CONTROL ROOM DESIGN REVIEW PLAN

SAN ONOFRE
NUCLEAR GENERATING STATION
UNITS 2 & 3

SCE DOCUMENT NO. M37327

SCE Southern California Edison Company

SDG&E SAN DIEGO GAS & ELECTRIC COMPANY

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REVISION 0

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TABLE OF CONTENTS

TABLE OF CONTENTS (Continued)

FIGURES

CONTROL ROOM DESIGN REVIEW PLAN

1.0 OVERVIEW

1.1 INTRODUCTION

This document describes the plan and philosophy of conducting the Control Room Design Review (CRDR) on Southern California Edison's San Onofre Nuclear Generating Station (SONGS) Units 2 and 3 located near San Clemente, California.

The Control Room Design Review program is required by NRC Regulatory Guides and NUREGs, and Southern California Edison (SCE) is determined to make the plant as safe and easy to operate as is reasonably achievable by identifying and correcting all significant Human Engineering Discrepancies (HEDs). The CRDR will be supplemented by feedback from the station operating personnel through a problem reporting procedure including Startup Problem Reports (SPRs) which will identify HEDs as well as other problems. Every SPR will require an evaluation and a formal disposition to resolve it. Standard, documented procedures exist to track these SPRs and close them out.

The plan is to obtain a simulator which will replicate the Unit 2 and common areas of the control room. In addition to providing a training facility, the simulator will be used for operating procedure walk-throughs and for identifying additional HEDs which will be evaluated for corrective action.

1.2 OBJECTIVES

The major objective of the CRDR is to identify specific instrumentation and control components, environmental factors, and other man-machine interface aspects which are less than optimal and could cause confusion, difficulty, or undue fatigue for the plant operators in the performance of their duties.

The items identified will be referred to as Human Engineering Discrepancies (HEDs). The HEDs will be classified as to seriousness and priority of need for correction or improvement and recommendations for means of improvement will be submitted to SCE management for approval. It is not planned to maintain records on each item reviewed in the control room inventory. All instruments will be reviewed, but only HEDs will be recorded and reported.

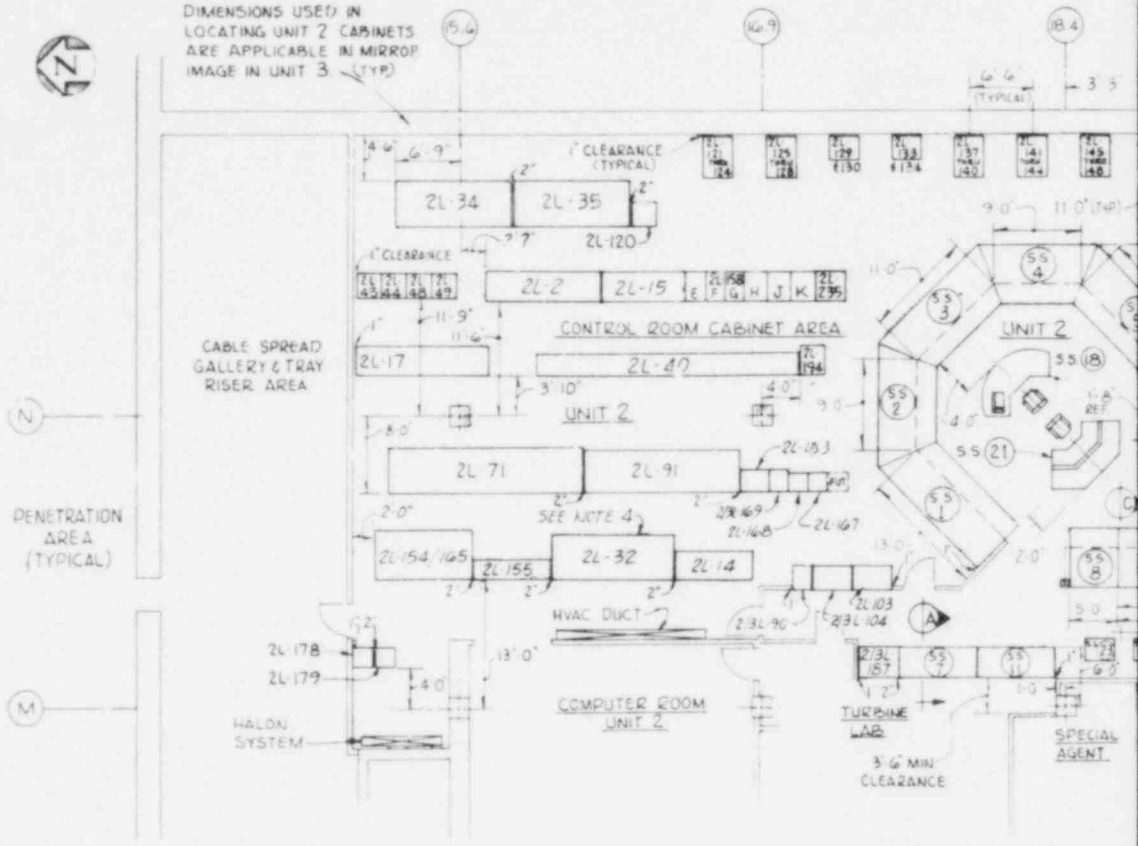
The recommendations which are accepted will be implemented by issuing Design Change Packages (DCPs) and Construction Work Orders (CWOs) which will define and document the design change and provide documents for the Construction and Startup departments to implement, test and place the improvement in operation in the plant. Signed forms verifying that the revision has been successfully completed and placed in operation will be returned to the responsible engineering design group.

1.3 SCOPE OF THE REVIEW

The CRDR program will be concentrated in the primary operating areas of the control room as shown on figure 1.3-1.

Since the Unit 2 and Unit 3 panels are identical in design (same hand and not mirror-image arrangement), corresponding instruments and controls will be reviewed for only one of the units and for the common control panel sections.

Local control panels will be excluded from this review.

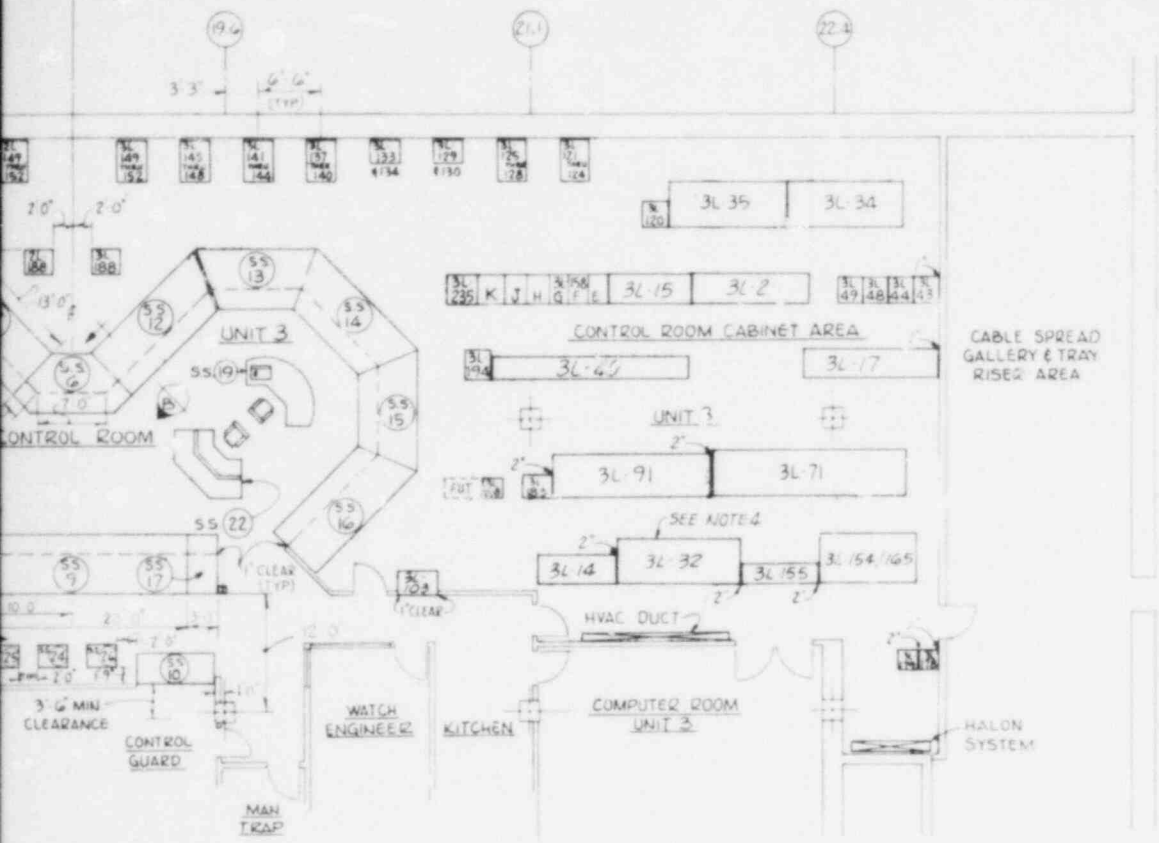


PANELS & CABINETS WITHIN MAIN CONTROL ROOM

SHIPPING SECTION	BECHTEL PANEL NO.	DESCRIPTION	PANEL ENTRY (FIELD CABLE)
1	2CR-57	ENGINEERED SAFETY FEATURES SYSTEM	BTM
2	2CR-56	PLANT PROT. SYST. & REACTOR COOLANT PUMPS	BTM
3	2CR-58 50, 51	CHEM. VOL. CONTROL, REACTOR COOLANT AND REACTIVITY SYSTEMS	BTM
4	2CR-52 & 53	STM. GEN. WATER LEVEL CONTROL AND FEEDWATER & CONDENSATE	BTM
5	2CR-54 & 64	TURBINE AND SALTWATER & COMPONENT COOLING WATER SYST.	BTM
6	2/3CR-61	COMMON SYSTEMS	BTM
7	2/3CR-62	CHEMICAL CONTROL	BTM
8	2/3CR-60	HEATING & VENTILATING-UNIT 2 & COMMON (SEE NOTE 1)	BTM
9	2/3CR-63	ELECTRICAL MIMIC BUS (SEE NOTE 1)	"M
10	3CR-59	RECORDERS	BTM
11	2CR-59	RECORDERS	BTM
12	3CR-57	ENGINEERED SAFETY FEATURES SYSTEM	BTM
13	3CR-56	PLANT PROT. SYST. & REACTOR COOLANT PUMPS	BTM
14	3CR-58, 50 & 51	CHEM. VOL. CONTROL, REACTOR COOLANT AND REACTIVITY SYSTEMS	BTM
15	3CR-52 & 53	STM. GEN. WATER LEVEL CONTROL AND FEEDWATER & CONDENSATE	BTM
16	3CR-54 & 64	TURBINE AND SALT WATER & COMPONENT COOLING WATER SYST.	BTM
17	3CR-60	HEATING & VENTILATING UNIT 3 (SEE NOTE 1)	BTM
18	2CR-65	OPERATORS DESK - UNIT 2	BTM
19	3CR-65	OPERATORS DESK - UNIT 3	BTM
20	—	——— ———	—
21	2CR-55	COMPUTER CONSOLE	BTM
22	3CR-55	COMPUTER CONSOLE	BTM
23	2L-100	OPERATOR'S PRINTER	BTM
24	3L-100	OPERATOR'S PRINTER	BTM
25	2L-101	DOCUMENTATION PRINTER	BTM
26	3L-101	DOCUMENTATION PRINTER	BTM

PANELS & CABINETS WITHIN CONTROL ROOM C

BECHTEL PANEL # UNIT 2	UNIT 3	DESCRIPTION
2L 2	3L-2	TURBINE PROTECTION CUBICLE (ELECT)
2L14	3L-14	UNITISED ACTUATOR PANEL
2L-15	3L-15	TURBINE SUPERVISORY EQUIP. CUBICLE
2L-17	3L-17	ELECTRIC GOVERNOR CUBICLE (EHG)
2L-32	3L 32	PLANT PROTECTIVE SYSTEM CABINET
2L-34	3L-34	ENG. SAF. FEAT. ACT. SYST. AUX. CAB.
2L-35	3L-35	ENG. SAF. FEAT. ACT. SYST. AUX. CAB.
2L-40	3L-40	ANNUNCIATOR LOGIC CABINET
2L 43	3L-43	REACTIVITY REGULATING SYST NO 1 RACK
2L-44	3L-44	REACTIVITY REGULATING SYST NO 2 RACK
2L-48	3L-48	FEEDWATER CONTROL SYSTEM NO 1 RACK
2L 49	3L 49	FEEDWATER CONTROL SYSTEM NO 2 RACK
2L-71	3L-71	NSSS AUX. RELAY CABINET
2/3L-90		RADIATION MONITOR SYSTEMS
2L-91	3L-91	AUXILIARY PROTECTIVE CABINET
2L-103	3L 103	RADIATION MONITOR SYSTEMS
2/3L-104		RADIATION MONITOR SYSTEMS
2L-120	3L-120	STEAM BYPASS CONT. SYSTEM RACK
2L-121	3L 121	SPEC. 200 CABINETS
THRU	THRU	(EXCEPT 2&3L 151, 132, 135 & 136)
2L-152	3L 152	NOT REQUIRED
2L-154/165	3L 154/165	HVAC SYSTEMS CONTROL
2L-155	3L-155	HVAC SYSTEMS CONTROL
2L 158	3L 158	BECHTEL INTERFACE CABINET (BOP) (SPEC
2L-167	NONE	SEISMIC EVENT RECORDING
2L-168	3L 168	CIRC. WATER TEMP. DATA LOGGER
2/3L-169		CIRC. WATER FLOW MEASUREMENT
2L 178	3L-178	HYDROGEN RECOMBINER CONTROL
2L-179	3L-179	HYDROGEN RECOMBINER CONTROL
2L 183	3L-183	F.W. PUMP & TURB SUPERVISORY INSTR
2/3L 187		METEOROLOGICAL DATA LOGGER
2L-188	3L-188	BECHTEL INTERFACE CABINET (NSS
2L 194	3L-194	LOOSE PARTS MONITORING CABINET
2L 235	3L 235	MISC NSSS EQUIPMENT RACK



BINET AREA

PANEL ENTRY (FIELD CABLE)	
	BTM
NOTE 3)	BTM
	BTM
NOTE 3)	BTM
NOTE 4&5)	BTM
A"	BTM
B"	BTM
	BTM
	BTM
	BTM
	BTM
	BTM
	BTM
	BTM
	BTM
	BTM
	BTM
	BTM
	BTM
	BTM
200)	BTM
	BTM
	BTM
	BTM
	BTM
	BTM
PANEL	BTM
	BTM
5) (SPEC 200)	BTM
	BTM
	BTM

Figure 1.3-1 CONTROL ROOM ARRANGEMENT

2.0 MANAGEMENT, ORGANIZATION AND STAFFING

2.1 MANAGEMENT CONCEPT

2.1.1 Introduction

SCE's plan for the basic organization and management of the CRDR program includes six separate entities: the Steering Committee, the CRDR Working Group, an outside Human Factors Consultant, SCE Operations, the SCE Apparatus Group, and the Bechtel Power Corporation (BPC) Project Line Engineering Design Group. Figure 2.1-1 shows the management organization chart.

2.1.2 Responsibilities

2.1.2.1 Steering Committee

The major responsibility of the Steering Committee is to provide overall guidance to the CRDR Working Group concerning the scope and required completion date of their activities and to exercise the authority to approve the ultimate actions to be taken for control room improvement.

2.1.2.2 CRDR Working Group

The CRDR Working Group is responsible for establishing criteria, guidelines, and procedures for the review. It will set working schedules, initiate any required contacts and coordination with outside entities, maintain documentation, make recommendations and prepare the CRDR report.

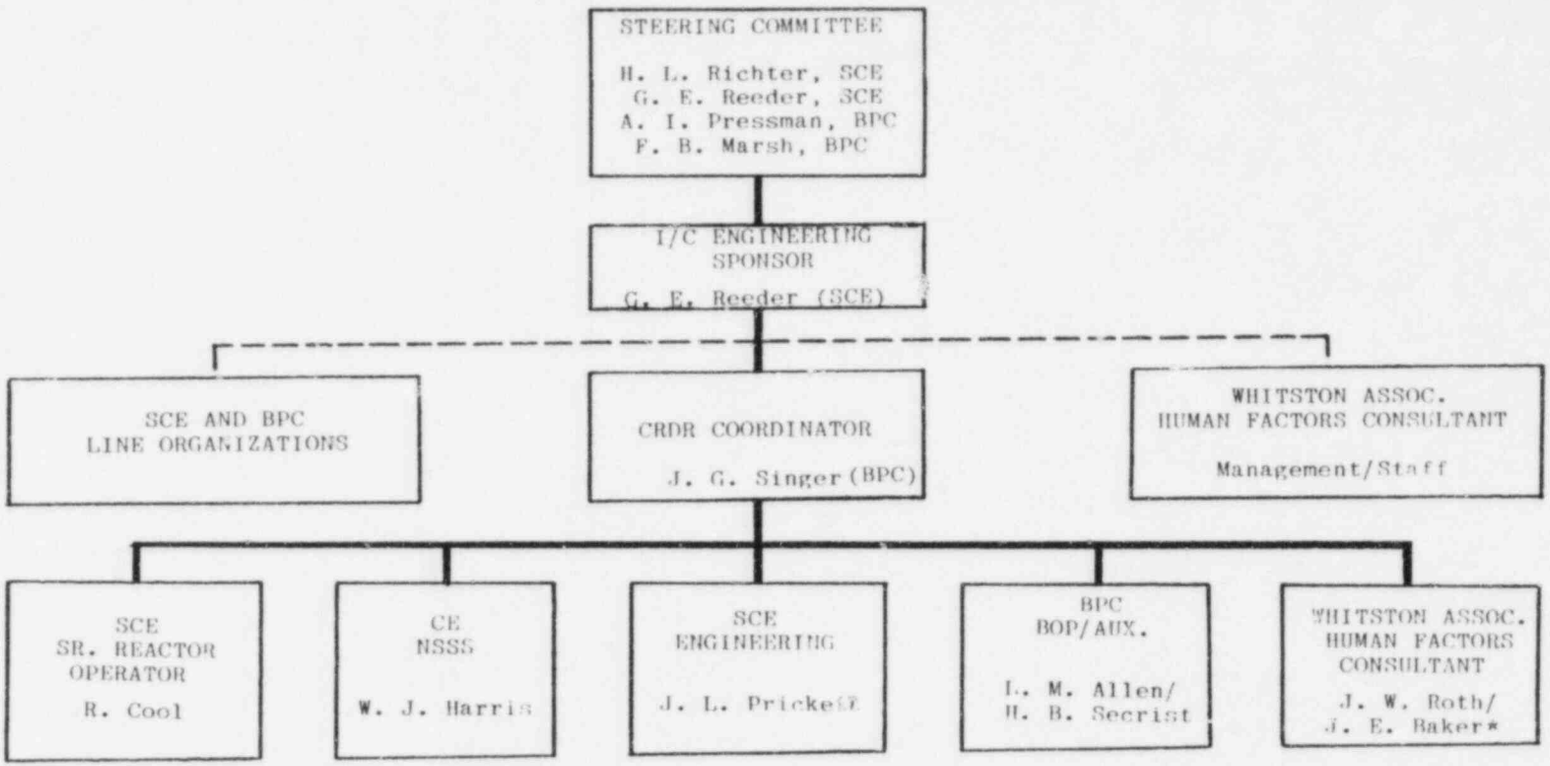


Figure 2.1-1 ORGANIZATION CHART OF THE CONTROL ROOM DESIGN REVIEW WORKING GROUP

2.1.2.3 Human Factors Consultant

The Human Factors Consultant will provide human engineering criteria and suggested methodology for the working group's consideration and adoption. The consultant will also provide instruction and counsel in Human Factors considerations and will provide a full-time member of the working group.

2.1.2.4 SCE Operations Group

The SCE Operations Group will perform task analyses in accordance with Combustion Engineering's operating guidelines for the nuclear steam supply system, nuclear technical specifications for SONGS, and other applicable documents. A task analysis must be performed before the related operating procedures can be developed and written. As operating procedures are written they will be used for operator training and in actual walk-through exercises in the plant simulator.

This activity by the SCE Operations Group will verify the adequacy of instrumentation, the relative locations of complementary instruments to satisfy operating needs and convenience, and the pathways taken through the control room by the operators in the performance of a task.

Feedback from this verification activity should result in improvements to the final operating procedures and to point out previously unidentified deficiencies in control room design.

2.1.2.5 SCE Apparatus Group

The SCE Apparatus group with input from the CRDR Working Group will determine or develop actual procedures to be used in the control room environmental surveys, conduct the required survey, report the results, and make recommendations for remedial measures.

2.1.2.6 Support Groups

The BPC and SCE Project Line Engineering Groups will have the responsibility for performing the detailed engineering design and issuing the DCPs to implement the recommended HED corrections.

2.1.3 Interfaces and Reporting Relationships

The CRDR Working Group will report through its sponsor to the Steering Committee. The Steering Committee will provide direction and guidance through the CRDR Working Group Sponsor. The Steering Committee will channel the recommendations of the CRDR Working Group to SCE Management for review and approval. SCE Management will

direct the BPC Project Line Engineering Design Group (through BPC Project Management) to proceed with the implementation of the accepted HED corrections.

2.2 ORGANIZATION, COMPOSITION AND QUALIFICATIONS

The background and qualifications of individuals involved in the CRDR program will be provided in the CRDR report.

2.3 ORIENTATION AND TRAINING

The primary basis for CRDR team member selection is past experience. It is desired to obtain a blend of experience including: nuclear plant operating, NSSS supplier engineering representation, control panel and balance of power plant engineering design, military/aviation/aerospace control panel design, and a human factors engineering consultant.

Orientation in human factors engineering aspects will be provided by the human factors engineering consultant. Additional, formalized training is not contemplated for individual CRDR group members but a cross-training effect is anticipated due to the close working relationship of the group.

3.0 DOCUMENTATION

3.1 INTRODUCTION

In order to provide a systematic and consistent means of conducting the CRDR, it is planned to obtain or generate working documents, as required, for the work activities of the CRDR and to retain for long-term storage, either in conventional files and/or microfilm, significant documents which support CRDR determinations, decisions and conclusions.

3.2 REFERENCES

Reference material will be gathered from many sources for guidance and formulation of criteria to be applied in the CRDR. Included are the following types of documents:

- Regulatory Guides (e.g., RG 1.47, 1.97)
- NUREG CR-1580/NUREG 0660
- Human factors criteria and guidelines provided from sources such as Whitston Associates (the Task Group's Human Factors Engineering Consultant), EPRI Publications, and statistical data compiled by the U.S. Military
- FSAR for SONGS 2 and 3
- Design criteria established for the design of SONGS 2 and 3
- Design documents provided by the SONGS Project Engineering Group including: Control Room Plan, Control Panel Layouts, Instrument Index and Data Sheets, Annunciator Window Layouts and Engraving List, and Plant Monitoring System Computer Input/ Output Tabulation

- o Control Room Photographs
- o Operating Procedures and Plant System Study Guides provided by SCE Operations
- o SONGS Unit 2 and 3 Technical Specifications
- o Review of past NRC audits of other public utility plants

3.3 CORRESPONDENCE

Letters initiated or received by the CRDR Working Group will be filed in the existing engineering project file system with an additional copy in the CRDR Working Group File.

3.4 DOCUMENTS GENERATED BY CRDR TASK GROUP

Review criteria, procedures, forms, tabulations, sketches, and other documents will be developed, as required, by the CRDR Working Group to:

- o Facilitate the systematic assessment and comparison of actual control room features against desired standards.
- o Record the results of the design review.
- o Identify HEDs or other instances of less than optimal design.
- o Provide recommendations for achievable, cost-effective design improvements.

A final CRDR Report will be prepared for submission to the NRC.

4.0 CONTROL ROOM DESIGN REVIEW PHASE

4.1 OBJECTIVE

The major goal of the CRDR is to identify Human Engineering Discrepancies (HEDs) which exist in the Control Room and which may create unnecessary difficulty or confusion for the operator in the performance of his/her duties or in recognizing and understanding existing and developing plant conditions.

The review will be concentrated in the following areas:

- o Control panel reviews
- o Control room design and layout
- o Control room instrumentation, controls and equipment
- o Control room environment review
- o System function identification and control room function validation
- o Remote shutdown panel

4.2 ACTIVITIES

4.2.1 Control Panel Review

The initial activity of the CRDR Working Group will be to gather human engineering factors information and criteria from all available sources including the consultant, Whitston Associates, retained for the review. These criteria will be selected, developed, and adapted to generate a usable set of criteria guidelines and methodology which can be employed in the review. CRDR Reports from other utilities will be reviewed for disclosures of typical problem areas.

Based upon the criteria and methodology selected and developed, the CRDR Working Group will proceed to the physical review of the controls and instruments.

4.2.2 Control Room Instrumentation Control and Equipment

This review will encompass readability, range and engineering unit suitability, appropriateness of location on the panel relative to other instruments in the same system and of the individual systems to each other to support logical operating sequences. Labeling and the possible need for system demarcation or mimics will also be reviewed. The review will include annunciator/alarm systems and computers. The review will employ photographs, a mockup of the Unit 2 and common major control panels, and onsite inspections of the control room.

4.2.3 Control Room Environment Review

The CRDR Working Group will investigate existing criteria and accepted procedures for evaluating control room environmental aspects such as lighting, noise level, communications, and heating, ventilation and air conditioning (HVAC). The CRDR Working Group will be assisted by the SCE Apparatus Group in the final selection and development of procedures to be employed and in conducting the survey, data gathering and recording, and for suggestions to correct the HEDs identified.

4.2.4 System Function Identification and Control Room Function Validation

The emphasis of the analysis will be on both normal operations and the emergency response capability of the control room operator and his/her equipment. Normal tasks as well as emergency tasks will be examined.

In order to create operating procedures and instructions, it will be necessary for the SCE Operations Group to make a thorough analysis of the operating tasks and the system responses, reactions, alarms, indicator readings anticipated, actual instrument and control devices available and required. Consideration will also be given to the control devices' operating sequence and locations. After operating procedures have been written they will be verified by walk-throughs and, finally, proven by use in actual operations. During these iterations the procedures will be corrected and revised as required.

Additionally, credit for task analysis will be taken for the Emergency Operating Procedures being generated using the NSSS supplier's generic system analysis and functionally oriented procedure guidelines. This will demonstrate the viability and completeness of the Emergency Operating Procedures.

In addition, the CRDR Working Group will select a few representative procedures, review them for consistency of format and quality of content and perform independent walk-throughs as an effectiveness type of check. Review comments will be transmitted to SCE Operations for incorporation into or modification of the operating procedures.

5.0 ASSESSMENT PHASE

5.1 OBJECTIVES

The objectives of the CRDR Assessment Phase are to evaluate and assess the significance and relative importance of the HEDs discovered in the Review Phase. Recommendations will be made concerning corrective actions to be taken and justification will be given in those instances when it is decided that no action is necessary.

5.2 DESCRIPTION

The transition to the Assessment Phase of CRDR will proceed as a natural extension of the Review Phase. Criteria will be developed to assess and categorize the HEDs as to seriousness of potential consequences, particularly with regard to safety if not corrected. Additional evaluations will be made concerning possibilities and alternate options for improvement and for difficulty of implementation. These factors will be weighed before determining the priority of need and making recommendations for corrective action.

HEDs which are minor in nature, have no safety consequences, or other potential significance consequences which could result in loss of plant availability or equipment damage will be given a lower priority for correction. All HEDs will be given consideration although it must be recognized that control panel design embodies numerous compromises among requirements competing for priority. Therefore, situations may exist where the most direct means of improvement for one feature or aspect would have a detrimental effect on some other feature or on overall design. If this occurs, an attempt will be made to find the best overall solution.

6.0 IMPLEMENTATION PHASE

6.1 OBJECTIVE

The objective of the Implementation Phase is to remedy, significant HEDs identified in the Assessment Phase. An effort will be made to give the most important items priority for corrective action. Prioritization will be based upon safety considerations, degree of difficulty imposed upon the operator if not corrected, consequences of potential operating errors, consequences of operator retraining, cost-effectiveness and difficulties in making the modification, and plant construction and startup schedules.

6.2 DESCRIPTION

Control room and control panel modifications recommended by the CRDR Working Group and accepted by SCE Management will be implemented by an established, closely controlled and scheduled procedure employing Design Change Packages (DCPs). The DCP procedure is defined in the Project Internal Procedures Manual (PIPM). Basically, a DCP will contain all of the engineering design information required to make the revision including the description of the change, the reason for it, the initiating document, nuclear safety assessment of the change, and all related design drawing change notices or drawing revisions. In addition, the DCP will identify whether or not other plant documents such as the FSAR require revision. Field construction and startup work to install and test the revised design defined by a DCP will be performed in accordance with established procedures and in coordination with SCE Plant Operations. Upon completion (implementation) of a DCP, a signed completion sheet will be returned to the responsible Project Engineering Design Group.

6.3 FUTURE CONTROL ROOM MODIFICATIONS

The criteria which has been established for the identification and resolution of HEDs will be supplied to the line engineering design group responsible for implementing recommended changes. This group will, therefore, have access to the criteria, as well as examples (recommended corrections for HEDs) of the criteria applied, to aid them in applying these human factors criteria to future modifications to the control room. In addition, most of the CRDR Working Group will subsequently return to the Instrument and Control System Staff of SCE and BPC, or SCE Station Operations, and will be available for consulting and direction in future control room revisions.

7.0 SUMMARY

The foregoing plan describes the proposed methods of conducting the CRDR and implementing any necessary or desired changes together with a description of the organizations and responsibilities of each group. As described, criteria to be used in the review and means of correcting HEDs are to be established as part of the activity.

Actual methodology employed, observations and conclusions made, corrections accomplished and planned will be described in the CRDR report.