix	2nd Refueling	

HED Description	Check-list Item No.	Panel ID.	Eval. Pro-duct	HED GR./ ID. No.	Enhance-ment Modifi-cations	Cate-gory/ Priority	Implemen-tation Action	Schedule For Implemen-tation	Comments/Resolutions
Communication system not redundant	F1.1	N/A	9	67/172S	Design Mod.	II	Fix	2nd Refueling	A new system being installed.
The PA system has no channel dedicated to operations.	F1.4	N/A	9	68/173S	Design Mod.	II	Fix	2nd Refueling	Refer to HED 172S
Communication system not equipped with channel select	F1.7	N/A	8	69/174S	Design Mod.	II	Fix	2nd Refueling	Refer to HED 172S
F. MAINTENANCE AND SURVEILLANCE & TRAINING AND MANNING									
Control room operator maintance and surveillance functions' responsibilities not clearly established	G1.1	N/A	9	70/175S	Enhanc.	B	Fix	1st Refueling	Improve division of responsibilities
Guidelines defining duties and responsibilities of shift members during emergency conditions are very general	H2.3	N/A	9	71/176S	Enhanc.	A	Fix	85	A guideline under implementation

HED DESCRIPTION	EOP FUNC-TION	PLANT SYSTEM OR SUBSYSTEM	COMPONENT	PANEL I.D.	HED ID. NO.	ENHANCE-MENT/ MODIFI-CATION	CATEGORY/ PRIORITY	IMPLE-MENTA-TION ACTION	SCHEDULE FOR IMPLEMEN-TATION	COMMENTS/RESOLUTIONS
WL scale on recorder paper does not match indicated scale.	EOP-1	RPV Level Instr.	WL Recorder LR/PR-97	9-5	1T	Enhanc.	A	Fix	85	Obtain new chart paper
Scale of one Rx press indication meter not in agreement with the remaining indications.	EOP-1	RPV Press.	Meter Ind. PI-90C	9-5	2T	Enhanc.	A	Fix	85	Replace scale or meter
Front panels primary containment press. recorders need to identify normal/off normal range of operation	EOP-1	Prim.Cont. Press. Instr.	Press. Rec. PC-PR-1A&B	9-4& 9-5	3T	Enhanc.	A	Fix	85	Place a marker to identify EOP entry conditions. Integrate with HED GR.32.
Rx scram information is indicated when the lights go from "LIT" to "OFF".	EOP-1	Rx Protec-tion system	Scram Group Ind. Lights 1,2,3,4	9-5	4T	Other Mod.	III	None		Not a serious problem. Redundancy of indi-cations (4 lights) and plant training suffice.
Prim.Cont. isolation information is indica-ted when the lights go from "LIT" to "OFF".	EOP-1	PCIS	Channel A& B lights	9-5	5T	Other Mod.	III	None		Same comments as HED 4T.

HED DESCRIPTION	EOP FUNC-TION	PLANT SYSTEM OR SUBSYSTEM	COMPONENT	PANEL I.D.	HED ID. NO.	ENHANCE-MENT/ MODIFI-CATION	CATEGORY/ PRIORITY	IMPLE-MENTA-TION ACTION	SCHEDULE FOR IMPLEMEN-TATION	COMMENTS/RESOLUTIONS
Front panel meter indication not available	EOP-1	Main steam Process Rad.	Meter Ind.		6T	Other Mod.	II	Add to PMIS/ SPDS	2nd Refueling	Meter Indication Available on back panels 9-10 & 9-02.
Recorder identification label missing	EOP-1	Main Steam Process Rad.	MS Rad. Recorder	9-02	7T	Enhanc.	A	Fix	85	
Positions of TCVs and TSVs in the intermediate ranges of fully open and fully closed valve positions are indicated by the lights going "OFF".	EOP-1	Turbine Control & Stop Valves	Light Ind.	VBD-A VBD-B	8T	Other Mod.	III	None		Redundant indications available on VBD-A.
Scram discharge volume water level indication not available	EOP-1	Scram Discharge volume	Meter Ind.	9-5	9T	Other Mod.	II	Place on PMIS	2nd Refueling	
Intermediate range monitor switches need color marking improvements	EOP-1	Int. Range Mon. (IRM)	Switches	9-5	10T	Enhanc.	A	Fix	85	
APRM trip setpoints at core flow 100% not directly available (calculations necessary)	EOP-1	APRM	Ind. setpoints at Flow 100%	9-5	11T	Other Mod.	II	Place on PMIS	2nd Refueling	
A signal indicating combined occurrence of Rx scram demand and APRM 2.5% (or undetermined power level) is not available.	EOP-1	Rx Protection System	An Indication or alarm	9-5	12T	Other Mod.	II	Place on PMIS/SPDS	2nd Refueling	

HED DESCRIPTION	EOP FUNCTION	PLANT SYSTEM OR SUBSYSTEM	COMPONENT	PANEL I.D.	HED ID. NO.	ENHANCEMENT/ MODIFICATION	CATEGORY/ PRIORITY	IMPLEMENTATION ACTION	SCHEDULE FOR IMPLEMENTATION	COMMENTS/RESOLUTIONS
An APRM value of 2.5% is at the low-end of the scale, and difficult to read.	EOP-1	Power Range Monitor	APRM Recorders	9-5	13T	Enhanc.	A	Fix	85	Mark the scale at 2.5%
Information lights for system isolation demand for groups 2,3,6 and 7 not available.	EOP-1	Group Isolation	Information Lights		14T	Design Mod.	II	Fix	2nd Refueling	
HPCI and RCIC systems' start alarms needed	EOP-1	HPCI & RCIC	Alarms	9-3 & 9-4	15T	Design Mod.	II	Fix	2nd Refueling	
RF pump discharge pressure indication has incorrect label	EOP-1	Reactor Feed	Meter Ind.	VBD-A	16T	Enhanc.	A	Fix	85	
SLC test tank level indication not available	EOP-1	SLC System	Meter Ind.		17T	Other Mod.	I	To be Evaluated	1st Refueling	Integrate with other modifications under ATWS rule. Revise procedures to correct this HED.
RPV Wide Range water level trend recording not available	EOP-1	RPV level Instr.	WL Recorder	9-5 & 9-3	18T	Design Mod.	I	Install Recorder	2nd Refueling	Implementation schedule dictated by long leadtime.
Wide range torus pressure indication not available	EOP-1	Prim. Cont.	Press. Ind.		19T	Design Mod.	I	Fix	1st Refueling	

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SRV label identification out of sequence	EOP-1	Safety Relief valves	Labeling	9-3	20T	Enhanc.	A	Fix	85	
Functional separation between ADS & LLS valves not evident	EOP-1	Safety Relief valves	Demarcation	9-3	21T	Enhanc.	A	Fix	85	
No direct reading of Rx subcriticality available	EOP-1	Rx Core	Ind.	9-5	22T	Other Mod.	II	EOP's Training	1st Refueling	Train operators for observing various parameters to verify subcriticality
Alternate system for boron injection (other than SLC) not presently in place.	EOP-1	SLC		9-5	23T	Other Mod.	I	To be evaluated	1st Refueling	Integrate with HED 17T.
Low-end of the scale on SRM recorders not identified.	EOP-1	Rx Neutron Monitoring System	SRM Recorder	9-5	24T	Enhanc.	A	Fix	85	
No direct readout of Rx cooldown rate available	EOP-1	RPV	Ind.		25T	Other Mod.	III	Place on PMIS	2nd Refueling	
Suppression pool bulk temperature indication not directly available (calculations required).	EOP-1	Supp. Pool	Meter Ind.	VBD-J	26T	Other Mod.	II	Place on SPDS	2nd Refueling	

HED DESCRIPTION	EOP FUNC-TION	PLANT SYSTEM OR SUBSYSTEM	COMPONENT	PANEL I.D.	HED ID. NO.	ENHANCE-MENT/ MODIFI-CATION	CATEGORY/ PRIORITY	IMPLE-MENTA-TION ACTION	SCHEDULE FOR IMPLEMEN-TATION	COMMENTS/RESOLUTIONS
Label marking of Group I isolation reset switches needs improvement.	EOP-1	Group I Isol.	Reset switches	9-5	27T	Enhanc.	A	Fix	85	
Rod sequence control switch label needs improvement	EOP-1	Rod Seq. control switch	Label	9-5	28T	Enhanc.	A	Fix	85	
SLC tank level indication is difficult to read at 1% level	EOP-1	SLC System	Meter Ind.	9-5	29T	Enhanc.	A	Fix	85	Place a fine demarcation line at 1% level
Manual switches for actuating relays for reopening MSIV's not available	EOP-1	MSIVs	Switches	9-17	30T	Design. Mod.	I	Fix	1st Refueling	Design a special tool for reopening MSIV's. Modify EOP's.
SDV alarm tile label does not match alarm procedure	EOP-1	SDV	Alarm	9-5	31T	Enhanc.	A	Fix	85	
Concern regarding not enough phones to account for failure of communication between Rx building and control room.	EOP-1	CRD	Communication Link		32T	Design. Mod.	II	Fix	2nd Refueling	Install phones & system.

HED DESCRIPTION	EOP FUNCTION	PLANT SYSTEM OR SUBSYSTEM	COMPONENT	PANEL I.D.	HED ID. NO.	ENHANCEMENT/ MODIFICATION	CATEGORY/ PRIORITY	IMPLEMENTATION ACTION	SCHEDULE FOR IMPLEMENTATION	COMMENTS/RESOLUTIONS
Position lock switches for RCIC, CS and RHR to prevent automatic initiation not available	EOP-1	RCIC, CS, RHR's	lock swtiches	9-4	33T	Design Mod. & Proc. Review	II	FIX	2nd Refueling	Install locking system.
Pointer of fuel zone indication too wide - covers scale	EOP-1	RPV Level Instr.	Meter Ind.	9-3	34T	Enhanc.	A	Fix	85	
RHR service water pump controls and indications are located on back panels rather than panel 9-3	EOP-1	RHR	SW C&I	9-3	35T	Design Mod.	II	Fix	2nd Refueling	Install pump controls on panel 9-3
Front panel SP temperature alarm not available	EOP-2	Supp. Pool	Alarm	VBD-J	36T	Design Mod	II	Fix	2nd Refueling	Place alarm on front panel Identify EOPs entry condition on SPDS
DW bulk temperature Ind. not directly available (calculations required)	EOP-2	DW	Temp. Ind.	VBD-H	37T	Other Mod.	II	Place on SPDS	2nd Refueling	
DW bulk temperature alarm not available & local alarms located on back panels	EOP-2	DW	Alarm	VBD-H	38T	Design Mod.	II	Fix	2nd Refueling	Place alarm on front panel Identify EOPs entry condition on SPDS

HED DESCRIPTION	EOP FUNCTION	PLANT SYSTEM OR SUBSYSTEM	COMPONENT	PANEL I.D.	HED ID. NO.	ENHANCEMENT/ MODIFICATION	CATEGORY/ PRIORITY	IMPLEMENTATION ACTION	SCHEDULE FOR IMPLEMENTATION	COMMENTS/RESOLUTIONS
SP level alarm utilizes common annunciator for both high & low levels	EOP-2	Supp. Pool	Alarm	VBD-H	39T	Other Mod.	III	None		No action is necessary. Indications to verify alarms are located on same panel.
Incorrect demarcation of alarm setpoints on SP level indication	EOP-2	Supp. Pool	Level Ind.	9-3	40T	Enhanc.	A	Fix	85	
Alarm procedures for panels P_1 & P_2 specifying PC hydrogen concentration setpoints and operator actions not available	EOP-2	Prim.Cont.	Alarm Procedures	VBD-P_1&P_2	41T	Enhanc.	B	Fix	1st Refueling	Procedure change of of EOPs primary containment hydrogen control required. Alarm setpoints should be in accordance with EOPs entry condition.
PC hydrogen concentration alarms and indications are located on back panels.	EOP-2	Prim. Cont.	H_2 Concention Ind.	VBD-P_1&P_2	42T	Other Mod.	II	Place on SPDS	2nd Refueling	
Incorrect scale on PC hydrogen concentration recorder (should read 0-5% not 0-100%)	EOP-2	Prim.Cont.	Recorder B	VBD-P_1&P_2	43T	Enhanc.	A	Fix	85	
DW cooling fan switches located 19" from the floor.	EOP-2	DW Coolers	Fan Swtiches	VBD-K	44T	Design Mod.	II	FS(1)	1st Refueling	Integrate with HED GR.1. No problem to to operate
Torus air temperature and pressure indications located 30" from the floor	EOP-2	Torus	Temp & press Indications	VBD-J	45T	Design	II	FS(1)	1st Refueling	Include in feasibility study of HED GR.1. Not of an immediate concern due to redundancy of indications.

HED DESCRIPTION	EOP FUNCTION	PLANT SYSTEM OR SUBSYSTEM	COMPONENT	PANEL I.D.	HED ID. NO.	ENHANCEMENT/ MODIFICATION	CATEGORY/ PRIORITY	IMPLEMENTATION ACTION	SCHEDULE FOR IMPLEMENTATION	COMMENTS/RESOLUTIONS
Label differentiation between SP and DW system sprays needed	EOP-2	SP & DW	Labels	9-3	46T	Enhanc.	A	Fix	85	
NPSH for pumps taking suction from SP at various WLs not available.	EOP-2	SP	NPSH curves		47T	Other Mod.	I	Modify Proc.	1st Refueling	
Indications for the "two dimensional" PC limits of SP temp. and Rx pressure not in close proximity	EOP-2	SP & RPV	Temp.& Press. Indications		48T	Other Mod.	II	Place on SPDS	2nd Refueling	Place all EOPs two-dimensional PC limits on SPDS. (Refer to HED 26T for making SP bulk temp. available on SPDS).
Torus narrow range pressure indication has an incorrect scale	EOP-2	Torus	Press.Ind.	VBD-J	49T	Enhanc.	A	Fix	85	
SBGT and ACAD interface for venting the PC needs a mimic and identification of flow path.	EOP-2	SBGT & ACAD	Mimic & demarcation	VBD-P_1&P_2	50T	Enhanc.	B	Fix	1st Refueling	
The "two dimensional" PC limits of T_{HC} vs. SP WL requires performing calculations, and indications for input parameters not in close proximity.	EOP-2	SP & RPV	Press.,Temp., Level Ind.		51T	Other Mod.	II	Place on SPDS	2nd Refueling	Integrate with HED 48T

HED DESCRIPTION	EOP FUNC-TION	PLANT SYSTEM OR SUBSYSTEM	COMPONENT	PANEL I.D.	HED ID. NO.	ENHANCE-MENT/ MODIFI-CATION	CATEGORY/ PRIORITY	IMPLE-MENTA-TION ACTION	SCHEDULE FOR IMPLEMEN-TATION	COMMENTS/RESOLUTIONS
Recorder scale of DW Atm O_2 concentration not indicated - Needs to call to known scale.	EOP-2	Primary Cont.	Recorder	VBD-H	52T	Design Mod.	III	Fix	3rd Refueling	
Indication lights of sampling locations of DW Atm. O_2 concentrations not bright enough.	EOP-2	Primary Cont.	Ind. Lights	VBD-H	53T	Design Mod.	III	Fix	3rd Refueling	Integrate with HED 52T.
Limiting conditions of operation (LCO) radioactivity release rate not readily available. (Calculations required)	EOP-2	Radioactive Release	Ind.		54T	Other Mod.	II	Place on PMIS/SPDS	2nd Refueling	
Action levels on SP temperature and level and, Rx level and pressure need to be marked	EOP-2	SP, RPV	Demarcation	9-3 & 9-4	55T	Enhanc.	B	Fix	1st Refueling	Place demarcation lines as dictated by the EOPs
No functional label for secondary containment area temperature indication meter.	EOP-3	SC Area Temp. Detection	Temp.Ind. Meter	9-21	56T	Enhanc.	A	Fix	85	
SC area temperature indication meter located above line of sight.	EOP-3	SC Area Temp. Detection	Temp. Ind. Meter	9-21	57T	Design Mod.	II	Fix	3rd Refueling	Include in the feasibility study of [illegible] GR.1.
SC HVAC exhaust radiation meters A&B located 15" from the floor.	EOP-3	SC HVAC	Rad. Ind. Meter	9-10	58T	Design Mod.	II	Fix	3rd Refueling	Integrate with HED GR.1.

HED DESCRIPTION	EOP FUNCTION	PLANT SYSTEM OR SUBSYSTEM	COMPONENT	PANEL I.D.	HED ID. NO.	ENHANCEMENT/ MODIFICATION	CATEGORY/ PRIORITY	IMPLEMENTATION ACTION	SCHEDULE FOR IMPLEMENTATION	COMMENTS/RESOLUTIONS
Alarm setpoints are temporarily placed below SC area radiation indication meters	EOP-3	SC Area Rad. Detection	Temporary Additions	9-11	59T	Enhanc.	A	Fix	85	Replace by permanent labels.
Process units not identified on SC area radiation recorder	EOP-3	SC Area Rad. detection	Labels	9-02	60T	Enhanc.	A	Fix	85	
Paper scale of SC area radiation recorder does not match recorder scale.	EOP-3	SC Area Rad. Detection	Radiation Recorder	9-02	61T	Enhanc.	A	Fix	85	Replace chart paper
Recorder contains excessive plots - no single trend can easily be distinguishable.	EOP-3	SC Area Rad Detection	Radiation Recorder	9-02	62T	Design Mod.	II	Fix	2nd Refueling	Replace recorder
SC sump water level indication not available	EOP-3	SC Sump	Level Ind.	VBD-S	63T	Design Mod.	II	Fix	2nd Refueling	Provide sump WL indication
Indications and alarms for SC area levels (other than the torus) not available	EOP-3	SC Areas	Level Ind.		64T	Other Mod.	I	Evaluate EOP's.	85	Assess the need for identifying this HED as an independent entry condition for emergencies. (System analysis may be required.)

HED DESCRIPTION	EOP FUNCTION	PLANT SYSTEM OR SUBSYSTEM	COMPONENT	PANEL I.D.	HED ID. NO.	ENHANCEMENT/ MODIFICATION	CATEGORY/ PRIORITY	IMPLEMENTATION ACTION	SCHEDULE FOR IMPLEMENTATION	COMMENTS/RESOLUTIONS
Direct indication of SC floor drain sump pump discharge not available	EOP-3	SC Floor drain sump pumps	Press. or flow ind.	VBD-S	65T	Other Mod.	III	None		HED 63T sump level installation will provide necessary indication of system functional operation. No additional action required.
SC HVAC controls and displays not set off by demarcation lines	EOP-3	SC HVAC	Demarcation lines	VBD-R	66T	Enhanc.	B	Fix	1st Refueling	
Ranges (50-170°F) of area temperature indications for CS, RHR's, and HPCI do not extend to emergency limits (alert signal 200°F)	EOP-3	Area Temp. Detection	Temp. Indications	VBD-R	67T	Design Mod.	I	Fix	2nd Refueling	Implementation schedule dictated by long leadtime.
Direct indication of SC HVAC fan flow not available	EOP-3	SC HVAC	Flow Ind.	VBD-R	68T	Design Mod.	III	Fix	3rd Refueling	
Small print on alarm tile for ERP effluent monitor	EOP-4	Off-Gas effluent Monitor	Alarm	9-4	69T	Enhanc.	A	Fix	85	
Off-gas vent pipe indication meters located 24" from the floor	EOP-4	Off-Gas	Ind. Meter	9-02	70T	Design Mod.	II	Fix	3rd Refueling	Include in the feasibility study of HED GR.1.

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Location of functional labels of off-gas vent pipe indication meters are inconsistent (some-times above or below meter)	EOP-4	Off-Gas vent pipe	Labels on Ind. Meters	9-02	71T	Enhanc.	A	Fix	85	
Off-Gas vent pipe recorder pointer covers reading on scale	EOP-4	Off-Gas vent pipe	Recorder	9-02	72T	Enhanc.	B	Fix	1st Refueling	
Inconsistent functional labeling between meter and recorder for service water radiation monitor	EOP-4	Service Water Radiation Monitor	Ind. Meters & Recorders	9-02	73T	Enhanc.	A	Fix	85	
Service water radiation recorder pointer covers reading on scale.	EOP-4	Service water	Radiation Recorder	9-02	74T	Enhanc.	B	Fix	1st Refueling	
Radiation release monitor recorder paper scale does not match indicated Vtl. scale.	EOP-4	Radiation Release Monitors	Recorder	VBD-Q	75T	Enhanc.	A	Fix	85	Replace chart paper
CNS dose rate assess-ment requires perform-ing calculations	EOP-4	Effluent Radiation	Dose Rate Values		76T	Other Mod.	II	Place on PMIS	3rd Refueling	A backup method available. Operator uses a programmed calculator.
Site boundary dose rate not directly available - Requires communication with HP.	EOP-4	Effluent Radiation	Dose rate values		77T	Other Mod.	II	Evaluate Procedures	85	

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Operators express a serious need for integrated plant training.	Training	Simulator	1I	Other Mod.	III	Install	4th Refueling	Provide plant specific simulator training
Lack of ventilation system supply filtration	Ventilation	Filters	2I	Design Mod.	III	Install Filters	2nd Refueling	
Lack of an available backup cooling supply for the control room air conditioning system.	Air conditioning	Control Room	3I	Design Mod.	III	Install	2nd Refueling	
SRM Ramp switch is too small for holding for 90 seconds in surveillance position; need an operator aid.	SRM	Switch	4I	Design Mod.	III	Fix	2nd Refueling	
RFP minimum flow valve control switch installed backwards (turn to right to close)	RFP	Switch	5I	Design Mod.	II	Fix	2nd Refueling	
The RPS Power supply lights are opposite their respective positions on the transfer switch.	RPS	Indicator	6I	Design Mod.	II	Fix	2nd Refueling	
Sealing steam for main turbine, label description vague and unclear.	Main Turbine	Label	7I	Enhanc.	A	Fix	85	
SBGT damper: Positions are "Normal" and "Hand". "Normal" is actually the not normal lineup.	SBGT	Label	8I	Enhanc.	A	Fix	85	

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Control Rod drive water delta pressure gage has non-standard increments.	CRD	Press. Ind. CRD-DPI-303	9I	Design Mod.	II	Fix	2nd Refueling	Replace with standard-increments meter
Need for lower range meter for accurate operator control of blowdown.	RWCU	Flow Ind. RWCU-FI-134	10I	Design Mod.	II	Install	2nd Refueling	
RER 2/3 core height level permissive manual override switch label confusing	RHR's	Label	11I	Enhanc.	A	Fix	May 85	
Gland seal steam pressure gage range too large for normal operation	Gland seal steam	Press. Ind.	12I	Design Mod.	II	Fix	2nd Refueling	Replace gage.
No direct vessel level instrument on Panel 9-3 or Panel 9-4	Rx. Level	Instrument	13I	Design Mod.	III	Install	2nd Refueling	
Lack of digital indicators for reactor pressure and reactor level (on panel 9-5 above top of fuel matrix)	Rx. Press. Rx. Level	Indicators	14I	Design Mod.	II	Install	2nd Refueling	Integrate with HED 18T, 13I, 15I.
Lack of direct accident water level indication	Rx. Level	Indicator	15I	Design Mod.	II	Evaluate	2nd Refueling	Evaluate installation of a compensating water level system.
Computerized tech specs needed	Computer	Software	16I	Other Mod.	III	Place on Prime	2nd	Utilize key word search