Response to Human Factors Engineering Control Room Design Review/Audit

For

LOUISIANA POWER & LIGHT COMPANY
WATERFORD SES UNIT NO. 3

DECEMBER 1982 – REV. 1

LOUISIANA POWER & LIGHT / 142 DELARONDE STREET
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MIDDLE SOUTH UTILITIES SYSTEM

L. V. MAURIN
Vice President
Nuclear Operations

December 22, 1982
W3T82-0491

Mr. T.M. Novak
U.S. Nuclear Regulatory Commission
Washington, D.C. 20555

SUBJECT: Waterford 3 SES Unit 3
Control Room Design Review

REFERENCE: W3T82-0407 dated October 20, 1982

Dear Mr. Novak:

The referenced letter transmitted a report documenting LP&L's disposition of Human Engineering Discrepancy identified to date at Waterford 3. On November 4, 1982, we had the benefit of detailed discussions with members of the NRC's Human Factors Branch and Consultants. As agreed to at the meeting, we are transmitting Revision 1 of this report which documents agreements reached at the November 4, 1982, meeting.

The major area of concern expressed to us by the Human Factors Branch at the meeting was the rate of progress being made on the implementation of Human Factors Enhancements and design changes in the control room. Another concern was that corrective action for a very large number of HEDs would take place just prior to licensing which could result in some negative transfer of learning to our operators as well as burden our on site resident inspector with a large amount of items to review in this short period of time. Therefore, as requested, you will find attached a graph showing the approximate number of HEDs that have been implemented and that will be implemented each month between now and our anticipated fuel load date (May 12, 1983).

Also note that it is one of our objectives to have all changes and enhancements to the main control boards implemented by hot functionals. At this time, the critical path item for the enhancement of the main boards is meter labeling. The first phase of higher hierarchical and demarcation has been completed on the main boards. Critical path items through fuel load include enhancement of the remote shutdown panel, meter scale changes and control switch coding enhancements. The attached report also documents the dates that various studies such as the lighting survey and color coding report will be submitted to NRC.

LP&L wishes to thank NRC for what we feel has been a very beneficial review in the area of Human Factors and we want to assure you that we are making our best efforts to implement corrective actions in a timely manner and that we will be continuing our program as described in Reference 1 after the date of licensing.

Should you have any questions, please contact Dr. Z.A. Sabri at (504) 464-3136.

Very truly yours,

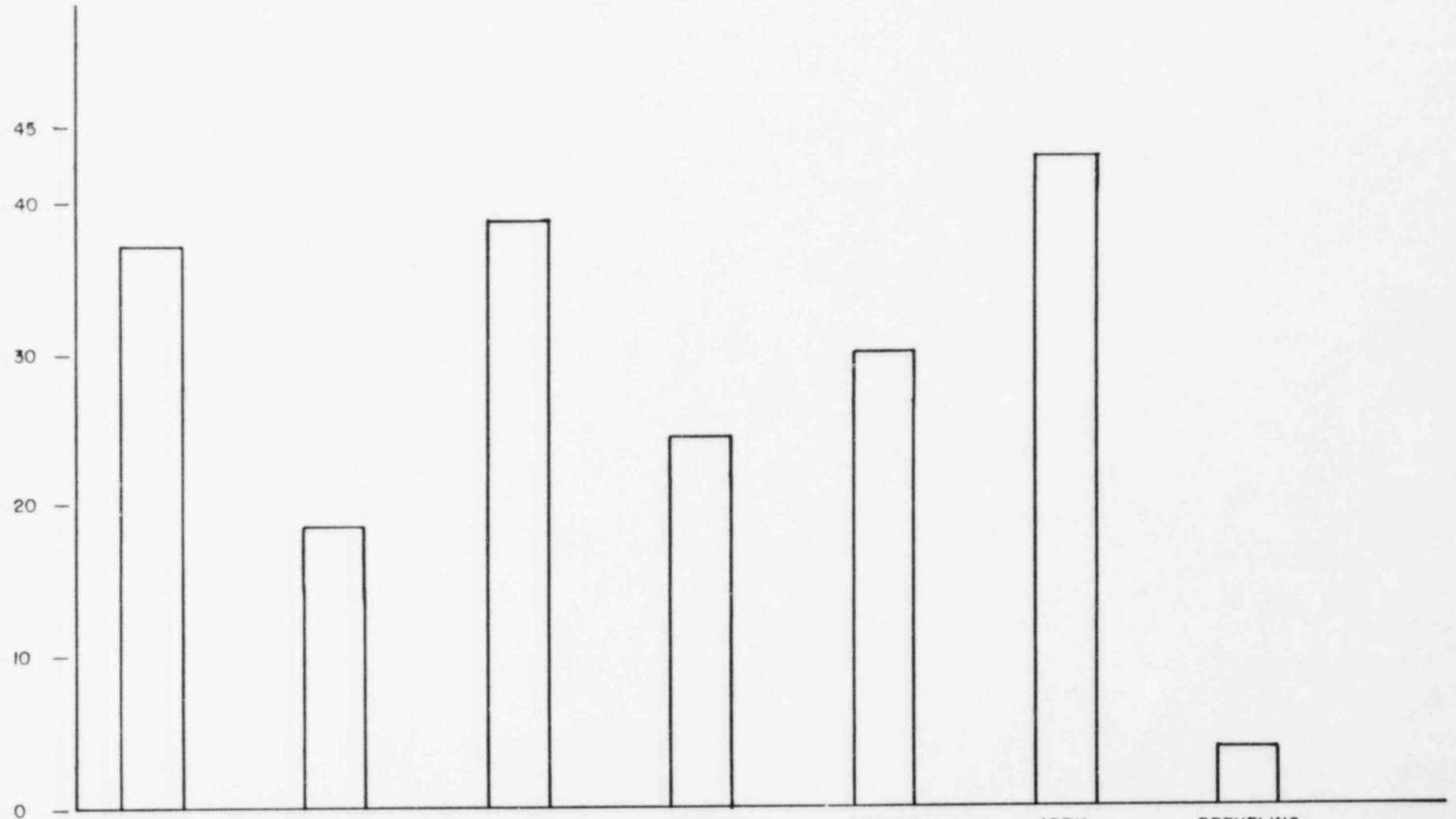
L.V. Maurin

LVM/pb

Attachment

cc: D. Tondi, A. Ramey Smith, R. Ramirez, E. Blake, M.L. Stevenson, S. Black

HED COMPLETION SCHEDULE



NOTE: 30 HED'S REQUIRE NO ACTION

Response to Human Factors Engineering Control Room Design Review/Audit

For

LOUISIANA POWER & LIGHT COMPANY
WATERFORD SES UNIT NO. 3

DECEMBER 1982 – REV. 1

RESPONSE TO HUMAN FACTORS ENGINEERING CONTROL ROOM DESIGN REVIEW/AUDIT

CONTENTS

LIST OF FIGURES

LIST OF FIGURES (Cont'd)

1

1.0 INTRODUCTION

1.0 INTRODUCTION

This report documents LP&L's disposition of the human engineering discrepancies (HEDs) identified to date as part of our Control Room Design Review Program (TMI Task I.D.1). Approximately 130 HEDs resulted from our review program as conducted by Lockheed Missile and Space Co., and an additional 95 HEDs resulted from the NRC audit of May 1982.

The organization of this report is basically by topic. Individual Control Room panels are discussed first in order of the original enhancement schedule. Next, sections covering remote shutdown, computer displays, generic findings, communications, lighting and accommodations are provided. For convenience a cross reference between NRC findings and report sections is contained in Section 1.3.

It should be noted that if a finding is against two panels (e.g. display-control integration), then the response is repeated in both subsections. However, generic panel findings which may potentially impact several or all panels are discussed in Section 2.15.

Each panel section contains a brief introductory write-up, and a copy of the human factors enhancement drawing. For those panels which have undergone the first phase of human factors enhancement (approximately 8 panels) copies of pre-enhancement and post-enhancement photographs are provided. Other drawings or photographs are provided to augment and clarify some of the responses to the NRC findings.

1.1 OVERVIEW OF THE WATERFORD - 3 CONTROL ROOM

1.1 OVERVIEW OF THE WATERFORD-3 CONTROL ROOM

The general arrangement of the Control Room and its adjacent facilities is shown on Figure 1.1-1.

The operators' workspace around the main control board and the key dimensions of this space are shown on Figure 1.1-2.

The Control Room area measures roughly 65 feet wide by 87 feet long in its two longest dimensions. The area containing the control panels measures about 36 feet wide by 31 feet deep and contains the supervisor's office and the desk consoles. The main control board is arranged as a nonsymmetrical wing shape and is approximately 50' 4" long measured on the vertical panel surface. (CP-13 to CP-8). The side panel is 33' long (CP-13 to CP-52). | 1

The operator's console is set within this area with an aisle of 6 to 7-1/2 feet wide between it and the main control console. This console is 13-1/2 feet long at its front edge. The operator at this console will be seated 12 to 13 feet from the closest main panel areas. The supervisor's office is a "D" shaped enclosure. The supervisor will be seated approximately 30 feet from the center of CP-2

The location of the supervisor's office in the Control Room permits a direct visual monitoring of the operating area and the quick access to the operator's workspace, whenever needed. The half-octagonal shape provides access clearance to the Control Room from the main entrance. There is a clearance of about 6 feet from the edge of the office to the corner of the fire alarm panel (FPE-3).

A toilet and kitchen facility are located on the periphery of the Control Room for the operators use. These are behind CP-13 and CP-33.

The Control Room has direct access to the Computer Room. This arrangement facilitates the cooperation which is expected between operators and computer staff.

Across the corridor from the main entrance to the Control Room is located the onsite Technical Support Center Conference Room. Beyond the opposite wall of the Control Room are located the emergency living quarters which is part of the technical support center with indirect access from the Control Room through an L-shaped corridor. | 1

GENERAL ARRANGEMENT OF THE CONTROL ROOM WITH ADJACENT FACILITIES

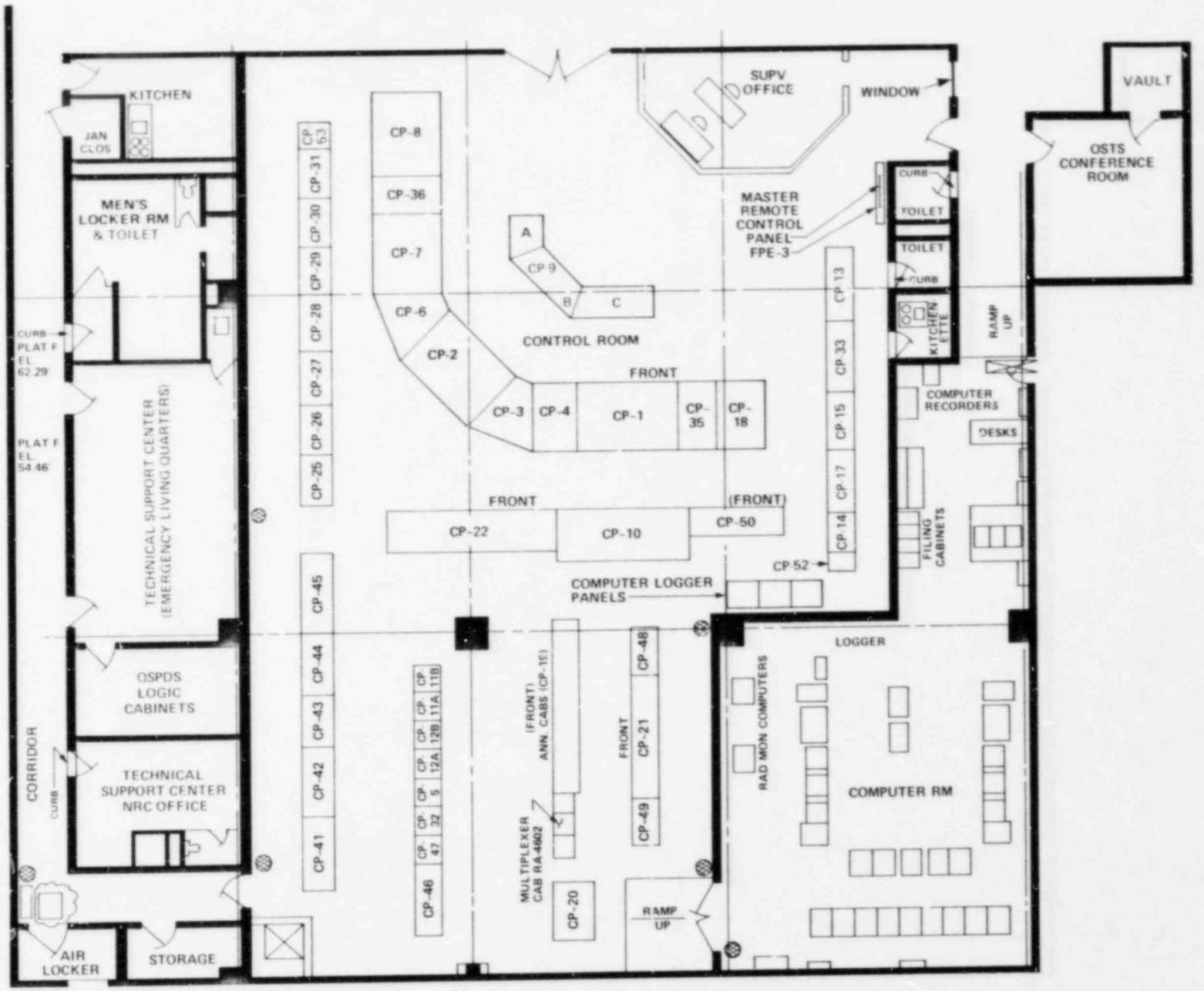


FIGURE 1.1-1

WATERFORD-3 CONTROL ROOM
DIMENSIONS OF OPERATOR WORKSPACE

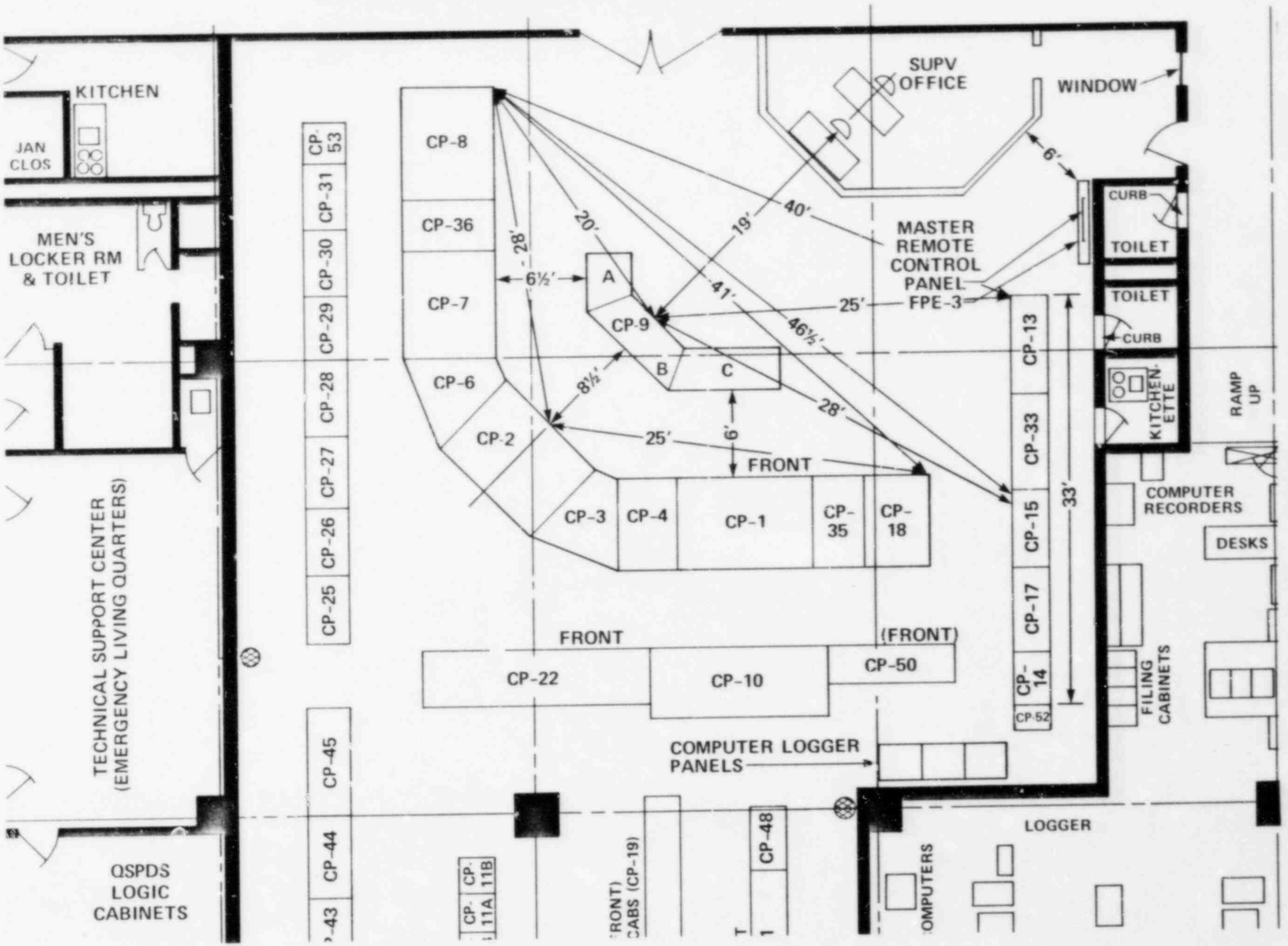


FIGURE 1.1-2

1.2 OVERALL STATUS OF HUMAN FACTORS ENHANCEMENT PROGRAM

1.2 OVERALL STATUS AND SCHEDULE FOR HUMAN FACTORS ENHANCEMENTS

In 1974 LP&L elected to dedicate substantial resources to the Waterford-3 man-machine interface. An advanced plant monitoring computer was decided on in late 1975 and a plant operational review program was initiated. Following the accident at TMI-2 and review of subsequent government and industry studies, LP&L decided to commit even more resources to insure a highly reliable man-machine interface. As part of this effort a Control Room design review and a systems operability review were initiated in November 1980. Human Factors experts from Lockheed Missile and Space Co., participated in a multidiscipline review/evaluation. A preliminary planning review was conducted in December 1980 (ref W3P81-1102), a half-scale mockup was constructed in late 1981, interface meetings were held in 1981, enhancement drawing review with the plant staff took place in late 1981, HED committee meetings began in early 1982, production of final enhancement drawings began in May 1982 and implementation of enhancements began in August 1982.

LP&L's goal is to complete human factors enhancements of the Main Control Room panels by hot functional testing, in order to give the operators time to become familiar with already enhanced panels. Hot Functional Testing is scheduled to begin January 18, 1983. In general, other Control Room improvements committed to in the following sections of this report such as additional meters and recorders, lighting improvements, etc. are planned to be completed prior to Licensing (presently equal to fuel loading which is scheduled for May 5, 1983). Some items which are presently under review and which may require corrective action will be implemented by first refueling. LP&L believes that all significant HEDs are being properly addressed. 1

Presently, the first phase of interim enhancements has been completed for 9 of the 12 panels slated for enhancement. A revision of the enhancement drawings is underway to incorporate additional enhancements such as control switch coding and to resolve discrepancies found during application of enhancements. LP&L will issue a manual for enhancement that will include the approved glossary of terms and abbreviations, and approved color code and controls for ensuring that enhancements are updated with changes to the control panels. 1

i.3 CROSS-REFERENCE OF NRC FINDINGS TO REPORT SECTIONS

1.3 CROSS REFERENCE OF NRC FINDINGS TO REPORT SECTIONS

NRC Report Section	Finding Number	NRC Priority	Panel or Topic	Report Section	Page
B-1	1	1	Transfer	2.14.2	2.14-9
B-1	2	1	Transfer	2.14.2	2.14-9
B-1	3	2	CP-2	2.1	2.1-1
B-1	4	2	CP-2	2.1	2.1-1
B-1	5	1	CP-33	2.8	2.8-1
B-1	6	1	Transfer	2.14.2	2.14-9
B-1	7	1	Environ	5.2	5.2-1
B-1	8	1	Generic	2.15.5	2.15-19
B-1	9	2	Environ	5.2	5.2-2
B-1	10	2	Environ	5.2	5.2-2
B-1	11	2	Environ	5.2	5.2-2
B-1	12	1	LCP-43	2.14.1	2.14-1
B-1	13	1	LCP-43	2.14.1	2.14-1
B-1	14	3	Generic	2.15.5	2.15-19
B-1	15	3	Generic	2.15.5	2.15-19
B-1	16	2	CP-4	2.3	2.3-1
B-1	17	3	Environ	5.2	5.2-1
B-1	18	1	Environ	5.2	5.2-3
B-1	19	3	Environ	5.2	5.2-1
B-1	20	1	Environ	5.1	5.1-1
B-1	21	1	Environ	5.1	5.1-1
B-1	22	1	CP-7	2.2	2.2-1
B-1	23	1	Environ	5.1	5.1-2
B-1	24	1	Environ	5.1	5.1-2
B-1	25	1	Communication	3.0	3.1-1
B-1	26	3	Environ	5.2	5.2-3
B-2	1	1	Communication	3.0	3.1-2
B-2	2	1	Communication	3.0	3.1-2
B-2	3	1	Communication LCP-43	3.0/2.14	3.1-2/2.14-10
B-2	4	1	Communication	3.0	3.1-2
B-2	5	3	Communication	3.0	3.1-2
B-2	6	1	Communication	3.0	3.1-3

NRC Report Section	Finding Number	NRC Priority	Panel or Topic	Report Section	Page
B-2	7	3	Communication	3.0	3.1-3
B-2	8	1	Communication	3.0	3.1-3
B-2	9	1	Communication	3.0	3.1-3
B-2	10	1	Communication	3.0	3.1-3
B-2	11	3	Communication	3.0	3.1-4
B-3	1	3	Fire	2.12	2.12-1
B-3	2	3	Annunciator	2.11	2.11-2
B-3	3	2	Annunciator	2.11	2.11-2
B-3	4	[illegible]	Annunciator	2.11	2.11-2
B-3	5	[illegible]	Annunciator	2.11	2.11-2
B-3	6	[illegible]	Annunciator	2.11	2.11-3
B-3	7	[illegible]	CP-8/Annunciator	2.9/2.11	2.9-2/2.11-3
B-3	8	[illegible]	Annunciator	2.11	2.11-3
B-3	9	[illegible]	Annunciator	2.11	2.11-4
B-3	10	[illegible]	Annunciator	2.11	2.11-4
B-3	11	[illegible]	Annunciator	2.11	2.11-4
B-3	12	1	Annunciator	2.11	2.11-4
B-3	13	3[1]	Annunciator	2.11	2.11-4
B-3	14	1	Annunciator	2.11	2.11-5
B-3	15	3	Annunciator	2.11	2.11-5
B-3	16	1	Annunciator	2.11	2.11-5
B-3	17	1	Generic	2.15.1	2.15-1
B-3	18	1	Generic	2.15.1	2.15-1
B-3	19	2	13/33	2.5/2.8	2.5-1/2.8-1
B-3	20	1	Fire	2-12	2.12-2
B-3	21	2	Annunciator	2.11	2.11-6
B-3	22	2	Annunciator	2.11	2.11-6
B-3	23	1	Annunciator	2.11	2.11-6
B-4	1	1	LCP-43	2.14.1	2.14-2
B-4	2	1	CP-33	2.8	2.8-2
B-4	3	1	CP-7	2.2	2.2-2
B-4	4	1	CP-8	2.9	2.9-2
B-4	5	1	Generic	2.15.2	2.15-6

NRC Report Section	Finding Number	NRC Priority	Panel or Topic	Report Section	Page
B-4	6	3	CP-4	2.3	2.3-2
B-4	7	2	Generic	2.15.2	2.15-8
B-4	8	1	CP-1	2.4	2.4-2
B-4	9	1	Generic	2.15.2	2.15-10
B-4	10	1	Generic	2.15.2	2.15-10
B-4	11	2	Fire	2.12	2.12-2
B-4	12	1	Generic	2.15.2	2.15-7
B-4	13	3	Generic	2.15.2	2.15-7
B-4	14	1	LCP-43	2.14.1	2.14-2
B-4	15	2	CP-4	2.3	2.3-2
B-4	16	1	Generic	2.15.2	2.15-8
B-4	17	1	CP-2	2.1	2.1-2
B-4	18	2	CP-2	2.1	2.1-2
B-4	19	1	Communication	3.0	3.1-4
B-4	20	3	Generic	2.15.2	2.15-7
B-4	21	3	CP-33	2.8	2.8-2
B-5	1	1	CP-2	2.1	2.1-2
B-5	2	3	CP-33	2.8	2.8-2
B-5	3	1	CP-8	2.9	2.9-2
B-5	4	1	CP-8	2.9	2.9-3
B-5	5	1	CP-8	2.9	2.9-3
B-5	6	1	CP-8	2.9	2.9-3
B-5	7	1	CP-8	2.9	2.9-3
B-5	8	1	Generic	2.15.2	2.15-8
B-5	9	1	Generic	2.15.3	2.15-14
B-5	10	3	Generic	2.15.3	2.15-15
B-5	11	1	Generic	2.15.3	2.15-12
B-5	12	1	Generic	2.15.3	2.15-13
B-5	13	1	CP-1	2.4	2.4-2
B-5	14	3	Generic	2.15.3	2.15-15
B-5	15	1	CP-1	2.4	2.4-2
B-5	16	1	Generic	2.15.3	2.15-12
B-5	17	1	LCP-43	2.14.1	2.14-3
B-5	18	3[1]	CP-13	2.5	2.5-2

NRC Report Section	Finding Number	NRC Priority	Panel or Topic	Report Section	Page
B-5	19	3[1]	Generic	2.15.4	2.15-17
B-5	20	1	CP-2	2.1	2.1-2
B-5	21	3	Generic	2.15.3	2.15-13
B-5	22	1	Generic	2.15.3	2.15-13
B-5	23	1	Generic	2.15.3	2.15-13
B-5	24	1	CP-2	2.1	2.1-3
B-5	25	3	CP-7	2.2	2.2-2
B-5	26	1	CP-7	2.2	2.2-3
B-5	27	1	LCP-43	2.14.1	2.14-3
B-5	28	1	CP-4	2.3	2.3-2
B-5	29	1	Generic	2.15.1	2.15-4
B-5	30	2	LCP-43	2.14.1	2.14-3
B-5	31	1	LCP-43	2.14.1	2.14-3
B-5	32	1	CP-8	2.9	2.9-4
B-5	33	3[1]	Generic	2.15.3	2.15-15
B-5	34	3[1]	Generic	2.15.3	2.15-15
B-5	35	1	Generic	2.15.2	2.15-9
B-5	36	1	Generic	2.15.2	2.15-10
B-5	37	1	Generic	2.15.2	2.15-9
B-5	38	1	CP-2	2.1	2.1-3
B-5	39	1	Generic	2.15.4	2.15-18
B-5	40	3	Generic	2.15.4	2.15-18
B-5	41	3	Generic	2.15.4	2.15-16
B-5	42	3	Generic	2.15.4	2.15-16
B-5	43	3[1]	Generic	2.15.4	2.15-17
B-5	44	1	Generic	2.15.4	2.15-16
B-5	45	1	CP-33	2.8	2.8-3
B-6	1	1	Generic	2.15.2	2.15-6
B-6	2	1	CP-4	2.3	2.3-2
B-6	3	1	CP-4	2.3	2.3-3
B-6	4	1	Transfer	2.14.2	2.14-10
B-6	5	1	CP-1	2.4	2.4-3
B-6	6	1	Finding Withdrawn		

NRC Report Section	Finding Number	NRC Priority	Panel or Topic	Report Section	Page
B-6	7	3	Fire	2.12	2.12-2
B-6	8	1	CP-1	2.4	2.4-3
B-6	9	1	Generic	2.15.1	2.15-2
B-6	10	1	Transfer	2.14.2	2.14-10
B-6	11	1	LCP-43	2.14.1	2.14-4
B-6	12	1	CP-1/2	2.1/2.4	2.1-3/2.4-3
B-6	13	1	LCP-43	2.14.1	2.14-4
B-6	14	1	LCP-43	2.14.1	2.14-4
B-6	15	1	LCP-43	2.14.1	2.14-5
B-6	16	1	LCP-43	2.14.1	2.14-5
B-6	17	1	Generic	2.15.1	2.15-2
B-6	18	1	CP-7	2.2	2.2-3
B-6	19	1	Generic	2.15.1	2.5-2
B-6	20	1	Generic	2.15.3	2.15-14
B-6	21	1	LCP-43	2.14.1	2.14-5
B-6	22	3[1]	Communication	3.0	3.1-4
B-6	23	3[1]	Generic	2.15.1	2.15-3
B-6	24	2	Generic	2.15.2	2.15-7
B-6	25	1	Generic	2.15.3	2.15-12
B-6	26	1	CP-4	2.3	2.3-3
B-6	27	3	Fire	2.12	2.12-3
B-6	28	3	Fire	2.12	2.12-3
B-6	29	3	Fire	2.12	2.12-3
B-6	30	1	Transfer	2.14.2	2.14-1
B-6	31	1	LCP-43	2.14.1	2.14-5
B-6	32	1	Generic	2.15.1	2.15-3
B-6	33	1	CP-4	2.3	2.3-3
B-6	34	1	Generic	2.15.2	2.15-6
B-6	35	1	CP-4	2.3	2.3-4
B-6	36	3	Fire	2.12	2.12-4
B-6	37	1	Generic	2.15.1	2.15-1
B-6	38	1	Generic	2.15.1	2.15-2
B-6	39	1	CP-13	2.5	2.5-2
B-6	40	1	LCP-43	2.14.1	2.14-5
B-6	41	3 1.3-5	Generic	2.15.1	2.15-3

NRC Report Section	Finding Number	NRC Priority	Panel or Topic	Report Section	Page
B-6	42	1	Generic	2.15.1	2.15-5
B-6	43	1	Communication	3.0	3.1-4
B-6	44	1	Generic	2.15.3	2.15-12
B-6	45	1	Generic	2.15.1	2.15-3
B-6	46	1	CP-33/Generic	2.8/2.15.1	2.8-3/2.15-3
B-6	47	3[1]	Generic	2.15.2	2.15-6
B-6	48	1	CP-1	2.4	2.4-3
B-7	1	3	Computer	2.13	2.13-1
B-7	2	1	Computer	2.13	2.13-1
B-7	3	1	CP-2	2.1	2.1-3
B-7	4	1	Computer	2.13	2.13-2
B-7	5	1	Computer	2.13	2.13-2
B-8	1	1	CP-1	2.4	2.4-3
B-8	2	2	CP-8	2.9	2.9-4
B-8	3	1	CP-4	2.3	2.3-4
B-8	4	2	CP-8	2.9	2.9-4
B-8	5	3	CP-13/33	2.5/2.8	2.5-2/2.8-3
B-8	6	1	LCP-43	2.14.1	2.14-6
B-8	7	1	CP-1	2.4	2.4-4
B-8	8	1	CP-1	2.4	2.4-4
B-8	9	1	LCP-43	2.14.1	2.14-6
B-8	10	1	CP-33	2.8	2.8-3
B-8	11	2	CP-13	2.5	2.5-2
B-8	12	3	Annunciator	2.11	2.11-6
B-8	13	1	Generic	2.15.3	2.15-14
B-8	14	1	LCP-43	2.14.1	2.14-6
B-8	15	3	Fire	2.12	2.12-4
B-8	16	1	Generic	2.15.1	2.15-4
B-8	17	1	CP-2/4	2.1/2.3	2.1-4/2.3-4
B-8	18	1	CP-2	2.1	2.1-4
B-8	19	1	CP-8	2.9	2.9-4
B-8	20	1	CP-8/Generic	2.9/2.15.1	2.9-5/2.15-4
B-8	21	3	LCP-43	2.14.1	2.14-7

NRC Report Section	Finding Number	NRC Priority	Panel or Topic	Report Section	Page
B-8	22	1	LCP-43	2.14.1	2.14-7
B-8	23	2	CP-8	2.9	2.9-5
B-8	24	1	LCP-43	2.14.1	2.14-7
B-8	25	1	CP-4	2.3	2.3-4
B-8	26	2	CP-8	2.9	2.9-5
B-8	27	3	CP-2	2.1	2.1-4
B-8	28	2	CP-4	2.3	2.3-5
B-8	29	3	CP-2	2.1	2.1-5
B-8	30	2	CP-13	2.5	2.5-3
B-8	31	3	Fire	2.12	2.12-4
B-8	32	3	CP-33	2.8	2.8-4
B-8	33	1	CP-4	2.3	2.3-5
B-8	34	1	CP-7	2.2	2.2-3
B-8	35	1	CP-1/8	2.4/2.9	2.4-5/2.9-5
B-9	1	1	CP-33	2.8	2.8-4
B-9	2	1	CP-2	2.1	2.1-5
B-9	3	1	CP-2	2.1	2.1-5
B-9	4	2	CP-2	2.1	2.1-6
B-9	5	1	CP-2/4	2.1/2.3	2.1-6/2.3-5
B-9	6	1	CP-4	2.3	2.3-5
B-9	7	2	CP-2	2.1	2.1-6
B-9	8	2	CP-8	2.9	2.9-6
B-9	9	2	CP-1	2.4	2.4-5
B-9	10	3	LCP-43	2.14.1	2.4-8
B-9	11	1	CP-1	2.4	2.4-5

2.0 MAIN CONTROL BOARDS

2.1 REACTOR CONTROL PANEL (CP-2)

2.0 MAIN CONTROL BOARDS

2.1 REACTOR CONTROL PANEL - CP-2

CP-2 contains the indicators and the controls for the following systems constituting or directly related to the reactor:

a) Control Rods - position indicators (CRT, bottom-out mimic, digital indicators for selected group and selected CEA) and controls (CEA Drive Mechanism Control).

b) Reactor Coolant System - indicators (pressurizer level, pressure and temperature; Hot and cold leg temperatures, Coolant Pumps monitoring instrumentation) and controls (Pressurizer Heater Controls, Spray Controls, Coolant Pump Controls).

c) Reactor Regulating System - Power monitoring and control (Reactor power and rate of change indicators, Neutron Flux Monitors, Core ΔP and COLSS indicators, Boronometer, RRS System Selector).

d) Megawatt Demand Setter - insert with corresponding indicators and controls.

e) Reactor Power Cutback - indicators and controls.

f) Reactor Trip - pushbuttons

CP-2 also contains the Safety System Status Indication insert and a limited number of other distinct controls (Fuel Pool Pumps, Quench Tank Valves, Annunciator Controls, etc).

Figure 2.1-1 is the human factors enhancement drawing for CP-2. Figures 2.1-2 and 2.1-3 show photographs of the panel before and after enhancement.

Twenty findings or Human Engineering discrepancies were reported against CP-2. These findings and their disposition are discussed below:

B-1, Finding 3, Priority 2

"A wide range hot leg temperature (T_h) recorder is not provided on CP-2."

Response

A dual scale wide range temperature recorder is being provided (DCN-IC-1085). The range of this recorder is 50-750°F for both hot legs. It will be located on the far right vertical panel surface between the existing RCS average and reference temperature and cold leg temperature recorders. The recorder will be installed prior to Licensing. 1

B-1, Finding 4, Priority 2

"A sub-cooling monitor is not provided on CP-2."

Response

In accordance with TMI action Item II.F.2 a saturation margin temperature indicator is provided in the upper left vertical panel section of CP-2 next to the reactor power rate of change indication (ref DCN-IC-837). This indicator had not been installed at the time of the NRC Human Factor Audit.

B-4, Finding 17, Priority 1

"On CP-2, the legends for the audible count rate meter Audio Range Switch and Audio Channel Selector switch are unclear, i.e., the Audio Range Selector Switch label does not indicate range scale; the Audio Channel Switch has no position label for the 2 position toggle."

Response

Clear labels are now provided for the channel selector switch as can be seen on Figure 2.1-1. A scale will be provided for the Audio count rate selector switch by Hot Functional Testing. This scale will show the audio count rate multipliers (e.g. x 1, x 10, x 10^2, x 10^3, x 10^4) | 1

B-4, Finding 18, Priority 2

"On panel CP-2 and CP-4 Hagan Flow Controllers, the skirt diameter is less than 2" (1.25) and the finger stop is less than 1.25" (1.0")."

Response

Several LP&L operators have successfully manipulated the subject Hagan Flow Controllers. No operational problems are anticipated . | 1

B-5, Finding 1, Priority 1

"Motor amperage is not displayed and is considered necessary by operators. NUREG-0700, para 6.5.1.1b requires that necessary information be presented."

Response

Motor amperage is generally displayed via the plant monitoring computer. However, at the operators request, ammeters for the four reactor coolant pump motors are being provided on the middle right vertical section of CP-2 (DCN-IC-837). (Ammeters for 14 other pumps are also being evaluated. These safety-related pumps are HPSI, LPSI, Cont. Spray, Emer. F.W., CCW on CP-8 and ACCW pumps on CP-33. If LP&L feels ammeters are necessary for these pumps, then they will be provided prior to Licensing.) | 1

B-5, Finding 20, Priority 1

"The log scale (on the startup neutron flux level meter) appears inverted - possibly an assembly error. Major divisions are correct; intermediate and minor (divisions) are not."

Response

The meter scale has been corrected (refer to Figure 2.1-3).

B-5, Finding 24, Priority 1

"On CP-2, one PZR LVL meter scale states DC volts; the other PZR LVL scale states % but units are not indicated."

Response

LP&L will correct the scales to indicate the proper units (% level) prior to fuel load.

B-5, Finding 38, Priority 1

"Numbered rod bottom-out indicator lamp caps are not keyed to prevent installation in improper location or improper orientation."

Response

In order to avoid improper installation, rod numbers will be added on the panel behind the cover door as shown on Figure 2.1-4 prior to Hot Functional Testing. | 1

B-6, Finding 12, Priority 1

"On the mimic on CP-1 and on CP-2 there are sets of indicator lights that are either not labeled or not inscribed."

Response

LP&L will provide labels above or on the indicating lights whichever is appropriate as part of the enhancement effort by Hot Functionals. | 1

B-7, Finding 3, Priority 1

"CRT Displaying CEA positions - scaled tapes are applied to the face of the CRT, at borders." Scales delineate the order of CEA sub-groups labeling for part length groups, and the individual CEA numbers.

1. Tape scales do not correspond with the sub-group order, labeling for part length groups, or CEA number sequence used on the CEDMCS Module.

2. The upper scale is about 78" above the floor, on the convex surface of the CRT face and about 32" viewing distance (excessive) for the 95th percentile operator height. Viewing angle and distance are excessive for readability/use.

3. Registration (lateral alignment) of the 91 CEA vertical (rod) bars with the tape scales will vary with the viewing angle, and registration reliability of the CRT."

Response

The scaled tapes will be removed since the display software now provides coordinates for the CRT. Incorporating coordinates in the CRT display will help the readability. The high density of this display is acceptable considering the intended function (i.e., gross display of group positions). Indicating modules above the selector switch are being revised to be consistent with selector switch positions.

The need to have the same CEA order used on CRT and the CEDMCS module has been reviewed and evaluated to be of very little consequence to trained operators. Refer to Section 2.15.5, B-1, Findings 14 and 15 for a generic discussion of anthropometric/readability issues. | 1

B-8, Finding 17, Priority 1

"The letdown valve selector, controller, and indicator are not on the same panel; e.g., Selector is on CP-4, Controller is on CP-2, Indicator is on CP-4. The distance between CP-2 and CP-4 is about 10 feet."

Response

The letdown valve controller has been transferred from CP-2 to CP-4 as indicated on the enhancement drawings and photos (2.1-1, 2, 3 and 2.3-1, 2, 3). All controls and indicators for the letdown valves are now located on CP-4. (DCNs-IC-837 and 1011)

B-8, Finding 18, Priority 1

"Reactivity is controlled during startup at CP-2, while indicators (count rate steps) is provided on panel CP-7 approximately 10 feet away. The indicator, when viewed from CP-2, has 2 bands of glare near mid-scale."

Response

Two, redundant Rate of Power Change indicators will be added to CP-2 prior to Hot Functional Testing. These indicators are duplicates of the same ones mounted on CP-7. (DCN-IC-837) | 1

B-8, Finding 27, Priority 3

"On CP-2, the left-to-right order of the Quench Tank meters does not match the top-to-bottom order of the corresponding annunciator tiles; e.g. Meters: QT Temp, QT Level, QT Press. Annunciators: QT Level, QT Press, QT Temp."

Response

This finding does not present any problem to the operator; therefore, no corrective action is warranted. The human factors engineer also concurs.

B-8, Finding 29, Priority 3

"On CP-2, the Quench Tank vent and drain valve controls are not directly below their corresponding meters."

Response

The Quench Tank Vent and drain valves are located four feet to the right of the Quench Tank pressure and level indicators. These valves are open-close rather than modulating valves. Therefore, the operators will not have a significant readability problem for this infrequent operation.

B-9, Finding 2, Priority 1

"PZR Setpoint-SMC displays on CP-7 are separate from the associated controls on CP-2. The pressurizer pressure display on CP-2 only goes to 1600 psig."

Response

The four pressurizer pressure (0-1600 psig) displays on CP-2 have been replaced by two wide range (0-3000 psia) displays and two narrow range (100-750 psia) displays. The operator will control RCS pressure from CP-2 and will observe the pressure from these displays. For example, during the shutdown the operator will initially use the 0-3000 psia display and then use the 100-750 psia displays when going to cold shutdown.

The four safety channels of pressurizer pressure on CP-7 are each provided with a setpoint indicator (normally at approximately 1600 psia). These are associated with the reactor protection system. During shutdown, as RCS pressure is gradually reduced, the operator will manually lower the individual setpoints. If system pressure comes too close to the setpoint before the operator has lowered the setpoint, then an alarm will be sounded. During startup the setpoint is elevated automatically. In view of the changes to the pressurizer pressure displays on CP-2, there will be no human factors problems with the control-display integration.

B-9, Finding 3, Priority 1

"Four startups rate-of-change power meters on CP-7 are used in conjunction with the rod insert-withdraw joy stick on CP-2, about eight feet away."

Response

Two rate of power change indications will be installed on CP-2 to the left of the CRT by Hot Functional Testing. | 1

B-9, Finding 4, Priority 2

"On CP-2, the RRS Panel/Local Panel Status indicator is not located near associated controls and displays. It is not clear where the control is for switching of local/remote."

Response

The subject display indicates where the value of control signal (i.e., setpoint) for pressurizer level control system is established. This area of CP-2 has been modified. The pressurizer level controller will be located directly below the status indicator. The indicator has been relabeled to provide immediate display recognition. Operations has concurred with the enhancement/modification and these changes will be completed by Hot Functional Testing.

Switching from the Reactor Regulating System to RTGB takes place at CP-31. With RRS selected, the "RRS" section of the indicator light will be lit and the pressurizer level will be controlled by the Reactor Regulating System 1 or 2. The position of the RRS system selector switch (also on CP-2) determines which subsystem is controlling the pressurizer level.

With RTGB selected, the "RTGB" section of the indicator light will be lit and pressurizer level will be controlled by the M/A station directly below the indicating light on CP-2.

B-9, Finding 5, Priority 1

"Operator states that letdown flow is controlled on CP-2 (Item 1) and indicated on CP-4 (Item 2). Letdown back pressure is indicated on meter at left of back pressure controller on CP-4 (Item 3). During manual operation, either control will affect both indicators. Operation will be a difficult two-man job."

NRC Review Team Comment: Controller and display are approximately 8 feet away from the valve A, B and both selectors.

Response

The letdown flow controller has been moved from CP-2 to CP-4 (DCNs-IC-837 and 1011). Therefore, both the controls and indicators are now on CP-4. Also, refer to B-8, Finding 17.

B-9, Finding 7, Priority 2

"On CP-2, RCP Oil Lift Pump Controls (1A, 1B, 2A, 2B) and RCPs controls and corresponding instrumentation are nicely arranged vertically. However, the associated annunciator tiles are on an adjacent panel not directly above the pump controls."

Response

Although the associated annunciator tiles are not directly above the controls, they are still above CP-2 on the left-hand side. This is within an acceptable viewing distance as far as control is concerned.

B-4, Finding 4, Priority 1

"Reactor trip pushbuttons on CP-2 and CP-8 do not have protective housings as described in NUREG-0700; pg. 6.4-4, Exhibit 6.4-1. Turbine trip pushbuttons on CP-1 do have these housings."

Response

Guards will be provided on the reactor trip pushbuttons by Hot Functional Testing (DCN-IC-1009). The identical type pushbuttons presently used for turbine trip including the protective housing will be used. | 1

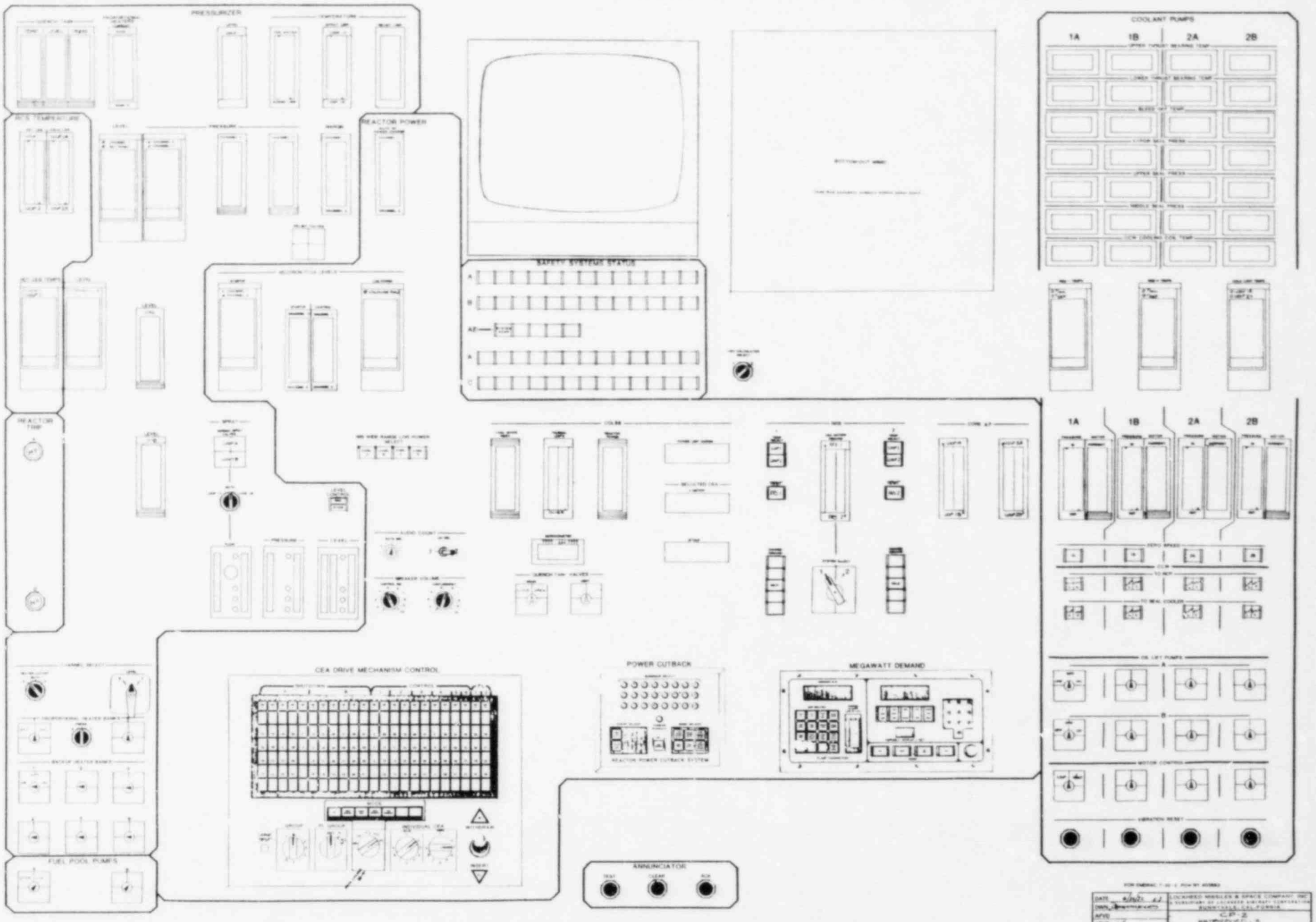

PRESSURIZER
REACTOR POWER
COOLANT PUMPS
1A
1B
2A
2B
SAFETY SYSTEMS STATUS
REACTOR TEMP
CEA DRIVE MECHANISM CONTROL
POWER CUTBACK
MEGAWATT DEMAND
FUEL POOL PUMPS
ANNUNCIATOR

FIGURE 2.1-1

FIGURE 2.1-2

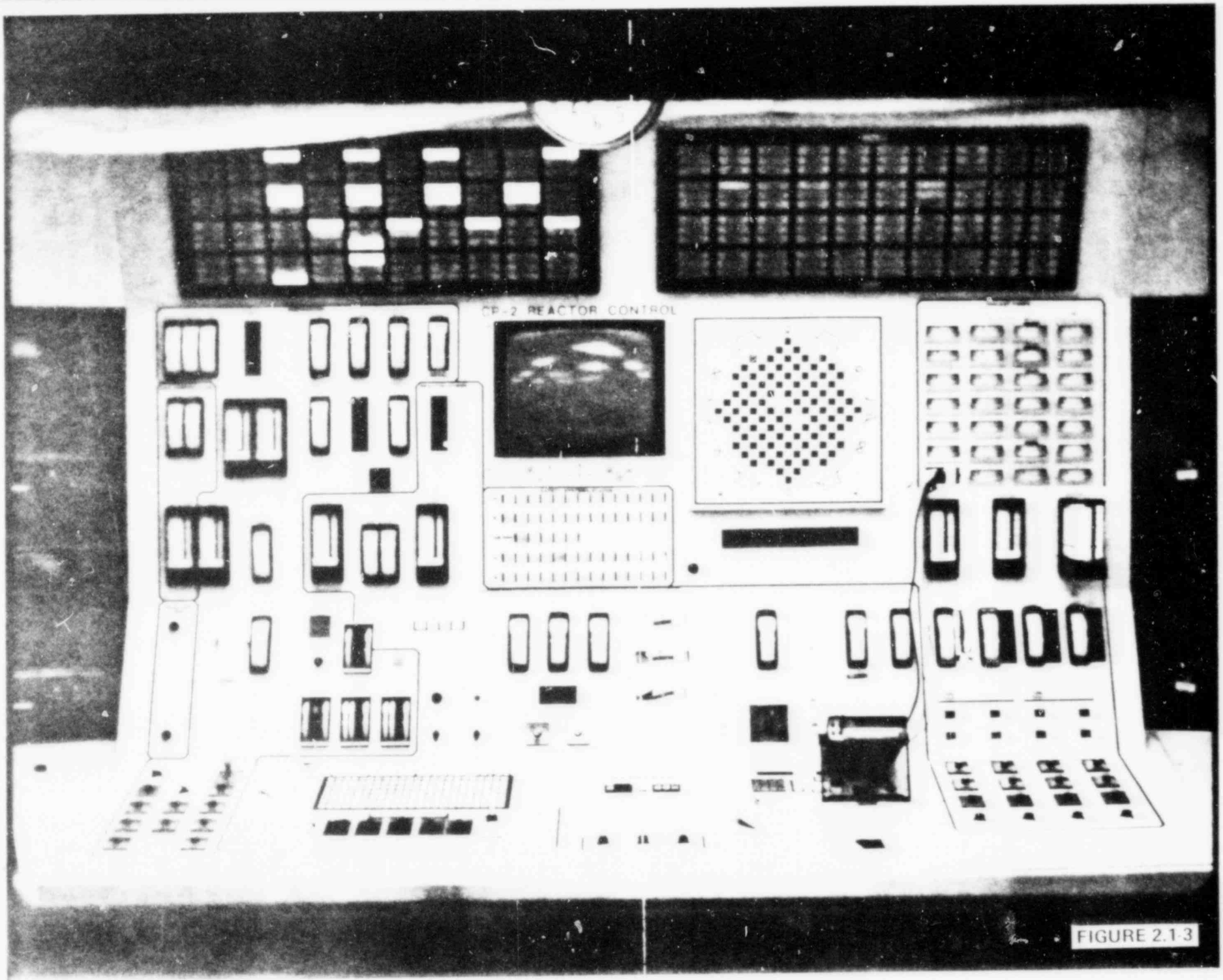
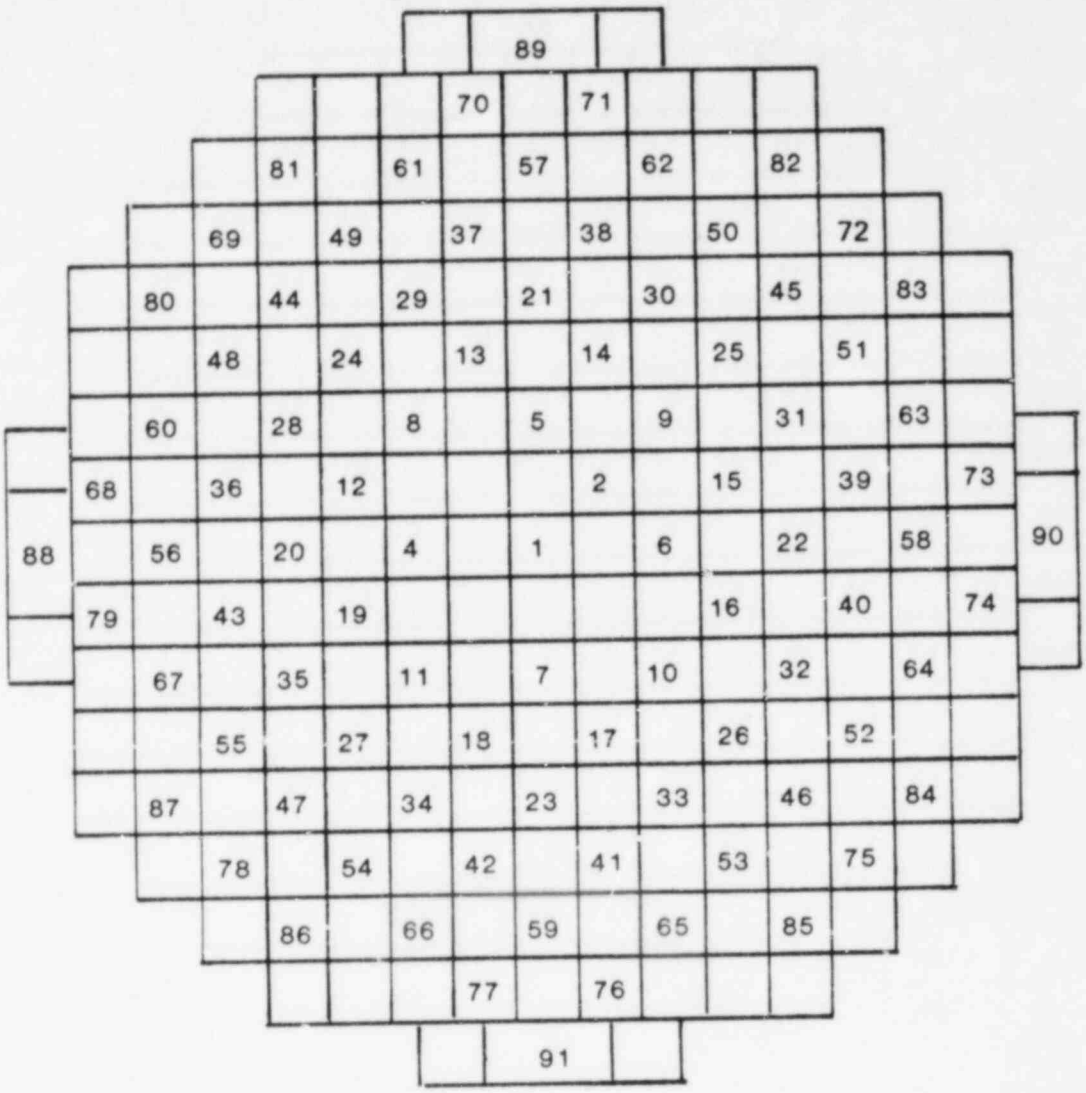


FIGURE 2.1-3

FIGURE 2.1-4



NUMBERS ASSOCIATED WITH INDICATING LIGHTS ARE TO BE PERMANENTLY ATTACHED ON THE INSIDE FACEPLATE ABOVE INDICATORS

DATE 8/16/82	LOCKHEED MISSILES & SPACE COMPANY, INC. A SUBSIDIARY OF LOCKHEED AIRCRAFT CORPORATION SUNNYVALE, CALIFORNIA
DWN RDS	Rod Bottom Mimic Display
APVD	FOR EMDRAC 7-30-2 PO# NY 403683
APVD	
ENGRG	
CHKR	
APVD	SIZE: CODE IDENT: DRAWING NO SK-2 on CP-2 REV D
APVD	SCALE: 1/2" = 1' SHEET (No A-C)

2.2 PLANT PROTECTION CONTROL PANEL (CP-7)

2.2 PLANT PROTECTION CONTROL PANEL - CP-7

CP-7 contains the indicators and the controls for the Plant Protection System (PPS) and the Engineered Safety Features Actuation System (ESFAS). The control panel is organized in four measurement channels monitoring protective NSSS and containment parameters. Besides the four measurement channels, CP-7 includes a set of manual controls for actuating ESFAS equipment to limit the consequences of an accident.

Each measurement channel includes indicating instrumentation for reactor parameters (neutron flux, rate of power change, local power density, DNBR margin) RCS parameters (Pressurizer pressure, Hot leg and Cold leg temperatures), containment pressure and RWSP level. Each channel also includes recorders for key reactor and RCS parameters.

Distinctive inserts are provided for each channel.

- A Plant Protection System Remote Control Module indicating the reactor trip, pre-trip and the bypassed status lights for each monitored process parameters, and providing controls for the reset (adjustment) of the "Low Pzr. Press" and "Low SG Press" setpoints, the bypass of the "Low Pzr. Press" and "Low SG Press" setpoints, the bypass of the "High Log. Pwr." and the calibration of the "Excore Linear Power" setpoints. | 1

- A CEAC/CPC Control Module, permitting monitoring of specific inputs and calculated values provided by the corresponding calculators.

Figure 2.2-1 shows the human factors enhancement drawing for CP-7. Figures 2.2-2 and 2.2-3 are photographs of this panel before and after enhancement.

Six findings or HEDs were reported against CP-7. The disposition of these findings are discussed below: | 1

B-1, Finding 22, Priority 1:

1. "Labels are excessively redundant. Abbreviations easily confused. Font size appears small for a control with this level of importance. EFAS selector SWs are labeled below SW while all others are labeled above. EFAS labels for the same control are different from CP-7 to CP-8."

2. "Labels are engraved on polished (silver) metal. Glare and poor contrast make readability poor."

Response

Hierarchical labeling has been provided. To the extent possible words rather than abbreviations have been used. In addition the engraved silver plates have been replaced by direct lettering on the panel. | 1

B-4, Finding 3, Priority 1:

"The Containment Spray Activation System pushbuttons near the front of the CP-7 benchboard are vulnerable to inadvertent actuation. The pushbuttons are not guarded."

Response

Guards will be provided for all ESFAS pusnbuttons by Hot Functional Testing. The containment spray buttons have been moved one position up away from the front edge of the benchboard (DCN-IC-1009). The bottom buttons are spares and will be removed if not needed prior to Licensing. |1 |1

B-5, Finding 25, Priority 3:

1. "These critical meters use multipliers (reading X100) in lieu of showing entire actual value on the scale. Other pressure meters show actual values, (e.g., 0-30 psia for Containment). (Other meters in control room show value X10.)"

2. "Wide range and setpoint meters display in 40 psia graduations. Adjacent narrow range meter displays 20 psia graduations. (Re: NUREG 0700, 6.5.1.5d). Cross-reference can be confusing. Normal operating pressure of 2250 psia is at same vertical point on the scales, aiding normal operation; but increases potential for confusion/error, reading other values."

Response

The use of multipliers on meter scales is a standard practice that generally represents only a minor nuisance to the operators. If taken alone these might not be a significant discrepancy. However, the use of various multipliers when space would permit actual values is one of several factors which can combine with others to result in poor meter scale displays. While these meters on CP-7 are felt to be acceptable all meters are presently being reviewed, and any unduly confusing scales will be changed prior to Licensing. (Refer to Section 2.15, Generic Panel findings.) |1

Regarding the different scale graduations between wide and narrow range pressurizer pressure, the consequences of misreading values are considered to be very slight since the PPS is fully automatic and the operator would normally control pressurizer pressure from CP-2. The dual scales provide some benefit as a way of checking the channel reading.

2310W-3

B-5, Finding 26, Priority 1:

"Containment wide range pressure measures from 0-40 psi. Narrow range measures from 0-30 psi. Mixed scales on same meter make easy interpolation/reading difficult".

Response

The subject containment pressure indicators are not for the monitoring of narrow and wide ranges. They are part of two independent loops; one for containment isolation (CIAS); and the other for containment spray (CSAS). As shown on the enhancement drawing (Figure 2.2-1), labels to clarify this point will be provided. No comparison of the subject scales will be required. | 1

B-6, Finding 18, Priority 1:

1. "Labels are excessively redundant. Abbreviations easily confused. Font size appears small for a control with this level of importance. EFAS selector SW's are labeled below SW while all others are labeled above. EFAS labels for the same control are different from CP-7 to CP-8."

2. "Labels are engraved on polisned (silver) metal. Glare and poor contrast make readability poor."

Response

Refer to B-1, Finding 22, above.

B-8, Finding 34, Priority 1:

"On CP-7 Containment Pressure meters, wide range meter is on right; on Pressurizer Pressure meters, wide range is on left."

Response

Refer to B-5, Finding 26. The meters for containment pressure had been mislabeled. This will be corrected. The scales are separately provided for monitoring of the containment isolation actuation signal and the containment spray actuation signal. | 1

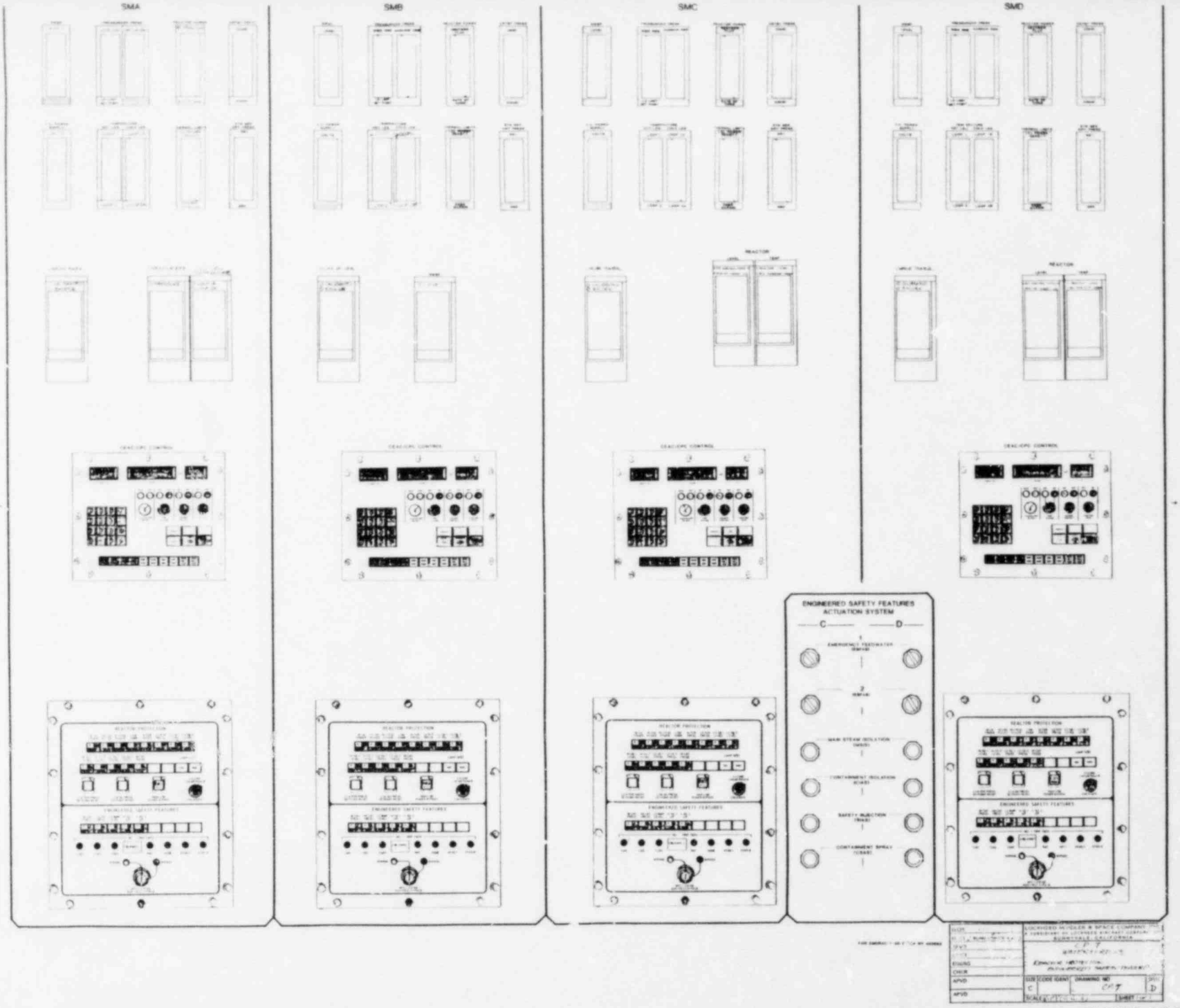

SMA
SMB
SMC
SMD
ENGINEERED SAFETY FEATURES
ACTUATION SYSTEM
C
D

FIGURE 2.2-1

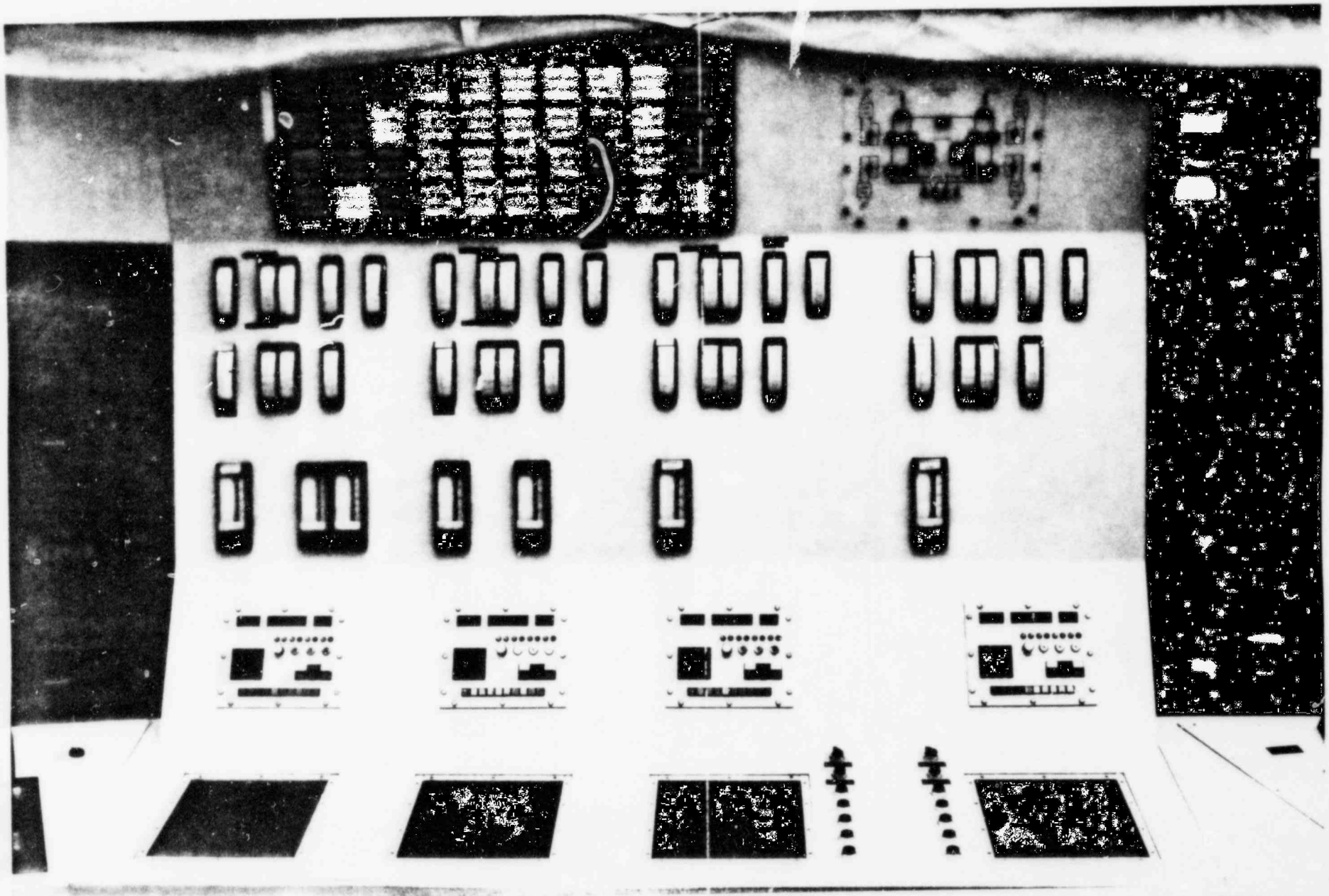


FIGURE 2.2-2

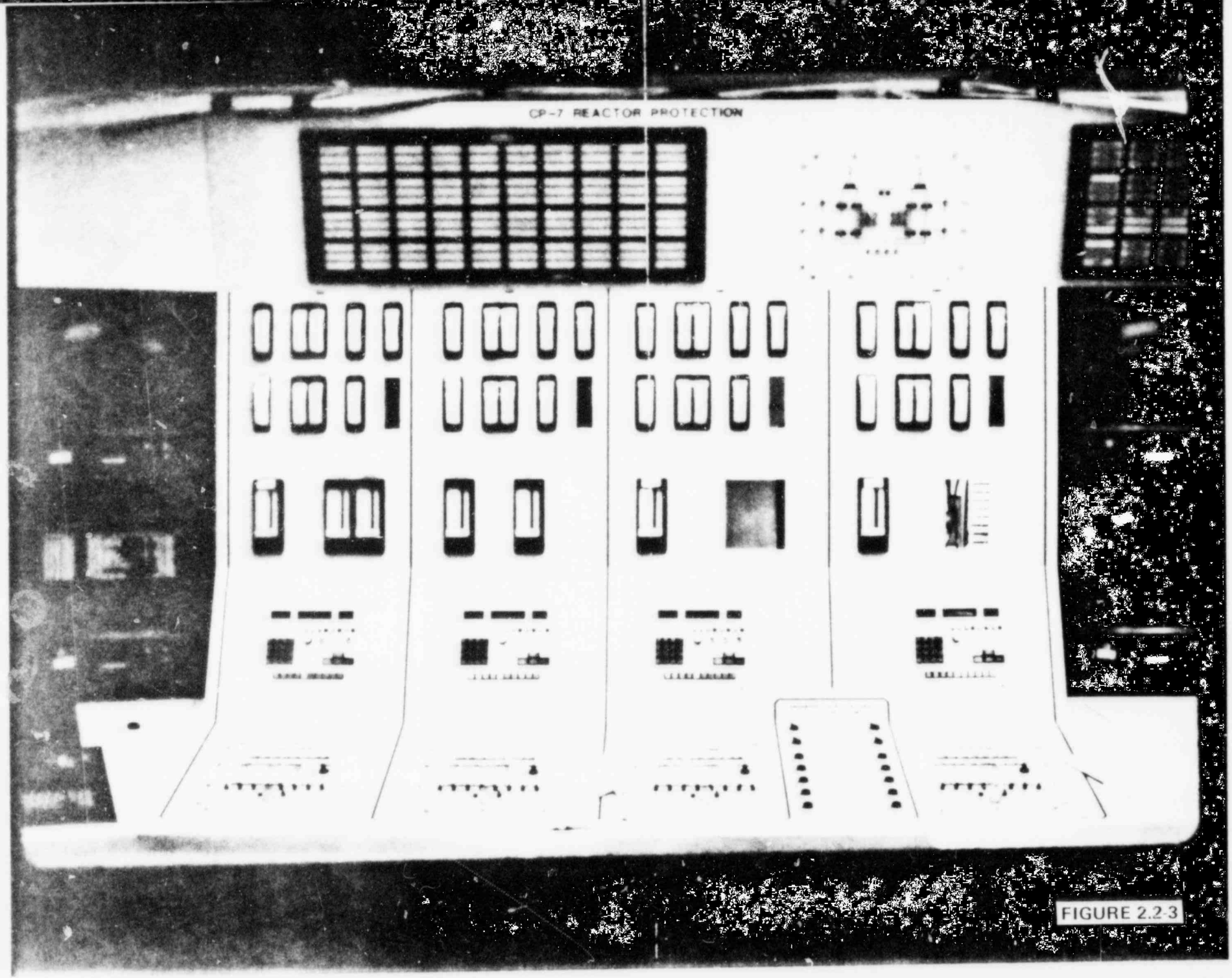


FIGURE 2.2-3

2.3 CHEMICAL AND VOLUME CONTROL PANEL (CP-4)

2.3 CHEMICAL AND VOLUME CONTROL SYSTEM (CP-4)

CP-4 groups together the indicators, recorders and controls for the chemical and volume control system (CVCS) and ties to the Boron Management System (BMS).

The upper left side of the control panel includes the indicators for the key parameters of the letdown loop (temperatures and flow), Volume Control Tank (temperature, pressure and level) and charging loop (temperature and flow). The same row of indicators includes wide range and narrow range Pressurizer pressure instruments.

A second row of instruments for the CVCS includes a pair of level indicators for the boric acid makeup tanks, a pressure indicator for the RCP bleedoff header, and a set of recorders monitoring the process radioactivity, the boron concentration and the flows of primary water (for dilution) and boric acid (for boration).

The next row (on the inclined section of the panel) groups the valve control switches and the process control stations by loops (Letdown, Makeup, RCP Bleedoff) and equipment (Volume Control Tank). The bench section of the CP-4 includes a set of control switches for the Charging and Pressurizer Spray loops, flanked on both sides by groups of switches controlling various related valves and the Boric Acid Makeup pumps.

The right side of the CP-4 (with the exception of the bench section) is dedicated to Boron Management System (BMS) related equipment. | 1

The top row of indicators monitors the level and pressure of various tanks (Reactor drain, equipment drain, flash, holdup tanks).

Three counters and three recorders on the same vertical section monitor the flow and the radiation level of the boric acid condensate, liquid waste and gaseous waste.

The inclined section includes all control switches and control stations for the various pumps, valves and tanks.

A set of two double-trace trend recorders are located on the vertical section between the CVCS and the BMS sets of recorders. These recorders are driven by the plant monitoring computer and are able to record any key parameter of these two systems.

Figure 2.3-1 is the CP-4 enhancement drawing; Figures 2.3-2 and 3 are photo's showing this panel before and after enhancement respectively.

Sixteen findings or HED's were reported against CP-4. The disposition of these findings are discussed below. | 1

B-1, Finding 16, Priority 2:

1. "The panel meters that are located on the upper portion of the panel are placed too high. They are located beyond the optimum visual distance for good human engineering practices."

2. "Parallax in discrimination of the major/minor scales of the meter may result from the present location of many of the meters. Lighting reflections may increase the reading problem, especially for shorter operators."

Response

The control boards do not accommodate the 5th percentile female. However, the control boards are designed so that all the major controls and indicators are generally accessible and readable. If during startup testing and procedure validation a readability problem is discovered, then the individual component will be evaluated and modified if necessary prior to Licensing. Lighting changes will reduce reflective glare and ameliorate reading difficulties for the shorter operators. Also refer to Section 2.15.5, Findings 14 and 15. | 1

B-4, Finding 6, Priority 3:

"Some key switches on CP-4 and CP-8 have a black ring, some do not. There is no functional consistency for the use of black and silver switches".

Response

This does not conflict with any color code convention utilized in the Main Control Room. Black is a neutral color; therefore no corrective action is warranted.

B-4, Finding 15, Priority 2:

"On CP-4, some key switches have different key orientation from the key teeth down convention used in the Control Room".

Response

The key switch orientation has been reviewed and will be made consistent prior to Licensing. | 1

B-5, Finding 28, Priority 1:

"The two recorders adjacent to D-5 recorder waste flow in blue ink as per its window labels. D-5 recorder charts waste flow in red ink which is not consistent with the other."

Response

The ink color markers will be corrected to red for waste and green for radiation.

B-6, Finding 2, Priority 1

"These (valves) status indicators do not have labels to indicate status, i.e., valve position close-open."

NRC Review Team Comment: Refers to CP-4 Charging Pumps Header discharge valve and PZR Aux Spray valve.

Response

All controls have "open" or "close" position labels, associated with the corresponding red or green colors. Indicators do not have labels, but use the red and green colors to provide status. These colors follow the uniform color convention for this purpose and are not seen as a problem to the operator. No confusion is expected. Associated controls are labeled according to the position selection.

B-6 Finding 3, Priority 1:

"Refueling Water to Charging Pump

This switch is not labeled."

Response

Labeling is now provided for this switch as can be seen in the lower center bench board section of the enhancement drawing (Figure 2.3-1).

B-6, Finding 26, Priority 1:

"Meter C-12 "(Equipment Drain Tank) is not adequately labeled to show parameter being measured."

NRC Review Team Comment: One meter is labeled PSIG and another is labeled only %. This discrepancy also applies to the Holdup Tank and the Reactor Drain Tank."

Response

The meters have been labeled to designate the appropriate parameters as can be seen in the upper right portion of Figures 2.3-1 and 2.3-3.

B-6, Finding 33, Priority 1:

The combination and sequential arrangement of the (charging) pump selector sets as now exist and displayed on the face plate of the charging pumps is difficult to follow. There is no clear relationsnip between this switch selection arrangement and the pump switches it refers to above it."

Response

The meaning of the switch was misunderstood. It is now labeled correctly to indicate that it is a "backup pump" selector switch. Each position lists two pumps; the order of listing implies the sequence in which they will initiate as backups to the selected or primary pump. Labeling will reflect correct sequencing by Hot Functional Testing. Refer to Figure 2.3-1. 1

B-6, Finding 35, Priority 1:

"This vertical meter is mislabeled. It is now labeled (Hold Up Tank D). It should be labeled (Hold Up Tanks Vent Header Pressure)" by Hot Functional Testing.

Response

As shown on Figure 2.3-1 (upper right corner) this meter will be labeled, "Hold Up Tanks, Vent Header Pressure" by Hot Functional Testing. | 1

B-8, Finding 3, Priority 1

On CP-4, CVCS, there are duplications of controls; e.g.,

1) Letdown Containment Isolation VA IN
2) Charging Loop 1A Shutoff VA
3) Charging Loop 2A Shutoff VA

Response

There is no duplication of controls on CP-4. Specifically, letdown Containment Isolation Va, Charging Loop 1A Shut-off Va, and Charging Loop 2A Shut-off Va, have each an individual control switch with individual indication lights. Labels have been provided to show inside and outside containment. | 1

B-8, Finding 17, Priority 1:

The Letdown Valve selector, controller, and indicator are not on the same panel: e.g.,
Selector is on CP-4
Controller is on CP-2
Indicator is on CP-4
The distance between CP-2 and CP-4 is about 10'.

Response

The controller has been transferred from CP-2 to CP-4 as indicated on Figures 2.1-3 and 2.3-1. All controls and indicators for the letdown valves are now located on CP-4. (DCN No's IC-837 and 1011). | 1

B-8, Finding 25, Priority 1:

The order in which A73 and A77 (Boric Acid Gravity Feed Valves) are arranged, Valve B to the left of Valve A is poor. This arrangement breaks control board conventions and human expectations".

Response:

As can be seen on Figure 2.3-1 (bench board section, middle right), these valve control switches will be repositioned into the proper left to right sequence by Hot Functional Testing (DCN-IC-413). The switch for valve A is on the left and the switch for valve B is on the right. | 1

B-8, Finding 28, Priority 2:

"On CP-4 there is an inconsistent left to right, top to bottom numbering convention; i.e.,

1. Boric Acid Tank B and A Gravity Feed Valve

2. Charging Loop 2A and 1A valve controls."

Response

1. Refer to B-8 Finding 25, above.

2. Charging loop 1A valve switch will be moved to the left and charging loop 2A valve switch to the right on CP-4 by Hot Functional Testing. | 1

B-8, Finding 33, Priority 1:

The placement of C-11 and C-12 (Equipment Drain Tank) does not follow pattern set by the adjacent meters, that is (psig) TK vent, followed by (level) DRB TK."

Response

The subject meters have been interchanged (DCN-IC-1011) as can be seen in the upper right section of Figure 2.3-1.

B-9, Finding 5, Priority 1:

"Operator states that letdown flow is controlled on CP-2 (Item 1) and indicated on CP-4 (Item 2). Letdown back pressure is indicated on meter at left of back pressure controller on CP-4 (Item 3). During manual operation, either control will affect both indicators. Operation will be a difficult two-man job."

NRC Review Team Comment: Controller and display are approximately 8 feet away from the Valve A, B, and both selectors."

Response

Refer to Section 2.1, Reactor Control Panel Findings B-8; 17 and B-9; 5. Letdown flow control has been transferred to CP-4, therefore, both controls and indicators are on the same panel. | 1

B-9, Finding 6 Priority 1:

"On CP-4, the association between the gross coolant activity recorder and the pushbuttons/indicators above it is not clear."

Response

The indicators show the operator the selected range on the process radiation recorder. Enhancements have been provided to show this relationship.

FIGURE 2.3-1

CP-4 CVCS

DATE	LOCKHEED MISSILES & SPACE COMPANY, INC. A SUBSIDIARY OF LOCKHEED AIRCRAFT CORPORATION SUNNYVALE, CALIFORNIA
DWN	
AFVD	
APVD	CHEMICAL AND VOLUME CONTROL SYSTEM
ENGRG	
CHKR	
APVD	SIZE E / CODE IDENT / DRAWING NO / REV D
APVD	SCALE / SHEET 1 OF 1

FOR ENGRG T-30-1 PO# 40868

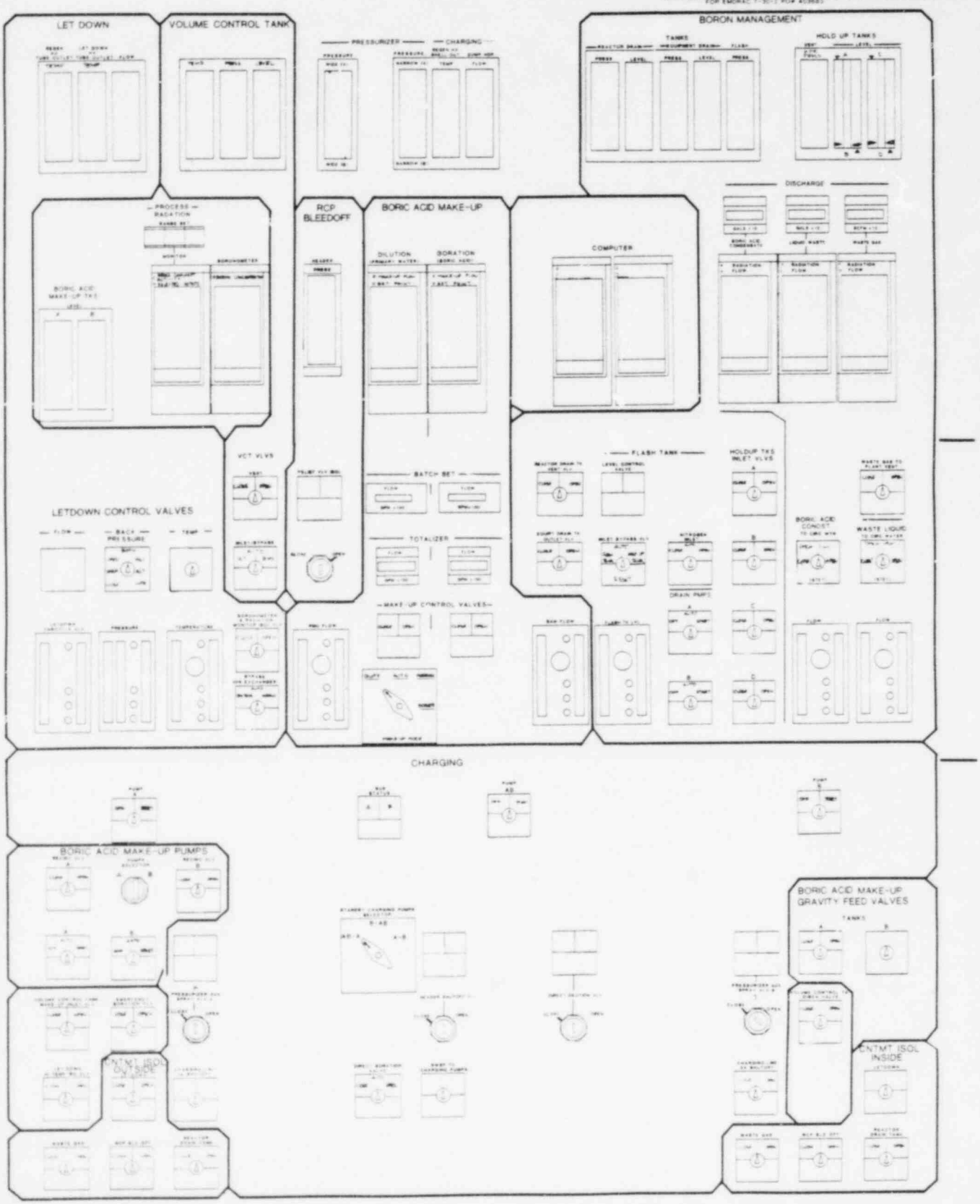


FIGURE 2.3-2

2.4 POWER CONVERSION AND DISTRIBUTION PANEL (CP-1)

2.4 POWER CONVERSION AND DISTRIBUTION PANEL (CP-1)

CP-1 includes the indicators and controls of the Main Turbine Generator, the Emergency Diesel Generators, their electrical distribution network and their related systems and subsystems. The equipment grouped on CP-1 corresponds to the continuous operational needs for running these systems and subsystems, while the equipment required only for status recording, occasional supervision, or for operation in infrequent, non-emergency situations (like start-up) is located on separate control panels (e.g., CP-13 for the main turbine and related subsystems or the local control panels for the Emergency Diesel Generators).

On the left side of the vertical section of CP-1 are located the key parameter indicators of the Main Generator (including the exciter), the synchroscope and the Main Generator Lockout Trip pushbuttons. On both sides of this cluster are located the indicators, synchroscopes and Trip Pushbuttons of the Emergency Diesel Generators (EDG's), as well as light indicators showing the transfer of controls between the Main Control Board (MCB) and the EDG Local Control Panels.

On the lowest row of the vertical section are located the control switches for testing the under voltage relays of buses A, B and AB, as well as the control switches for testing the sequencers A and B, with corresponding light indicators showing the sequential loading of the diesels.

On the inclined and bench sections on the left side of CP-1 is located the Mimic of the station power distribution network, with lights indicating the main breakers status, switches for operating the breakers, for starting and for adjusting the speed of the EDG's, and for adjusting the voltage of all three generators.

On the right side of the vertical section of CP-1 are located the indicators for key parameters of the Main Turbine, Condensate, Blowdown, Steam Generators, Feedwater Pumps, FPT and Auxiliary Steam. Below the Main Turbine indicators are mounted the Turbine Trip pushbuttons, the indicating lights showing the trip coil status and the Condenser Vacuum Breaker control switch. Farther below on the vertical section and on the inclined and bench sections are located the DEH Control System inserts and switches controlling the Turbine Oil Pumps and the E-H Fluid Pumps.

On the right side of CP-1 are also located the following clusters of instruments:

- Indicators and switches for the control of the Turbine Generator Temperature Control Valves, Moisture Separator Reheater Valves, Blowdown Valves, Turbine Drains and Extraction Valves.

- Control Stations, switches and indicators for the Steam Bypass, Feedwater, Condensate and Blowdown loops.

- Control switches and status indicators for the Heater Drain Pumps, Circulating Water and Screen Wash Pumps, River Water Pump, Air Evacuation Pump, Primary Water Pumps and Condensate Vacuum Pumps.

A set of pushbuttons for the annunciator control completes the CP-1 equipment.

The enhancements for CP-1 are shown on Figure 2.4-1. Thirteen findings or Human Engineering discrepancies were reported against CP-1. These findings and their disposition are discussed below:

B-4, Finding 8, Priority 1

"On CP-1 there are intermixed status lights and pushbutton controls which are the same size and appearance with no differentiation between those that are indicators and those that are controls."

Response

LP&L will ensure that the enhancement effort adequately differentiates status lights and pushbutton controls located on CP-1 that are of the same size and appearance. This is a surface enhancement process and the changes will be completed by Hot Functional Testing. | 1

B-5, Finding 13, Priority 1

"Reference meters are dual-pointer units. Content of upper and lower meters are the same in each case: LP TURB (A, B or C) STM INLET."

Response

Labeling will be corrected prior to Hot Functional Testing. | 1

B-5, Finding 15, Priority 1

"Both meters display 0-33 (AC volts x 1000). On C20, numeric values are present at intervals of 10. On C23, numeric values are present at intervals of 5."

NRC Review Team Comment: One meter is Running Bus; other is AC GEN VOLTS.

Response

Indicator C20 is used only during synchronization of the main generator. Indicator C23 is a permanent display of generator voltage.

Scales will be changed to be consistent by Hot Functional Testing. | 1

B-6, Finding 5, Priority 1

"Association of dual action controls and association of "think" button and applicable controls are not shown."

Response

As part of the surface enhancement, lines were added to show the relationship of these switches.

B-6, Finding 8, Priority 1

"Circuit breaker indicators (not micro-switches) are not labeled. Bus sections are labeled."

Response

Corrections/completion of the mimic on CP-1 will be provided by Hot Functional Testing. Enhancement will include the labeling of the circuit breaker status indicating lights. | 1

B-6, Finding 12, Priority 1

"On the mimic on CP-1 and CP-2, there are sets of indicator lights that are either not labeled or not inscribed."

Response

LP&L will provide labels or inscriptions, whichever is appropriate, as part of the enhancement effort by Hot Functional Testing. | 1

B-6, Finding 48, Priority 1

"Mimic of diagram of power flow to transformers supply power to plant equipment is incomplete and inaccurate."

Response

Correction/completion of the mimic on CP-1 will be provided as part of the enhancement effort, prior to Hot Functional Testing. | 1

B-8, Finding 1, Priority 1

Panel review by Human Engineering personnel and Waterford-3 operators indicates that existing arrangement of panel elements does not reflect functional relationships as understood by operators in all cases.

NRC Review Team Comment: Examples:

1. River water pump control is separated from circulating water system controls.

2. Condensate vacuum pump system controls are located at the lower left bottom sloping panel and the Condenser Exhaust Selector control is located at the lower right of bottom sloping panel. | 1

3. COND to MAKEUP TIE (TK) VALVE located in middle of the right lower sloping panel.

4. Cond. Vac. Brkr, Cond. B Vac. recorder are located on the upper left vertical panel below annunciators.

Response

1. River Water Pump is used during the plant shutdown to provide make-up water to the Primary Water System via circulating water system pipes.

2. This is an appropriate location for the condenser exhaust selector control switch. Enhancement effort will address functional relationship problems by Hot Functional Testing.

3. The control switch for condensate to make-up tie valve has been removed. | 1

4. Condenser vacuum breakers control switch and condenser vacuum recorder are located on the vertical section of the control panel. This is an appropriate location for this equipment.

B-8, Finding 7, Priority 1

"On CP-1, steam generator pressure is shown only as combined value on indicator SBCS master controller. Individual Steam Generator pressures are shown only on CP-8. Operator desires individual Steam Generator pressures on CP-1, at least to help localize a tube rupture. Isolation valve controls are on CP-1."

NRC Review Team Comment: Isolation valve controls are on CP-8.

Response

Individual steam generator pressure indicators are being added to CP-1 (DCN-IC-1014).

B-8, Finding 8, Priority 1

"Referenced switch controls river water supply. It is located between feedwater and blowdown areas of the panel. It is minimally related to either of those groups."

Response

River Water Pump is operated only during complete shutdown of the plant to provide the make-up water to the Primary Water System. Functionally, the River Water Pump is not related to any other equipment on the control panel except that it belongs to the balance of the plant.

B-8, Finding 35, Priority 1

"On CP-1 and CP-8 there are groups of 10 meters in a row, instead of the recommended maximum of five in a row."

Response

There is one group of 10 meters in a row on panel CP-1. All meters in that group are monitoring main turbine parameters. There are two groups of 10 meters in a row on panel CP-8. All meters in one group are monitoring parameters of the Safety Injection System in Safety Channel A, the other group for Safety Channel B. In addition, lines of demarcation clarifying the association of the meters will be provided by Hot Functional Testing. | 1

B-9, Finding 9, Priority 2

"The four referenced elements (Cooling Water Temp and Press Controls) are located in a vertical column, the two meters above the two switches. The upper meter and upper switch are associated, and the lower meter and lower switch are associated. Thus, associated meters and switches are not adjacent."

Response

Whenever the operator adjusts this system he has to move both valves. Since indicators are adjacent to each other LP&L feels that it is highly unlikely that he will not see the proper valve movement indication. Furthermore, labels showing temperature and pressure association have been provided.

B-9, Finding 11, Priority 1

"Operators report that Turbine Generator Temperature Control Valves will be difficult to operate with desired or necessary precision. Possible violation of NUREG-0700, Para. 6.9.3.2.a."

NRC Review Team Comment: Operators agree that the indication on valve position is adequate (0-100%), but there may be a question concerning valve travel rate (%/sec).

Response

No difficulty is anticipated with the modulating control valves. Valve position indication is provided over the full range and the temperature is also indicated. No problem with the valve travel rate is anticipated based on experience at other operating plants. The adequacy of the valve travel rate will be confirmed during startup testing and documented prior to startup following the first refueling. | 1

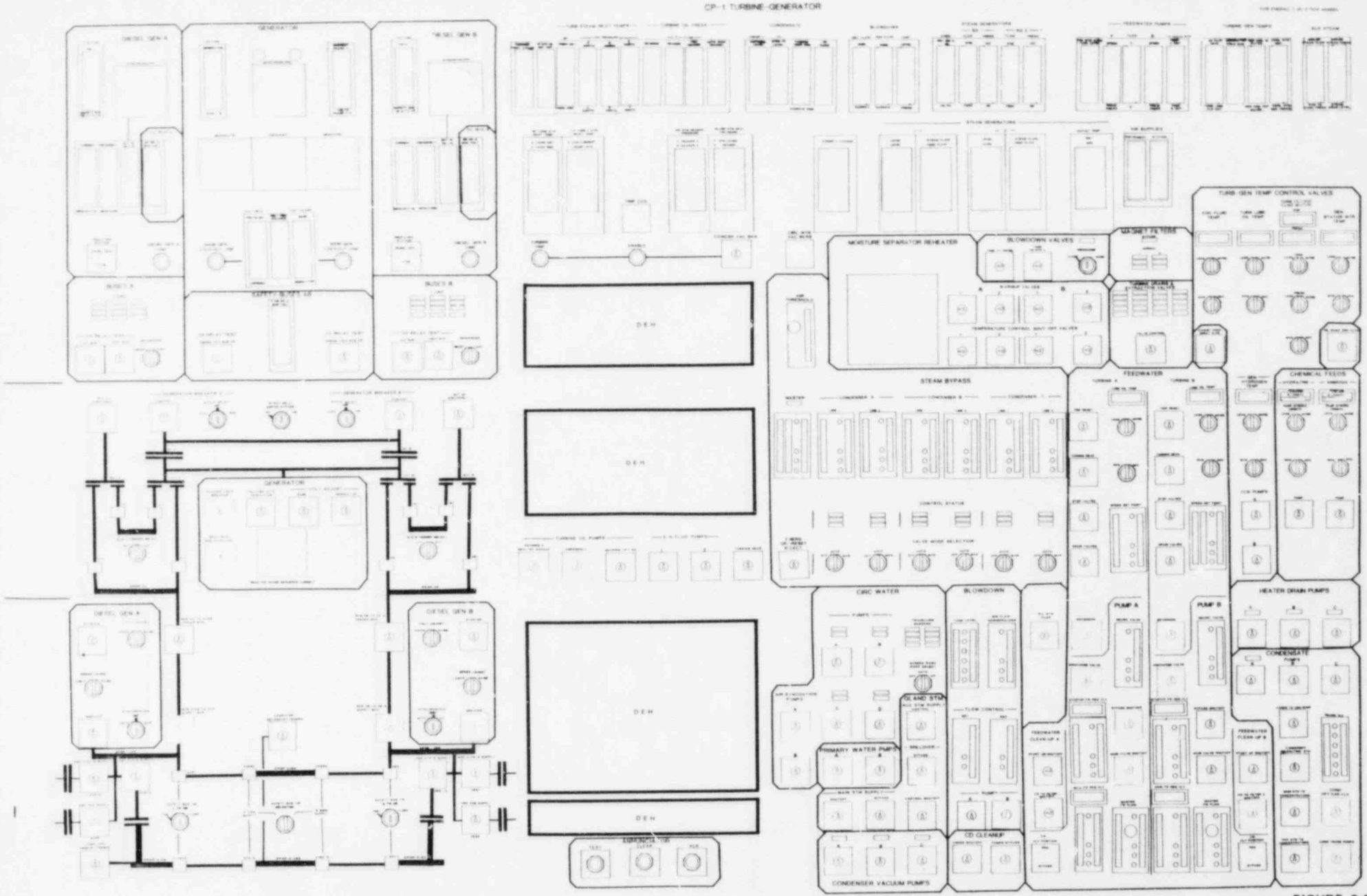

CP-1 TURBINE-GENERATOR
DIESEL GEN A
GENERATOR
DIESEL GEN B
BUSES A
EMERGY BUSES 1,2
BUSES B
DEH
DEH
DEH
DEH
MOISTURE SEPARATOR REHEATER
BLOWDOWN VALVES
MAINSTEP FILTERS
TURB-GEN TEMP CONTROL VALVES
STEAM BYPASS
FEEDWATER
CHEMICAL FEEDS
CIRC WATER
BLOWDOWN
PUMP A
PUMP B
HEATER DRAIN PUMPS
CONDENSATE
GLAND STM
PRIMARY WATER PUMPS
CD CLEANUP
CONDENSER VACUUM PUMPS

FIGURE 2.4-1

2.5 TURBINE STARTUP/SUPERVISORY PANEL (CP-13)

2.5 TURBINE STARTUP/SUPERVISORY PANEL (CP-13)

CP-13 includes all recorders, but only part of the indicators and controls pertinent to the Main Turbine and its related equipment (Feedwater Pump Turbines, Heaters, Drain Loops). While the equipment required by the continuous operational needs concerning the Main Turbine is located on CP-1, the instrumentation required for status recording, supervision and operation in infrequent, non-emergency situations (like start-up) is mounted on CP-13.

The top-center section of control panel is occupied by the annunciator cabinet A (including all alarms related to the Heaters, Moisture Separator - Reheater and Water detected in the steam lines). Left of the annunciator cabinet is located a cluster of indicators for the following Turbine parameters: speed, acceleration, rotor eccentricity phase angle and rotor vibration phase angle.

On the right side, the annunciator is flanked by the Feedwater Pump Turbines A and B recorders. A second row of recorders monitor the turbine bearing temperatures (bearing oil and bearing metal), the turbine metal and steam temperatures, the rotor vibration and eccentricity, the casing expansion and the differential expansion, the rotor speed and rotor position.

Below the recorders, the following clusters of instruments are mounted in a horizontal row:

- Indicators and switches for the control of drain valves.
- Indicators and switches for the control of heater valves.
- Control switches for the operation of Nitrogen Supply and Vent Valves.
- Control switches for the operation of FWPT steam line drain valves, condenser air exhausters, gland seal leakoff pump, heater bypass valves and L P heaters isolation valves.

The lower section of the CP-13 is occupied by the Feedwater Pumps Turbine Monitor Drawers (eccentricity, vibration and thrust bearing wear) and the Main Turbine Monitor Drawers (eccentricity, vibration, rotor position, casing expansion, differential expansion, speed and additive valve position).

A set of pushbuttons controlling the annunciator and a vibration detectors reset pushbutton (for the large motors) are also located on CP-13. | 1

The enhancements for CP-13 are shown on Figure 2.5-1. A post enhancement photograph is provided as Figure 2.5-2. | 1

Six findings or Human Engineering discrepancies were reported against CP-13. These findings and their disposition are discussed below:

B-3, Finding 19, Priority 2

"The annunciator controls for annunciator panel B on CP-33 are located on CP-13."

Response

The annunciator control pushbuttons for CP-33 and CP-13 are located on CP-13. Since these panels are adjacent no significant operational problems or confusion is anticipated. The operators will be trained to absorb the annunciated message before acknowledging from the pushbutton station. There is no need for the operator to be in front of the pushbutton while reading the annunciator. Moving the pushbutton station to the right side of CP-13 was considered, however internal wiring and structural supports precluded this move. 1

B-5, Finding 18, Priority 3[1]

"There is extraneous information on meter faces located on CP-13 (e.g., circular meters indicating phase angle, vibration, and speed)."

Response

The label will be removed from the meter scale as per EDN-EC-447 and hierarchical labeling will be added prior to Licensing. 1

B-6, Finding 39, Priority 1

"There is inconsistent labeling on CP-13; e.g., on "Heater" subpanel, 1 & 2 indicates HP, 3 & 4 indicates IP, 5 & 6 indicates LP. On "Heater bypass" subpanel, HP indicates HP, IP indicates IP, LP indicates LP."

Response

Labeling has been corrected as part of the enhancement effort.

B-8, Finding 5, Priority 3

"The vibration reset pushbutton for the cooling tower fans is presently located on CP-13. There are no other cooling tower related controls or displays nearby. It should be placed near cooling tower fan controls on CP-33."

Response

The vibration reset pushbutton is for all large motors, not just cooling tower fans. Therefore, the proper corrective action shall be to relocate the annunciator from CP-33 to CP-13 (DCN-IC-987) and labels will be corrected by Hot Functional Testing. 1

B-8, Finding 11, Priority 2

"On CP-13 displays and controls related to turbine/generator shaft vibration are separated by a group of controls and displays associated with secondary side steam extraction and drains. Panel demarcation and associated labeling is not clear and does not compensate for the poor layout. There are two unassociated controls on the panel, i.e., a reset pushbutton for annunciators on CP-33 and a CR Potable Water switch."

Response

The location of recorders in the upper part of the panel is appropriate. The location of the power drawers that process field signals for display indicators, recorders, and alarms are also appropriate in the lower part of the panel since they have no direct relation to the rest of equipment on that panel and could have been located, as a group, outside of that panel with no effect on operational procedure. The layout of the control stations on panel CP-13 is functionally correct and is in proper sequence to provide a clear supervision of equipment operation to the operator. The annunciator pushbuttons located on panel CP-13 are associated with annunciator display cabinets located on panels CP-13 and CP-33. The Control Room potable water control switch is provided to enable the operator to quickly isolate potable water to Control Room in case of potable water pipe break within the confines of the Control Room, thus preventing flooding of essential control circuits. This is a regulatory requirement and control switch is located at extreme left of all controls in the Control Room to assist in quick location of the control switch in case of need.

B-8, Finding 30, Priority 2

"On CP-13 the Extraction Steam Heaters controls/displays are layed out in a dog leg arrangement."

Response

Feedwater heaters consist of two groups; high and low pressure. High pressure heaters are grouped on the left and low pressure heaters are grouped on the right. Therefore, the board components are properly arranged within each group of heaters. Enhancements will be provided by Hot Functional Testing to better clarify the arrangement. Refer to Figure 2.5-1. | 1

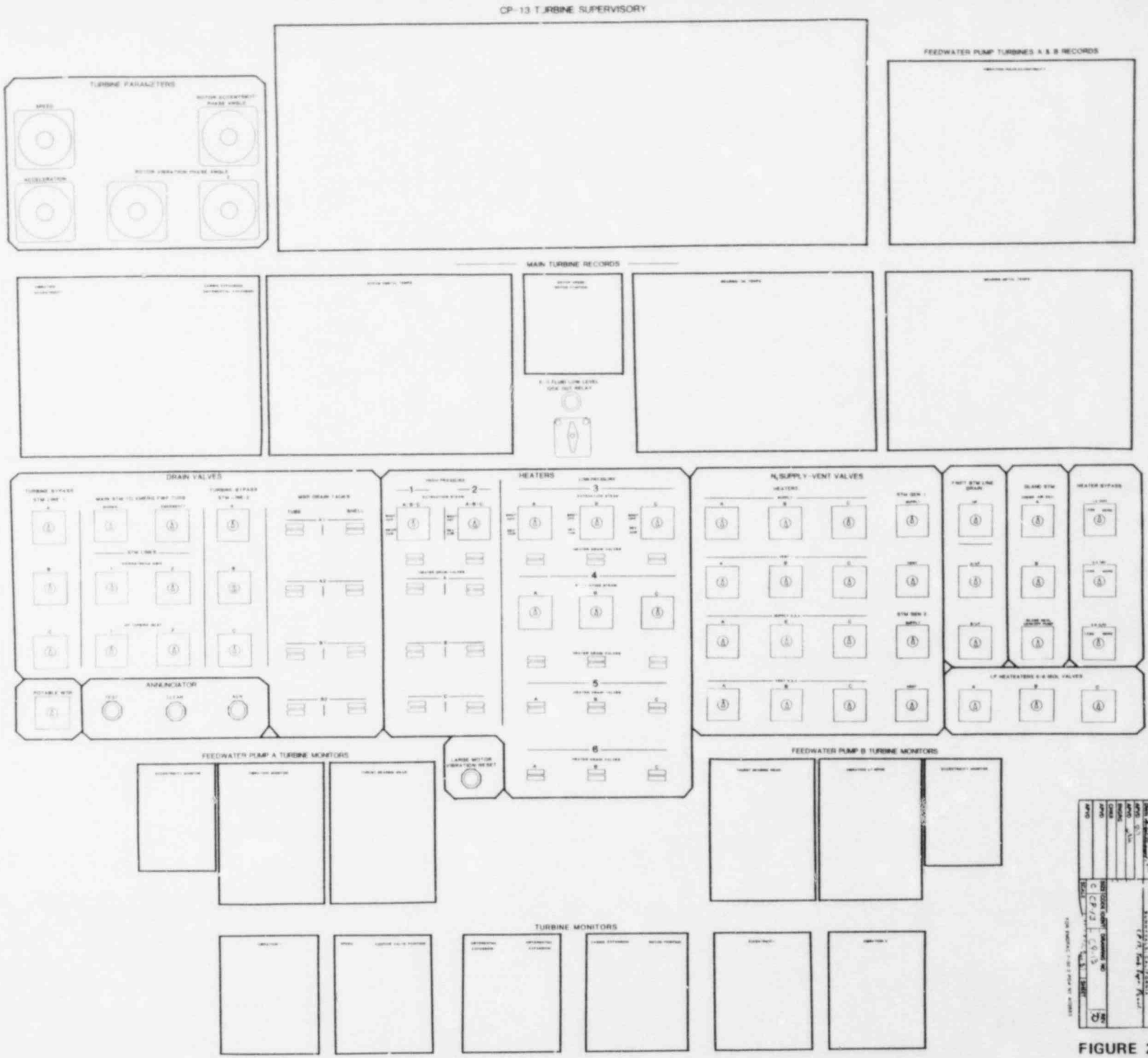

CP-13 TURBINE SUPERVISORY
TURBINE PARAMETERS
FEEDWATER PUMP TURBINES A & B RECORDS
MAIN TURBINE RECORDS
DRAIN VALVES
HEATERS
ANNUNCIATOR
FEEDWATER PUMP A TURBINE MONITORS
FEEDWATER PUMP B TURBINE MONITORS
TURBINE MONITORS

FIGURE 2.5-1

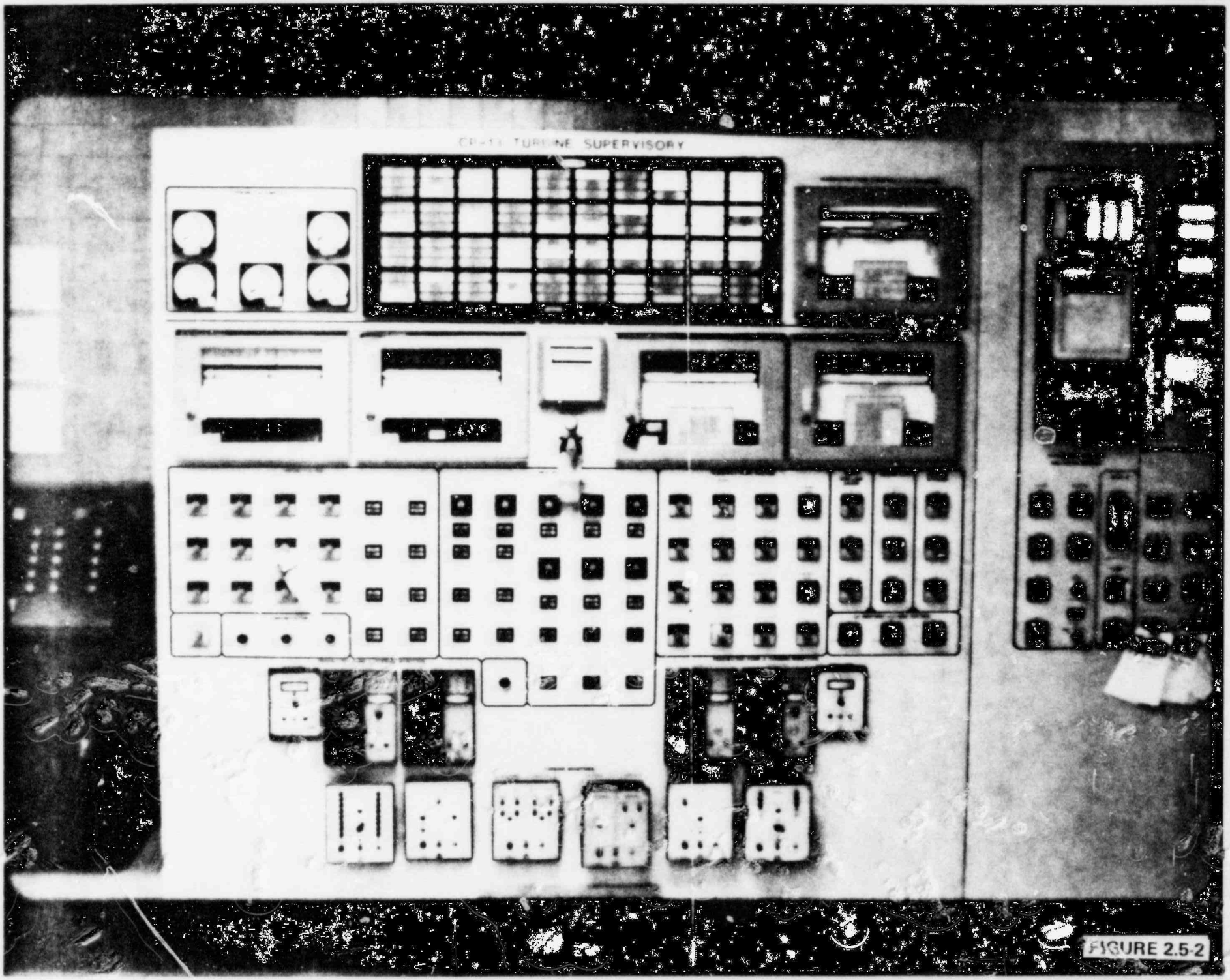


FIGURE 2.5-2

2.6 PROTECTIVE RELAYS PANEL (CP-15)

2.6 PROTECTIVE RELAYS PANEL (CP-15)

CP-15 includes the protective relays for the following equipment:

- Main Generator
- Main Transformers (3A and 3B)
- Unit Auxiliary Transformers (3A and 3B)

The Lockout relays for the Main Generator (primary lockout relay G1, backup lockout relay G2 and lockout relay D, operated by the distance relay) are also mounted on CP-15, with their trip/reset handles accessible on the front panel.

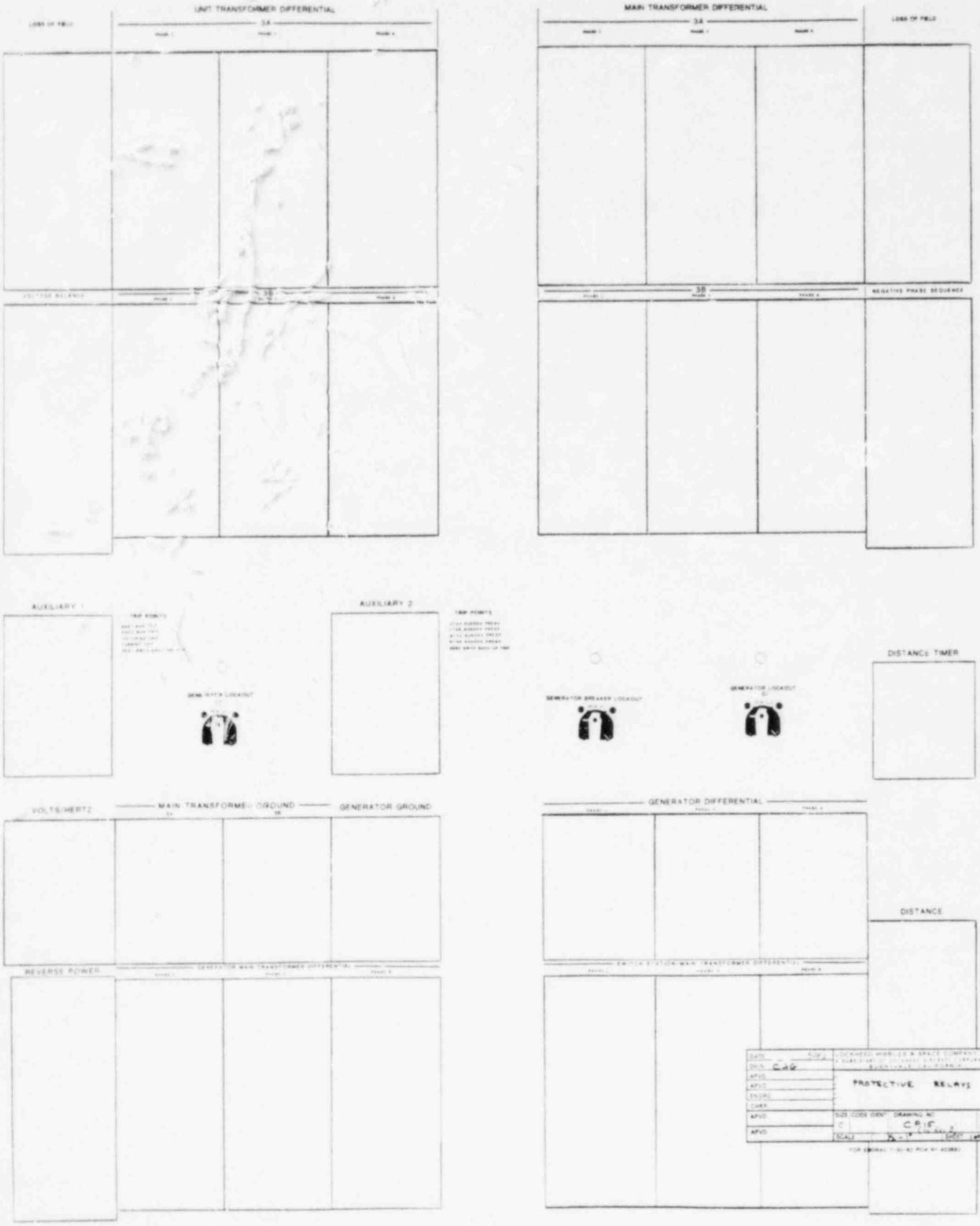
The enhancements for CP-15 are shown on Figure 2.6-1. Before and after enhancement photographs are provided as Figures 2.6-2 and 3, respectively.

Findings

There were no specific findings against CP-15, however, any of the generic findings (Section 2.15) applicable to CP-15 have been addressed as described in Section 2.15.

FIGURE 2.6-1

CP-15 PROTECTIVE RELAYS



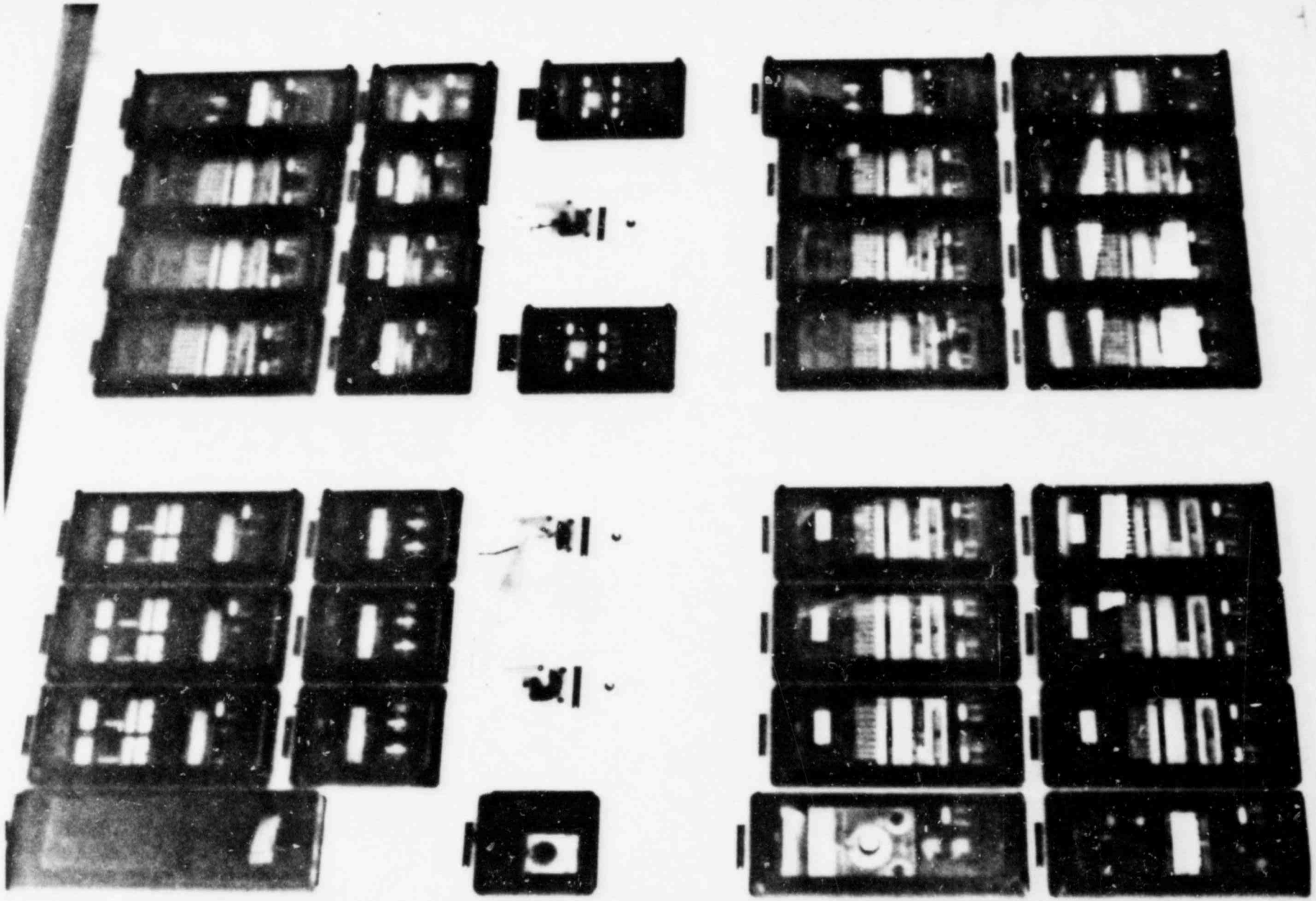


FIGURE 2.6-2

CP-15 PROTECTIVE RELAYS

FIGURE 2.6-3

2.7 ELECTRICAL MONITORING PANEL (CP-17)

2.7 ELECTRICAL MONITORING PANEL (CP-17)

CP-17 includes on its front panel the following instruments:

- Three recorders monitoring the Main Generator frequency (Hz), the Main Generator power (MW) and the Grid Voltage (V).

- Three energy (KWH) meters totalizing the Generator gross power, the power transmitted to the 4kV switchgear and the power transmitted to the 7kV switchgear.

- The Automatic Synchronizer.

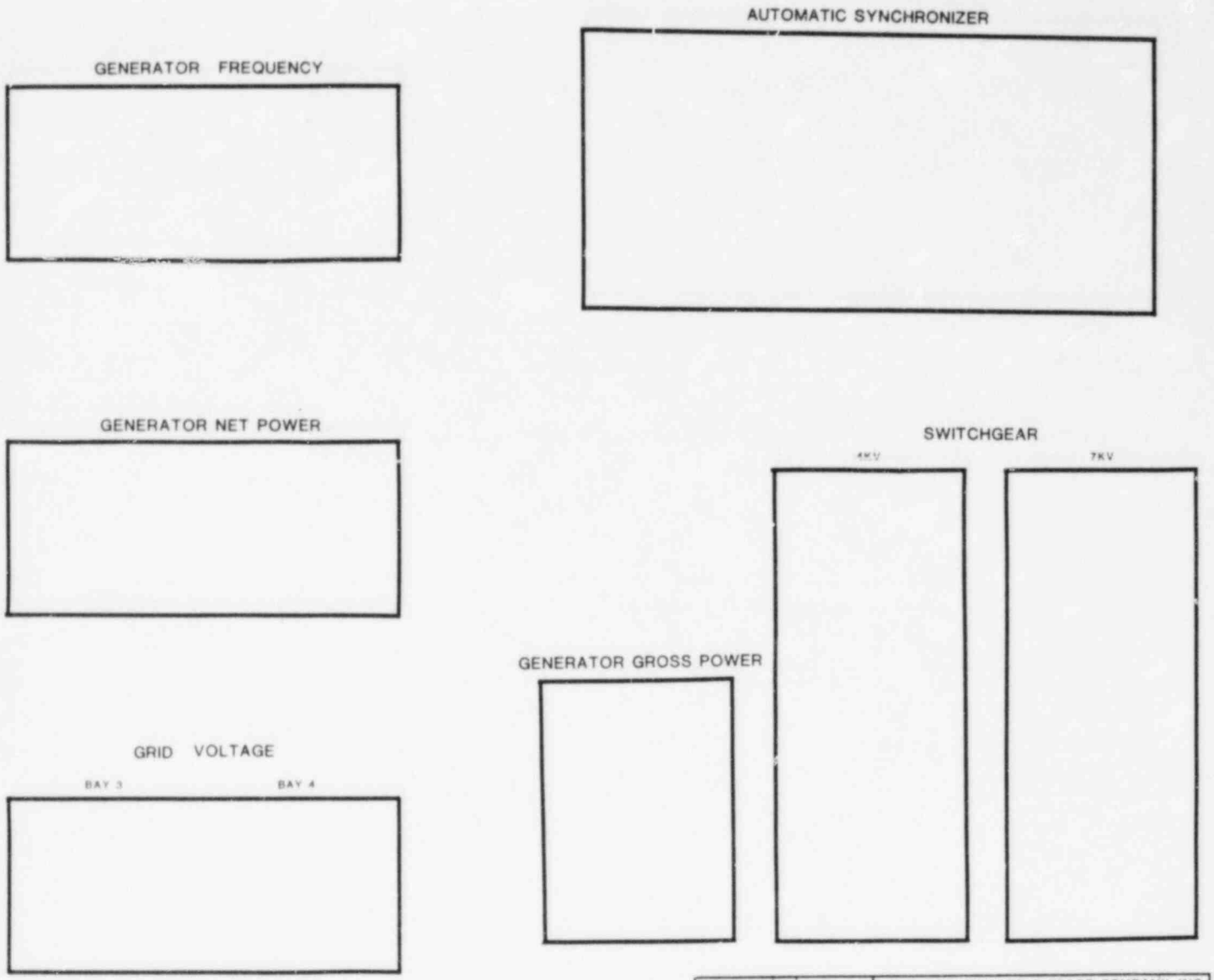
The enhancements for CP-17 are shown on Figure 2.7-1. Before and after enhancement photographs are provided as Figures 2.7-2 and 3, respectively.

Findings

There were no specific findings against CP-17, however, any of the generic findings (Section 2.15) applicable to CP-17 have been addressed as described in Section 2.15.

FIGURE 2.7-1

CP-17 ELECTRICAL MONITORING



DATE 6/28/82	LOCKHEED MISSILES & SPACE COMPANY, INC. A SUBSIDIARY OF LOCKHEED AIRCRAFT CORPORATION SUNNYVALE, CALIFORNIA			
DWN C.A.G.				
APVD	ELECTRICAL MONITORING CP-17			
APVD				
ENGRG				
CHKR				
APVD	SIZE C	CODE IDENT CP 17	DRAWING NO (Same as Sht 2 of (4 B))	REV D
APVD	SCALE 1/2 = 1"		SHEET 1 of 1	

FOR EMDRAC 7-30-2 PO# NY 403683

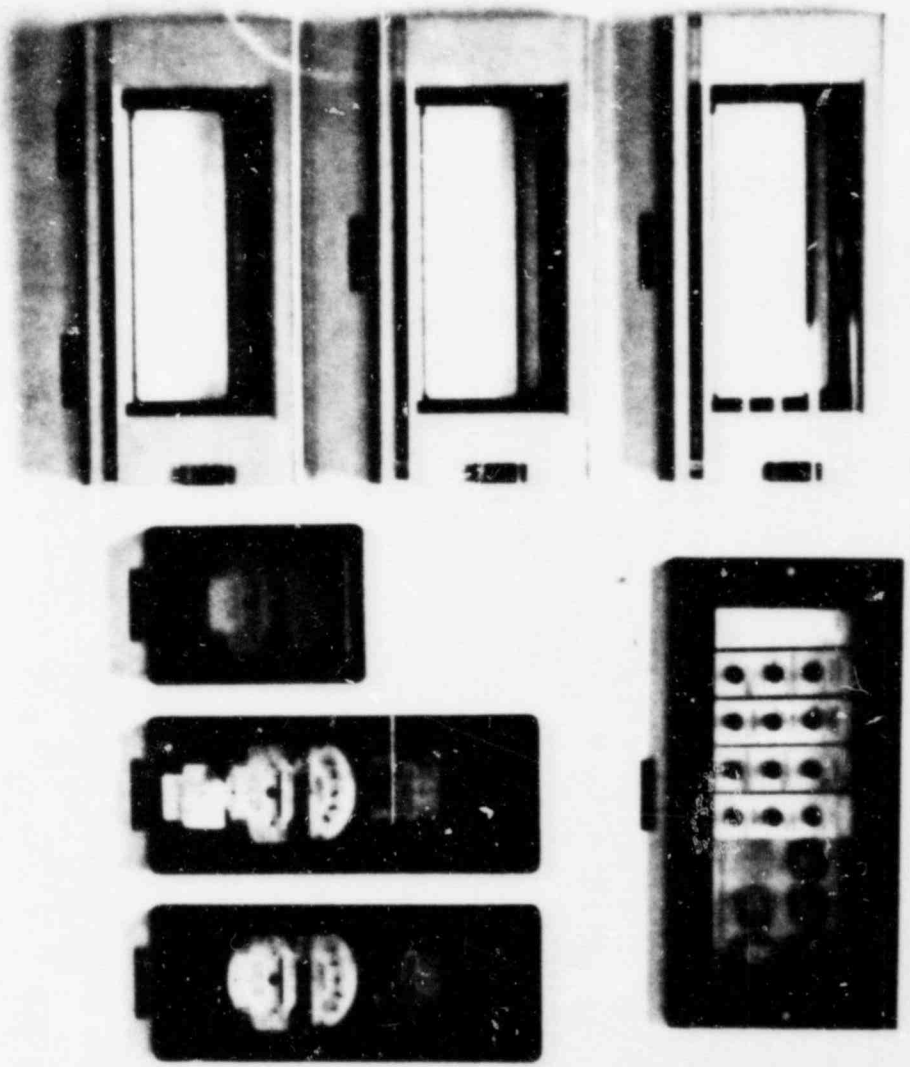


FIGURE 2.7-2

CP-17 ELECTRICAL MONITORING

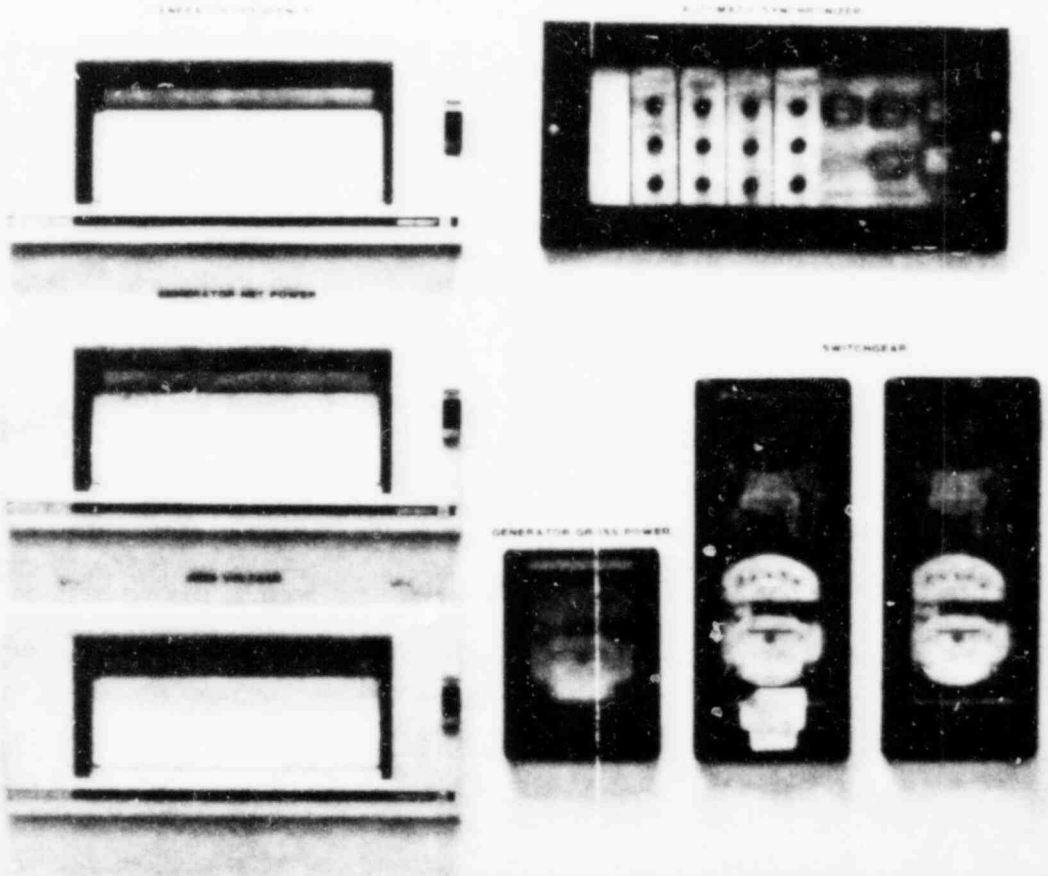


FIGURE 2.7-3

2.8 ESFAS TEST AND COOLING TOWERS AND CONTAINMENT HYDROGEN MONITOR AND RECOMBINER CONTROL PANEL (CP-33)

2.8 ESFAS TEST AND COOLING TOWERS AND CONTAINMENT HYDROGEN MONITOR AND RECOMBINER CONTROL PANEL (CP-33)

The top-center section of the CP-33 is occupied by the annunciator cabinet B, including alarms related to HVAC systems, various sumps, the Hydrogen Analyzer, the CCW/Auxiliary CCW loops and their cooling towers. Left and right of the annunciator cabinet are located clusters of indicators corresponding respectively to the loops A and B of the CCW (temp) auxiliary CCW (flow), wet tower basin (temp) and Hydrogen Recombiner (temp and power). Below these indicators are located the Hydrogen Analyzer recorders for the corresponding A and B systems, together with their sample selectors. Further down on the lateral sections of CP-33 are located the selector switches for the corresponding Hydrogen Analyzer and Recombiner Systems.

On the central section of CP-33, below the annunciator cabinet B, are mounted the ESFAS Test Modules A and B and ESFAS Reset Pushbuttons. Below these modules are located two clusters (A and B) of selector switches for the control of cooling tower fans, valves, and Auxiliary CCW Pumps.

Two control stations, for the auxiliary CCW A and B temperature control valves, are also mounted on CP-33.

The enhancements for CP-33 are shown on Figure 2.8-1. Before and after enhancement photographs are provided as Figures 2.8-2 and 3, respectively.

Eleven findings or Human Engineering discrepancies were reported against CP-33. These findings and their dispositions are discussed below:

B-1, Finding 5, Priority 1

"To reset reactor safety injection, the operator must go to a back panel in the Control Room for the master reset and down to the next elevation below the Control Room for the slave reset."

Response

A duplicate of the slave reset will be provided on CP-33 in the Control Room prior to fuel load. | 1

B-3, Finding 19, Priority 2

"The annunciator controls for annunciator panel B on CP-33 are located on CP-13."

Response

The annunciator control pushbuttons for CP-33 and CP-13 are located on CP-13. Since these panels are adjacent no significant operational problems or confusion is anticipated. The operators will be trained to absorb the | 1

annunciated message before acknowledging from the pushbutton station. There is no need for the operator to be in front of the pushbutton station while reading the annunciator. Moving the pushbutton station to the right side of CP-13 was considered, however internal wiring and structural supports precluded this move. 1

B-4, Finding 2, Priority 1

"Dry Cooling Tower Fans - Micro-switches

1. In order to turn the 4-position micro-switch from AUTO to OFF, it must be switched through the MANUAL FAST and through the MANUAL SLOW positions.

2. It was reported that the CWD's indicated push to activate 4-position micro-switches. If this is true, the hardware in the Control Room differs from that indicated by the CWD's.

3. These same 30 DRY COOLING TOWER FAN micro-switch controls are repeated on LCP-43, the Emergency Shutdown Panel. On LCP-43 the controls are 3-position (there is no AUTO mode) PUSH TO ACTIVATE. The controls should be identical at the two locations."

NRC Review Team Comment: Items 2 and 3 are not discrepancies.

Response

The problem indicated by paragraph 1 has been corrected per DCN-IC-885. Now the switch can go directly from auto to off.

B-4, Finding 21, Priority 3

"On CP-33 when the Containment Hydrogen Detection lower rocker switch is pushed to the ON position, the lower rocker is flush with the panel surface, making it difficult to depress the switch to the OFF position."

Response

LP&L has reviewed this HED; after having the rocker switch operated repeatedly to ON and OFF positions by various operators, no problem with this operation could be found.

B-5, Finding 2, Priority 3

"Of the 15 dry cooling tower fans on the A side and 15 on the B side, 9 of the A and 9 of the B fans are missile shielded and 6A and 6B are not. Operators indicated this would be useful information and it is not presently indicated on the control panel."

Response

This item has been corrected as part of the surface enhancement effort.

B-5, Finding 45, Priority 1

"Hydrogen Analyzer

1. The scale is from 0-100 with numerals in units of 10. The area of interest when monitoring hydrogen concentration is from 0-30%.

2. Hazardous levels (caution and danger) should be coded on scale (below 30%). Physical breadth on recorder paper is very narrow for quickly discerning trend and/or actual concentration level. Available width is wasted."

Response

This scale will be corrected by Hot Functional Testing to show 0-10% (vol) which is what the analyzer actually measures. This range is required by TMI task Task II.F.1. The lower flammability limit of hydrogen in a steam-air atmosphere is approximately 4% (vol). Hazardous levels need not be coded since an alarm is provided on CP-33 when concentrations approach 3% (vol). The correct scale will make the concentration trend more obvious. (FCR-IC-E-187). 1 1

B-6, Finding 46, Priority 1

"There is incomplete use of demarcation in the Control Room and remote shutdown panel; e.g., LCP-43, CP-1, CP-2, CP-18, CP-33."

Response

Surface enhancement effort will correct this deficiency on the main boards by Hot Functional Testing. LCP-43 will be enhanced prior to Licensing. 1

B-8, Finding 5, Priority 3

Pushbutton CP-33

"The vibration reset pushbutton for the cooling tower fans is presently located on CP-13. There are no other cooling tower related controls or displays nearby. It should be placed near cooling tower fan controls on CP-33."

Response

The vibration reset pushbutton is for all large motors, not just cooling tower fans. Therefore, the proper corrective action shall be to relocate the annunciator from CP-33 to CP-13 (DCN-IC-987) and labels will be corrected by Hot Functional Testing. 1

B-8, Finding 10, Priority 1

Dry Cooling Tower Fans - Labels

The dry cooling tower fan number sequence on CP-33 in the Control Room does not correspond with that on the CWD's. This discrepancy was reported by operators and was verified by looking at the cable wiring schemes.

Response

DCN-IC-885 has been issued to correct this problem. Refer to Figure 2.8-1.

B-8, Finding 32, Priority 3

On CP-33 partial mirror imaging exists, e.g., H_2 Analyzers and H_2 Recombiners.

Response

Two redundant Hydrogen Analyzers and Recombiners are located one at extreme left and one at extreme right of the control panel for channel separation purposes. No mirror imaging exists in this case.

B-9, Finding 1, Priority 1

Wet Cooling Towers - Meters

Controls for wet cooling tower equalizing valves A and B are located on CP-33. The two meters displaying water level in the Wet Cooling Tower Basins A and B are on CP-8, Engineered Safeguards Panel.

NRC Review Team Comment: Panels CP-8 and CP-33 are across the room from each other.

Response

The term "equalizing valves" is a misnomer and project documents will be corrected by Hot Functional Testing to refer to Valves 3CC-F285A and 286B as "cross-tie valves". It would be an error for the operators to try to maintain the same level in both wet cooling tower basins using the cross-tie. The two wet cooling towers are independent. The cross-tie between the wet tower basins was provided because NRC Reg. Guide 1.27 stipulates that a single mechanistic failure of a man-made structure be postulated in the case of the ultimate heat sink. | 1

In the unlikely event that the cross-tie is ever needed, e.g., as a backup source of makeup water post tornado, there is more than adequate time for the operators to walk from CP-8 to CP-33. Separating the cross-tie function from the basin level indication is a good design; however, this finding will be brought to the attention of the operators by the training program prior to Licensing in order to eliminate any confusion caused by previous reference to "equalizing valves". | 1

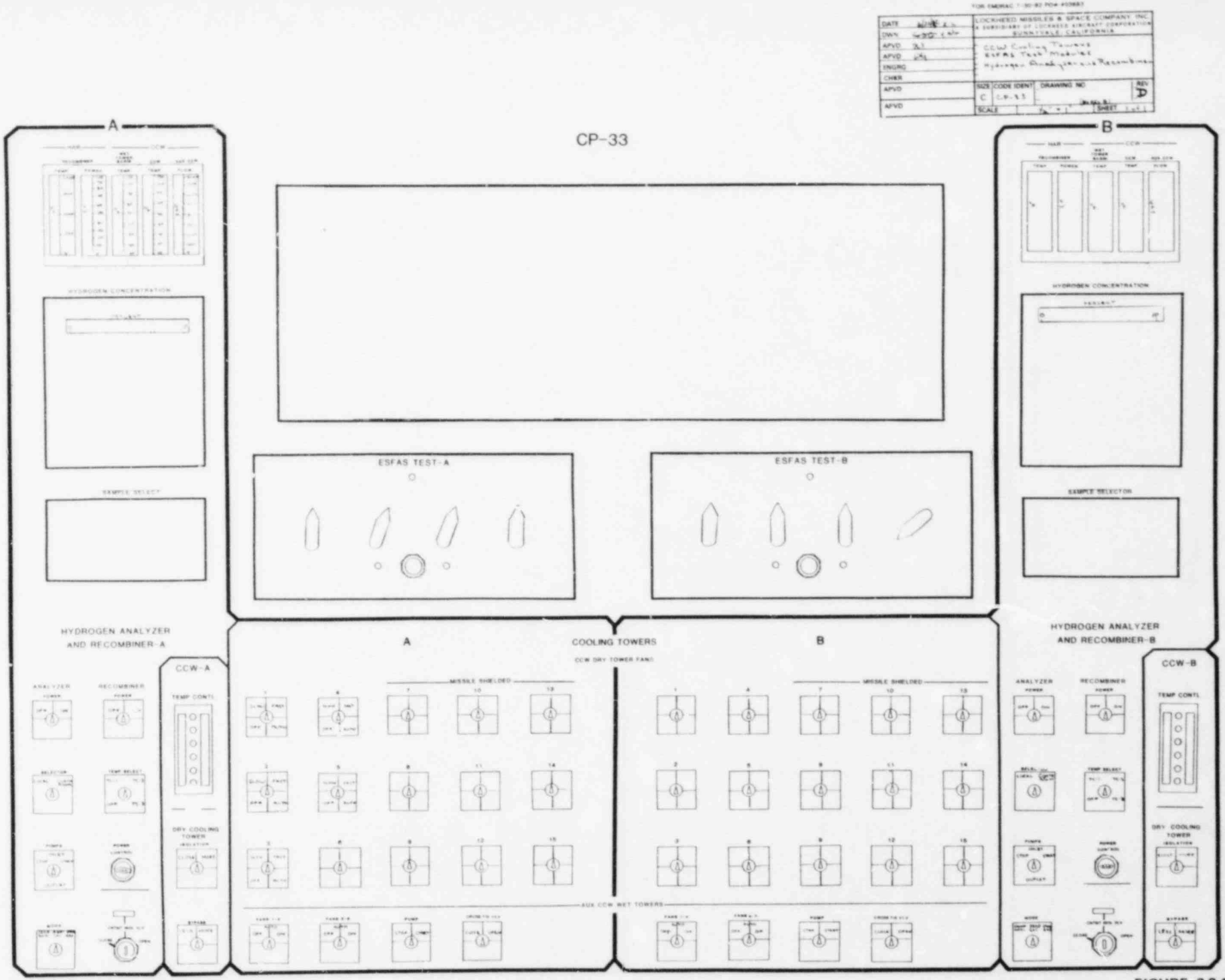

A
B
CP-33
ESFAS TEST-A
ESFAS TEST-B
HYDROGEN CONCENTRATION
SAMPLE SELECT
SAMPLE SELECTOR
HYDROGEN ANALYZER AND RECOMBINER-A
HYDROGEN ANALYZER AND RECOMBINER-B
CCW-A
CCW-B
TEMP CONTL
DRY COOLING TOWER ISOLATION
COOLING TOWERS
CCW DRY TOWER FANS
MISSILE SHIELDED
AUX CCW WET TOWERS
ANALYZER POWER
RECOMBINER POWER
TEMP SELECT
BYPASS

FIGURE 2.8-1

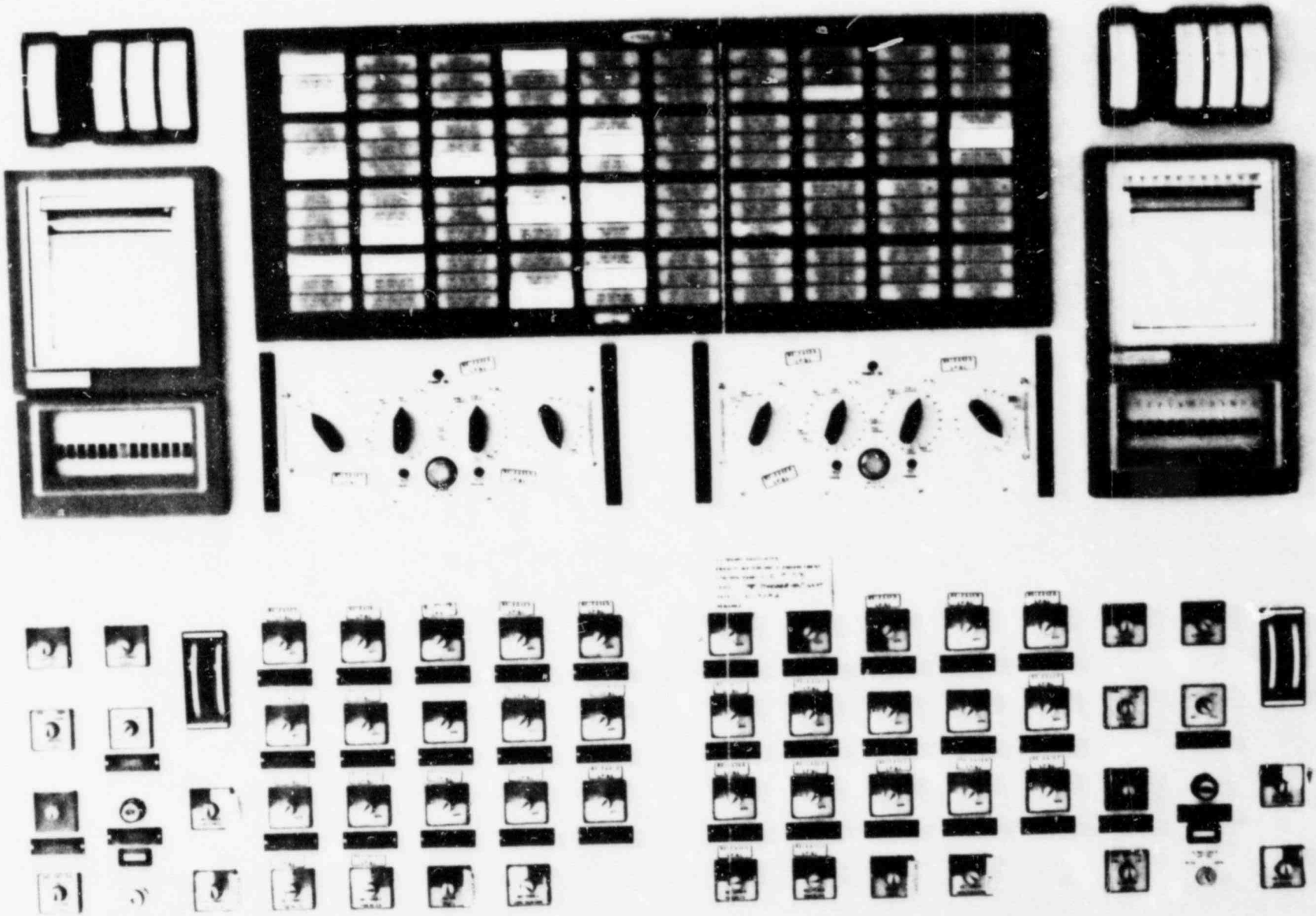


FIGURE 2.8-2

2.9 ENGINEERED SAFEGUARDS PANEL (CP-8)

2.9 ENGINEERED SAFEGUARDS PANEL (CP-8)

CP-8 includes indicators, recorders, control switches and control stations for a variety of systems and subsystems, most of which are part of, or related to the Engineered Safety Features Actuation Systems (ESFAS).

CP-8 includes also a pair of Reactor and ESFAS Trip pushbuttons and a set of annunciator control pushbuttons.

The top row of indicators provides the key parameters for the two Safety Injection System loops, the levels of the condensate storage pool, refueling water storage pool, wet cooling tower basin, the level of the steam generators and the pressure at the discharge of the Emergency Feedwater Pump.

The middle section of the second and third rows of indicators includes four measurement channels (SMA, SMB, SMC, SMD) for the pressure and level of the steam generators, together with two recorders for the same parameters.

Indicators for the CCW system status (loops A and B) are located left and right of the steam generator instrument clusters and the shutdown cooling loops A and B. Below these indicators, on the lateral zones of the vertical section, are located the following:

- Control switches for the Main Steam and Main Feedwater isolation valves test.
- Light indicators for the personnel airlock interior and exterior doors status.
- Indicators for the key parameters of the Containment Spray System.
- Recorders for the key parameters of the containment and the Shutdown Heat Exchangers.

The central zone of the vertical section of the CP-8 includes two clusters (channels A and B) of pushbuttons and switches for the manual initiation of the Engineered Safety Features. At their right are located the Reactor Trip pushbuttons (channels B and C).

The central zone of the inclined section includes indicators for key parameters of the turbine-driven EFW pump AB, light indicators for the EFW pump turbine governor and stop valves position, light indicators for the bus AB status (fed from bus A or from bus B), selector switches for the HPSI pumps A or B selection and for the CCW pumps A or B selection, control switches for the EFW pump turbine stop valves, for the HPSI pump AB and for the CCW pump AB.

Left and right of this "AB" zone, the inclined section of CP-8 includes the "A" and "B" clusters of control switches and control switches related to the main steam and main feedwater isolation, containment isolation, containment spray, emergency feedwater loops, RCS vent valves, atmospheric steam dump, steam generator blowdown, etc.

The central zone of the bench section includes the LPSI flow control stations, the control switches and indicating lights. The Annunciator control pushbuttons are located in the same central zone.

Left and right of the central zone, the bench section of CP-8 includes control switches, light indicators and analog position indicators for the valves of the following loops:

- Low Pressure Safety Injection
- High Pressure Safety Injection
- Safety Injection Tanks nitrogen filling, venting and isolation
- Containment Isolation
- Sampling

The enhancements for CP-8 are shown on Figure 2.9-1. Sixteen findings or Human Engineering discrepencies were reported against CP-8. These findings and their dispositions are discussed below.

B-3, Finding 7, Priority 1

"The SI tank (meter) displays on the left side of CP-8 (under annunciator panel M) have their corresponding annunciator on panel N - located on the right side of panel. The SI meters on the right have their annunciator on the left."

Response

The subject alarms and associated indicators on CP-8 will be rearranged prior to Hot Functional Testing. (DCN-IC-1010) |1

B-4, Finding 4, Priority 1

"Reactor trip pushbuttons on CP-2 and CP-8 do not have protective housing as described in NUREG-0700, page 6.4-4, Exhibit 6.4-1. Turbine trip pushbuttons on CP-1 do have these housings."

Response

Guards will be provided on reactor trip pushbuttons (DCN-IC-1009). The identical type pushbuttons presently used for turbine trip including the protective housing will be provided by Hot Functional Testing. |1

B-5, Finding 3, Priority 1

"Safety Injection Tank Display

The two meters appear to be measuring the same parameters. Why the duplicate instrumentation? If the globe valve(s) stuck, what assurance would the operator have that both instruments would remain accurate?"

Response

Refer to B-5, Finding 7 below.

B-5, Finding 4, Priority 1

"Safety Injection Tank Pressure

Duplicate instrument (C-52 measurement of C-53). Both transducers operate from the same side of the globe valve, adding no additional reliability to the reading/comparison. Determine why two meters display the same parameter. Determine if the meters are redundant."

NRC Review Team Comment: Also see B-5.3, B-5.5

Response

Refer to B-5, Finding 7 below.

B-5, Finding 5, Priority 1

"Safety Injection Tank Pressure

Meters seem to be duplicate. See HED Number 12. The two meters appear to be measuring the same parameters. Why the duplicate instrumentation? If the globe valve(s) stuck, what assurance would the operator have that both instruments would remain accurate?"

NRC Review Team Comment: Also see B-5.3, B-5.4.

Response

Refer to B-5, Finding 7 below.

B-5, Finding 6, Priority 1

"Safety Injection Tank Pressure

Duplicate instrument C-42 repeats measurement of C-43. Both transducers operate from the same side of the valve. Additional reliability to the reading/comparison is questionable."

NRC Review Team Comment: This and B-5.7 are repeats of B-5.4, B-5.5.

Response

Refer to B-5, Finding 7 below.

B-5, Finding 7, Priority 1

"Safety Injection Tank Pressure

Repeats measurements of C-42. Since both transducers operate from the same side of the valve additional reliability to the reading/comparison is questionable."

NRC Review and Team Comment: This and B-5.6 are repeats of B-5.4 and B-5.5.

Response

The narrow range of Safety Injection Tank's level and pressure is measured and displayed on the main control panel with two independent loops of instrumentation. The two independent loops of instrumentation are provided for each parameter to ensure the means of quick verification of one meter display by comparison with display of another identical and redundant meter.

B-5, Finding 32, Priority 1

"The pressurizer pressure and setpoint dual meter is loosely mounted on CP-7. This condition could allow vibration of the meter which in turn could cause erroneous readings." | 1

Response

The pressurizer pressure and setpoint dual meter is secured. All meters in the Main Control Room have been verified for proper installation.

B-8, Finding 2, Priority 2

"Current (Steam Generator and CCW Controls) arrangement can be improved upon to afford a better grouping of related controls."

Response

Refer to B-8, Finding 4 below.

B-8, Finding 4, Priority 2

"Current (Steam Generator and CCW Controls) arrangement can be improved upon to present a more accurate relationship between controls."

Response

Steam generators and CCW system controls will be rearranged by Hot Functional Testing for better grouping per DCN-IC-1010. | 1

B-8, Finding 19, Priority 1

"Identical side-by-side vertical meters that provide exactly the same information from redundant sensors located at the same spot are found at several places in the Control Room (e.g., CP-8). The rationale for the arrangement is that it provides a check on the sensor(s)/wiring/meter(s) involved. These duplicated meters are buried in the middle of a longer bank of similar meters and are not readily distinguishable from other meters in the string. That arrangement makes fast, accurate performance of the desired comparison difficult."

Response

The indicators displaying redundant parameters will be located side by side on CP-8 by Hot Functional Testing to provide means of a quick check on accuracy and performance of redundant instrumentation loops by visual comparison of their displays. Enhancement efforts will help operator to compare data fast and accurately. | 1

B-8, Finding 20, Priority 1

"On CP-8 enhancement techniques, such as spacing, demarcation, and color shading, are not used for setting apart groups of controls and displays."

Response

The association between controls and displays, as well as, functional groupings, wherever found to be unsatisfactory, have been corrected by DCNs. Demarcation and enhancement techniques such as hierarchical labeling will also be provided by Hot Functional Testing. | 1

B-8, Finding 23, Priority 2

On CP-8 displays which are observed in a specified sequence are not grouped together. Example:

SI TANK PRESS
SI TANK LEVEL

Response

Displays on CP-8 will be relocated by Hot Functional Testing per DCN-IC-1010 | 1

B-8, Finding 26, Priority, 2

"EFW Pump Turbine - AB Stop Valve

Switch is not located within the appropriate group of controls. A functionally more appropriate location should be found giving the criticality of the control."

Response

The EFW Pump Turbine Stop Valve is not used for control of the turbine. The valve is used to provide overspeed protection to the turbine and is appropriately located on CP-8 within the safety channel AB area. Improved hierarchical labeling by Hot Functional Testing will facilitate the location of the switch by operator. | 1

B-8, Finding 35, Priority 1

"On CP-1 and CP-8 there are groups of 10 meters in a row, instead of the recommended maximum of five in a row."

Response

There is one group of 10 meters in a row on panel CP-1. All meters in that group are monitoring main turbine parameters. There are two groups of 10 meters in a row on panel CP-8. All meters in one group are monitoring parameters of the Safety Injection System in Safety Channel A, the other group for Safety Channel B. In addition, lines of demarcation will clarify the association of the meters by Hot Functional Testing. | 1

B-9, Finding 8, Priority 2

"On CP-8, multiple controls and displays related to the same function are not grouped together, (e.g., SI TANK VENT VA)."

Response

Controls and displays are being rearranged on CP-8 per DCN-IC-1010 and enhancements will further improve the control display relationship by Hot Functional Testing. | 1

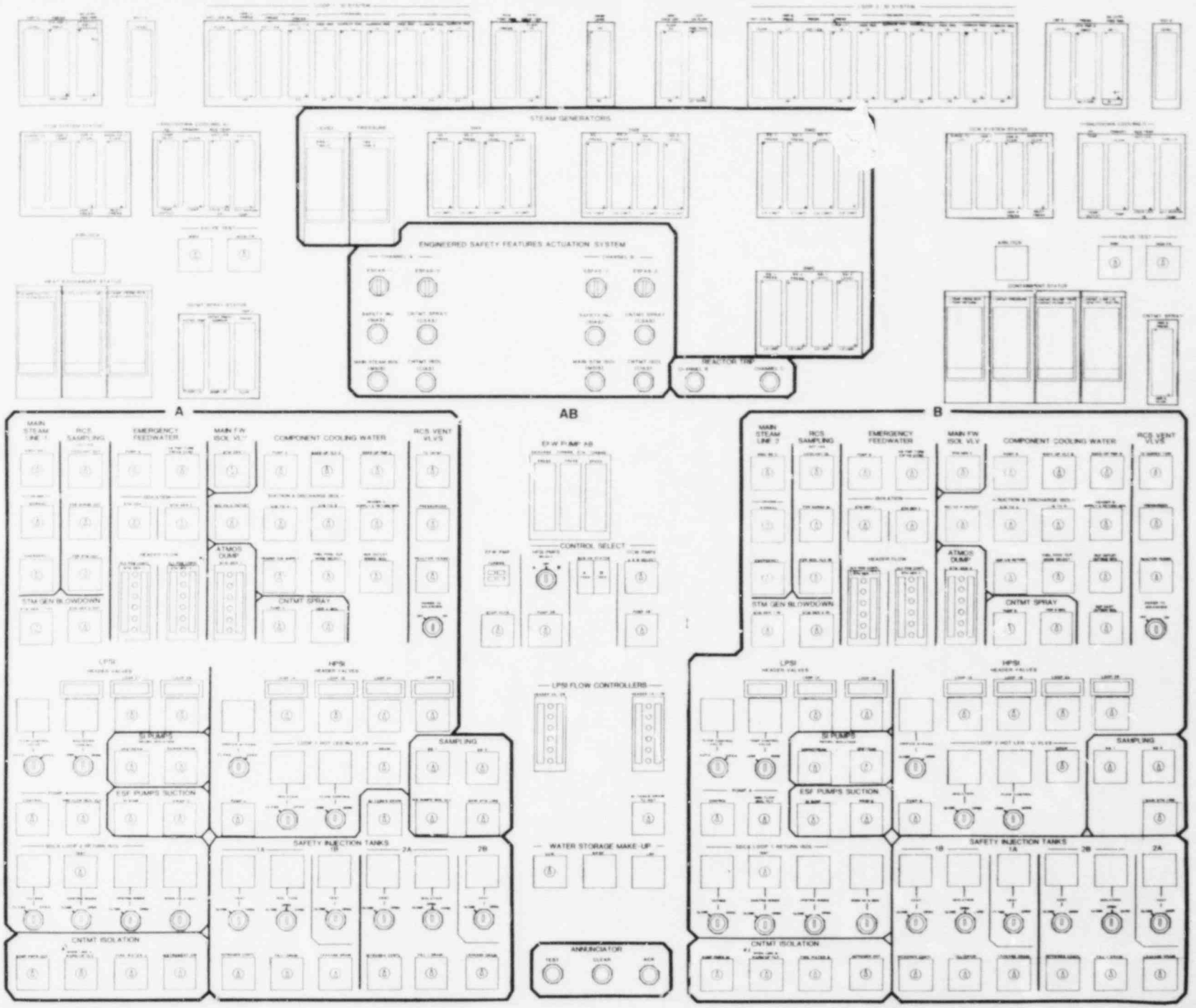

STEAM GENERATORS
ENGINEERED SAFETY FEATURES ACTUATION SYSTEM
REACTOR TRIP
A
AB
B
MAIN STEAM LINE 7
RCS SAMPLING
EMERGENCY FEEDWATER
MAIN FW ISOL VLV
COMPONENT COOLING WATER
RCS VENT VLVS
ATMOS DUMP
STM GEN BLOWDOWN
CNTMT SPRAY
EFW PUMP AB
CONTROL SELECT
LPSI
HPSI
HEADER VALVES
RCP PUMPS
ESF PUMPS SUCTION
SAMPLING
LPSI FLOW CONTROLLERS
SAFETY INJECTION TANKS
1A
1B
2A
2B
WATER STORAGE MAKE-UP
CNTMT ISOLATION
ANNUNCIATOR
TEST
CLEAR
ACK

FIGURE 2.9-1

2.10 HVAC PANEL (CP-18)

2.10 HVAC PANEL (CP-18)

The top two rows of instruments on the vertical section of CP-18 include indicators of the key parameters for the following equipment, equipment rooms and CCW loops:

- Water chillers A (left), AB (center) and B (right)
- Emergency Diesel Generator A Room (left) and B Room (right)
- Control Room Emergency Filter A (left) and B (right)
- Containment Fan Coolers CCW loops, trains A and C (left) trains B and D (right)
- CEDM Cooling (center)
- Containment: Ambient/Containment DP and Ambient/Annulus DP (center)

Below the indicators, a row of recorders are monitoring the key parameters of the following:

- Containment Fan Coolers, trains A and C (left), trains B and D (right)
- Emergency Ventilation Filters, train A (left) and train B (right)
- Reactor cavity: Area 1 and areas 2 temperatures (center)

Two trend recorders with two pens each are driven by the plant computer, and are capable of recording any key parameter selected by the operator. These recorders are also located in the center zone of the panel.

At the bottom of the vertical section of CP-18 are located clusters of indicating lights monitoring the status of the containment fan cooler component cooling water isolation valves, the RAB safety room coolers, control room kitchen exhaust, etc.

The inclined section of CP-18 includes indicating lights, control switches and control stations for the control room emergency ventilation, the Shield Building Ventilation, the Fuel Handling Building Ventilation and the RAB exhaust fans, grouped by train A (left side of the panel) and train B (right side of the panel). At the center area of the inclined section are grouped light indicators and control switches for the Control Room Envelope Ventilation, and the Chilled Water pump; a key-operated selector for the chiller channel, light indicators for the AB bus status and status indicators for the Equipment Room Coolers.

The bench section of CP-18 includes mostly control switches and only a few separate light indicators, for the following HVAC loops:

- Containment cooling, containment atmosphere release, containment vacuum relief and containment purge.
- EDG rooms ventilation, battery room ventilation, SWGR room ventilation and RAB - HVAC equipment room ventilation
- Controlled Ventilation Areas System (CVAS)
- Chilled Water Loops A and B

The central area of the bench section is occupied by control switches for the following HVAC loops:

- FHB normal ventilation
- RAB Ventilation and Cable Vault area Ventilation
- Annulus Negative Pressure
- Reactor Cavity Cooling
- Containment Airborne Radiation Removal

A Containment Purge Selector switch is located at the bottom of this central area.

Pushbutton sets for the control of the Safety Annunciator cabinets A and B are also located on the bench areas corresponding to the two safety trains.

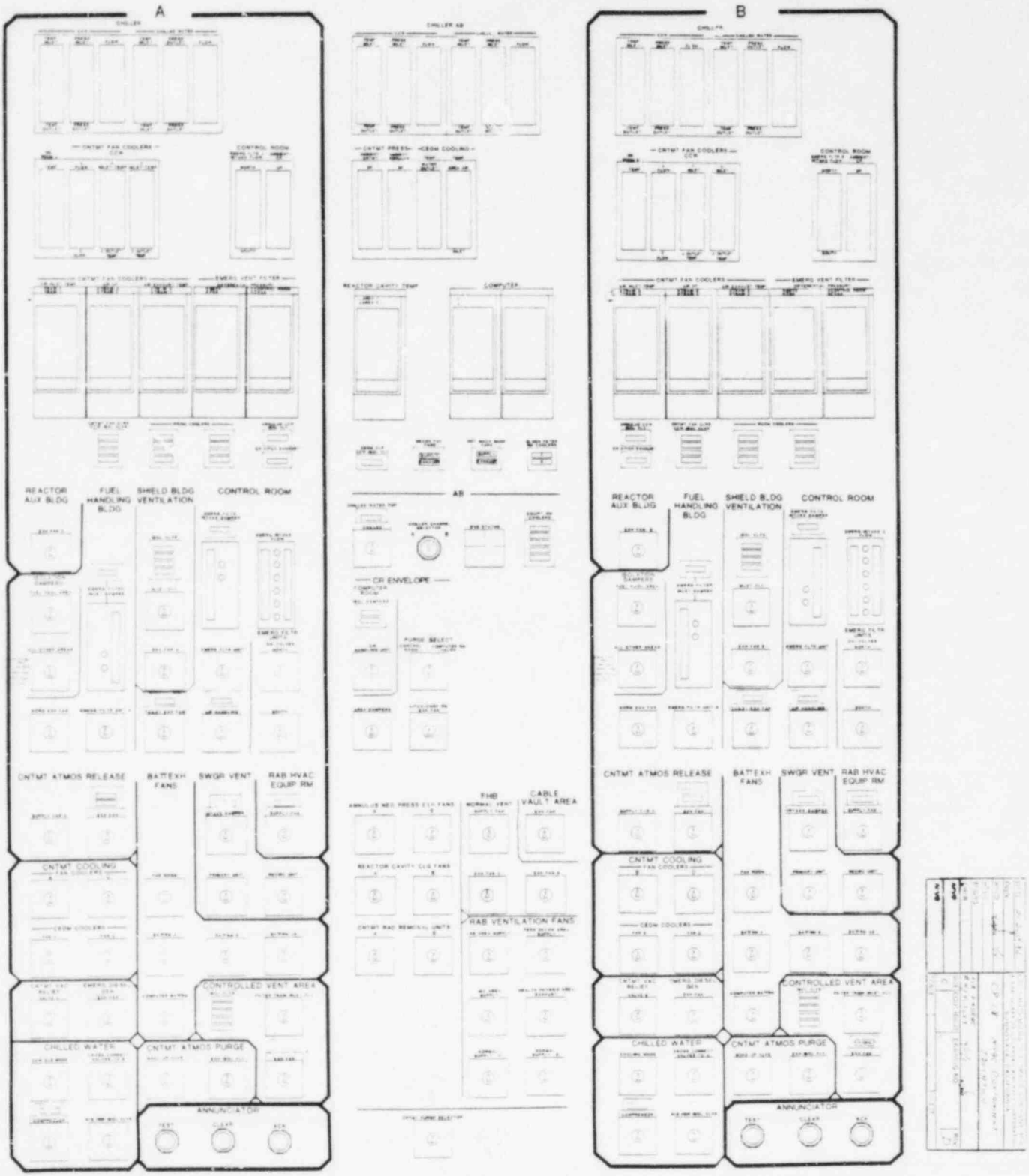
The enhancements for CP-18 are shown in Figure 2.10-1.

Findings

There were no specific findings against CP-18, however, many of the generic findings (Section 2.15) are applicable to CP-18 and have been addressed as described in Section 2.15.

FIGURE 2.10-1

CP-18 HVAC CONTAINMENT
ISOLATION



2.11 THE CONTROL ROOM ANNUNCIATOR SYSTEMS

2.11 THE CONTROL ROOM ANNUNCIATOR SYSTEMS

The Control Room is provided with two distinct Annunciator Systems:

1. The safety-related annunciator system composed of two cabinets (SA and SB) is seismic Category I, Class IE; located at the top of CP-18.

2. The non-safety annunciator system composed of 12 cabinets (A through N) is located as shown on Figure 2.11-1.

Annunciator cabinets SA and SB are identical, each one having a capacity of 5 columns x 9 rows = 45 alarm windows. Both cabinets are of integral design and include their own separate power supplies, logic circuits and their own horns. The bench section of CP-18 includes two distinct and separate sets of pushbuttons ("Test", "Clear" and "Acknowledge") for the independent control of the two annunciator cabinets.

Two white lights connected in parallel are used for each window. The "Test" operation simulates an alarm condition, with all windows fast flashing in synchronism. Release of the "Test" pushbutton simulates return to normal condition, with all windows which are not in alarm mode slow-flashing in synchronism. Operating the "Clear" pushbutton brings to Normal all windows which are not in alarm mode anymore. The points that are in alarm mode are not affected by test. The horn actuation is included in the test sequence.

Annunciator cabinets A through N are identical among themselves, with a single exception: Cabinet E is separated in two halves, located respectively on top of cabinets D and F, on CP-1.

In contrast with cabinets SA and SB, these non-safety cabinets are not of integral design; they are plain "lamp boxes" driven by separate logic circuits and power supplies located in CP-19. As initially designed, these cabinets were provided with two distinct "horn zones"; however, a design change to four zones is being planned as follows:

- Cabinets A & B will operate in conjunction with a horn located in CP-13.
- Cabinets C through F will operate in conjunction with a horn located in CP-1.
- Cabinets G through H will operate in conjunction with a horn located in CP-2.
- Cabinets L through N will operate in conjunction with a horn located in CP-8.

Panels CP-13, CP-1, CP-2 and CP-8 each includes a set of pushbuttons ("Test", "Clear" and "Acknowledge") for the independent control of the above four "control zones":

The operating sequence of the alarm cycle of cabinets A through N is identical with the sequence of cabinets SA and SB. Also identical is the construction of the light windows (with two white lights connected in parallel) and the operation of the annunciator control pushbuttons.

Figure 2.11-2 is a typical annunciator display cabinet.

While the horns of the SA, SB cabinets are of the electronic (static) type, with adjustable tone and warbling, the horns for the cabinets A through N are electromechanical, quite different in tone from the static ones.

Nineteen findings or Human Engineering discrepancies were reported against the Control Room Annunciator System. These findings and their disposition are discussed below. Fire Panel alarms findings are discussed in Section 2.12.

B-3, Finding 2, Priority 3

"Many auxiliary system annunciators require Control Room operator to direct auxiliary operator to given plant location to obtain specific information."

Response

The auxiliary systems annunciators are located on auxiliary systems control panels that are located in the vicinity of the equipment that they are associated with and do not require continuous supervision by operators. The alarms generated on local annunciator units are reproduced as a general alarm for that unit in the Main Control Room so that the Control Room operator is aware of the local conditions in the plant. Bringing all detail alarms in the Control Room would clutter the Control Room annunciators in an unacceptable measure, without providing much help to the operator. Most of the local alarms (provided by the auxiliary systems annunciators) are available to the operator, whenever required, through the computer displays.

B-3, Finding 3, Priority 2

"A separate first out panel is not provided for the Reactor System."

Response

LP&L feels that a first out panel is not required in this case. The Reactor System provides equivalent inputs to the Plant Computer for monitoring the sequence of events (SOE program). Hence, the first out trip input is available to the operators through the computer terminals.

B-3, Finding 4, Priority 2

"A separate first out panel is not provided for the turbine/generator system."

Response

The turbine trip alarms are provided with first out circuitry that allows only the first alarm signal to go through and be displayed on the plant annunciator display panel.

B-3, Finding 5, Priority 2

Alarms that have cleared do not initiate an audible signal and activate the alarmed and acknowledged visual tile in some way to provide positive confirmation.

Response

Alarms that have cleared after being acknowledged by the operator change the state of annunciator window from a steady light to a slow flash light. Alarms that return to normal before being acknowledged, change the state of the annunciator window from fast flash to slow flash at the moment they are acknowledged by the operator. The annunciator window will remain in the state of slow flash until the operator clears it by depressing the "clear" pushbutton of the annunciator system.

This arrangement has the advantage of requiring the operator to acknowledge an alarm even if it has returned to normal before he had a chance to acknowledge it. At the same time, it does not inconvenience the operator with additional audible signals when urgent action is not required.

B-3, Finding 6, Priority 1

"The auditory signals are not reliably discernible above average ambient noise. (10db(A) differential above ambient recommended.)"

Response

The annunciator horns are provided with adjustable tone and warble. The horns will be adjusted so that they are readily discernible above average ambient noise. The average ambient noise level can only be determined when normal Control Room activities begin however, an adjustment will be made prior to Licensing and followup adjustments will be made if necessary. | 1

B-3, Finding 7, Priority 1

"The SI tank (meter) displays on the left side of CP-8 (under annunciator panel M) have their corresponding annunciator on panel N - located on the right side of the panel. The SI meters on the right have their annunciator on the left."

Response

The subject alarms and associated indicators on CP-8 is being rearranged. (DCN-IC-1010) | 1

B-3, Finding 8, Priority 3

"The Diesel Fire Pump Annunciators on CP-4 CVCS panel appear to be poorly located."

Response

While there are no associated fire pump controls on the main panels, it was desirable to place the Diesel Fire Pump Annunciator on a centrally located panel.

B-3, Finding 9, Priority 3

"The annunciators for Reactor Cooling Pump Seal Water and Component Cooling Water appear to be inappropriately located on the CP-18 HVAC and Containment Isolation Panel."

Response

The annunciator panels on CP-18 are Class IE. Loss of Reactor Coolant Pump Seal Water should be responded to promptly. Therefore it is required to locate these alarms on the CP-18 annunciator panels. The seal water is also monitored on each Reactor Coolant Pump individually with alarm windows on CP-2 which is the same control panel where the control switches and indicators to the pumps are located. 1

B-3, Finding 10, Priority 3[1]

"Each annunciator panel is identified by a temporary label placed below the panel."

Response

The control board enhancement program will resolve this HED by providing permanent labels by Hot Functional Testing. 1

B-3, Finding 11, Priority 1

"Alarm windows are snap-on onto the frames. These slip out easily and more than one may come out inadvertently when removing one, or when door is handled to replace lamps. Error may occur when replacing windows - in wrong position."

Response

The annunciator panels are being reviewed for loose tiles. Loose tiles will be secured, and the annunciator administrative procedure will call for a review and correction of loose tiles. 1

B-3, Finding 12, Priority 1

"The operator aids/tools necessary for lamp replacement are not provided."

Response

All necessary aids/tools will be provided prior to fuel load.

B-3, Finding 13, Priority 3[1]

"No distinctive coding and administrative procedures are currently in place for annunciator tiles tnat must be "ON" for an extended period during normal operations."

Response

LP&L's annunciator system is designed for all lights off ("Black Board") in normal power operation conditions. The administrative procedures will require marking of those tiles which remain "ON" for an extended period due to maintenance, mode of operation or other specific abnormal situations that render the annunciator message moot. Self-sticking "markers" can be used to identity these annunciator windows. This practice will begin during Hot Functional Testing. 1

B-3, Finding 14, Priority 1

1. "Annunciator panels are not labeled for cross-reference to Alarm Procedures and I&C use".

2. "Windows are not coded for cross-reference to Alarm Procedures and I&C use."

3. "Existing window codes on drawing/diagrams are Numeric-Numeric (X,Y) in a row-column scheme. If operator (or I&C Tech) identifies window by Column-row (i.e., Y,X) he will locate incorrect Alarm Procedure or I&C document/wiring. The X,Y convention fits human stereotypes."

Response

Current method of window identification follows the method of word identification on a printed page (identification of line followed by identification of word position in that line). In order to achieve a viable cross-reference to alarm procedure and for I&C use, additional labeling will be provided where required. LP&L will add alpha-numeric annunciator labels prior to fuel load. Refer to Figure 2.11-2.

B-3, Finding 15, Priority 3

"Cues for prompt recognition of annunciators that are out-of-service are not presently available."

Response

LP&L will handle this by periodic testing and administrative procedures.

Self-sticking "markers" can be used on the corresponding windows. This practice will be tried out during Hot Functional Testing. 1

B-3, Finding 16, Priority 1

"The Annunciators audible alarm systems do not provide sufficient localization cues to direct the operator to the appropriate alarm source (e.g., CP-1, CP-2, CP-8)."

Response

Two additional horns will be added to the main annunciator system (on panels CP-13 and CP-2, respectively) and the circuits will be modified prior to Licensing to provide four alarm zones, each with its own horn and its own set of control pushbuttons. Refer to Figure 2.11-1. | 1

The fire system has its own horn and controls, as do the two safety-related annunciators located on CP-18.

B-3, Finding 21, Priority 2

"Alarmed annunciators automatically silence after 10 seconds without requiring any operator action."

Response

The present automatic silencing design will be changed to continuous audible alarm, silenced only by the actuation of the "acknowledge" pushbutton. However, automatic silencing is an annunciator feature preferred by LP&L in all our fossil-fired units. It has been proven to be preferred by most operators in these units and may well prove in the long run to be a desirable feature for the Waterford-3 annunciators. LP&L will notify the NRC if a change back to automatic silencing will be made. | 1

B-3, Finding 22, Priority 2

"There is no separate silence control in the annunciator control groups."

Response

Silencing is part of the "acknowledge" pushbutton function. Whenever the pushbutton corresponding to a certain "alarm zone" is actuated, it silences the horn of that alarm zone and acknowledges all current alarms in that zone.

B-3, Finding 23, Priority 1

"Repetitive groups of annunciator control pushbuttons do not have a consistent arrangement of pushbuttons at each panel location."

Response

A Design Change Notification (DCN-IC-837) nas beer implemented. All groups of annunciator control pushbuttons are now consistent.

B-8, Finding 12, Priority 3

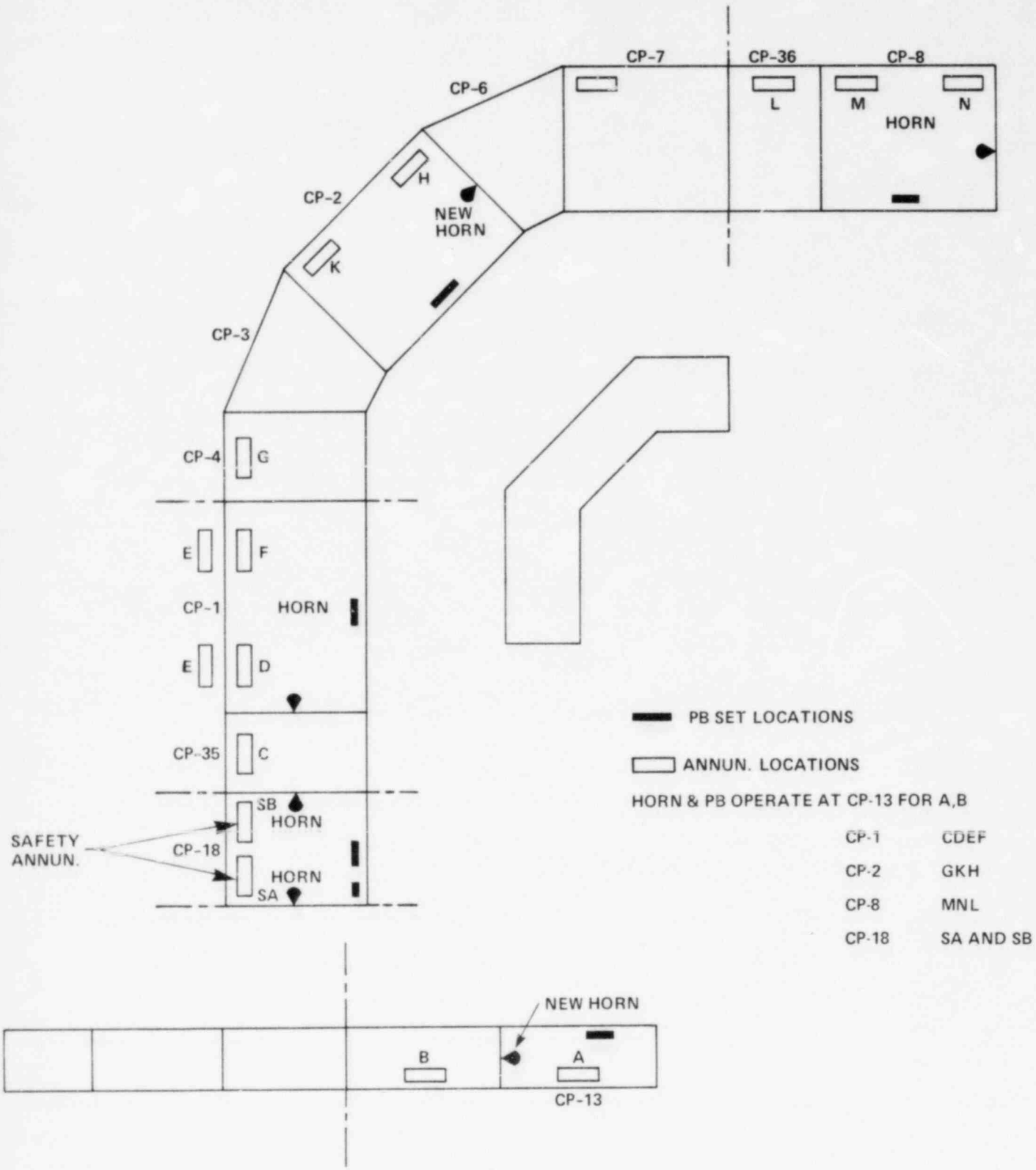
"Some annunciators for CP-18 equipment are on tne CP-33 and CP-35 annunciator panels."

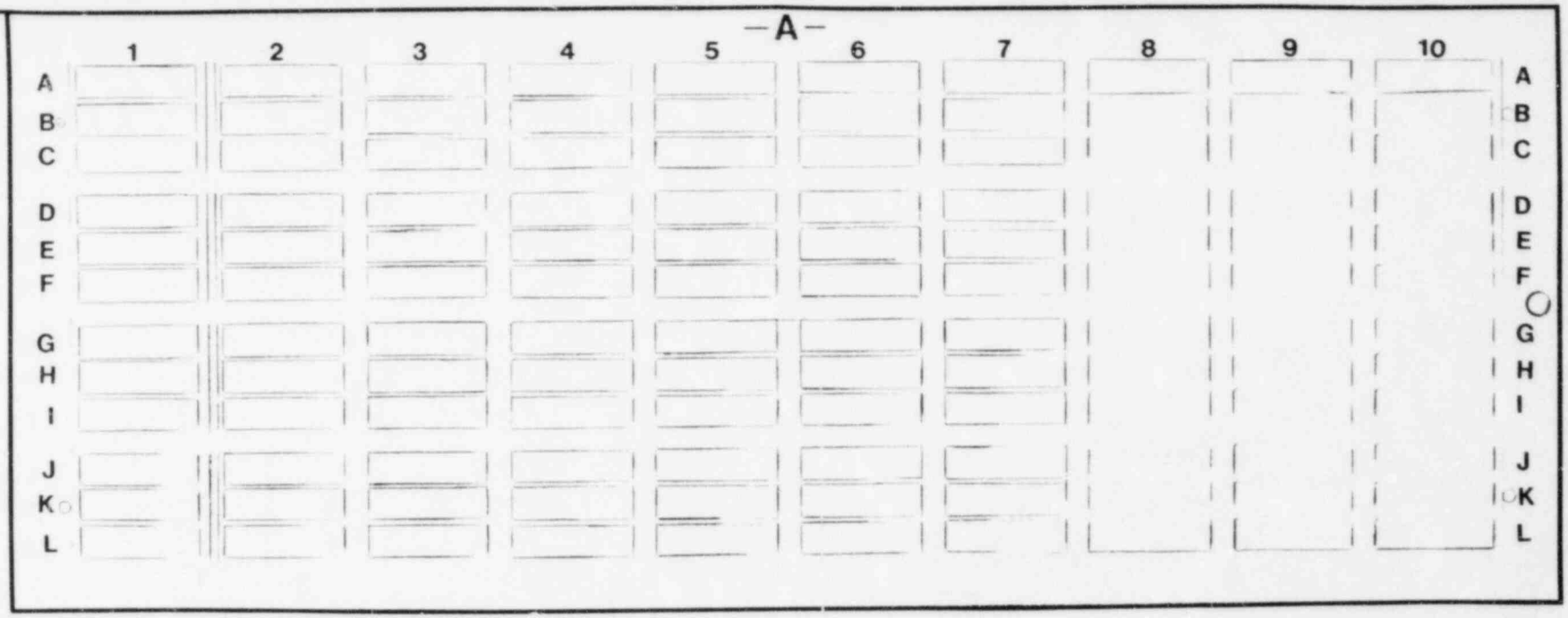
Response

Panel CP-33 is located to the left of panel CP-18 at an angle of 90°; panel CP-35 is adjacent to CP-18 on tne right. The annunciator display cabinets located on CP-33 and CP-35 are close enough to the displays on panel CP-18 for tne operator to perform all required functions.

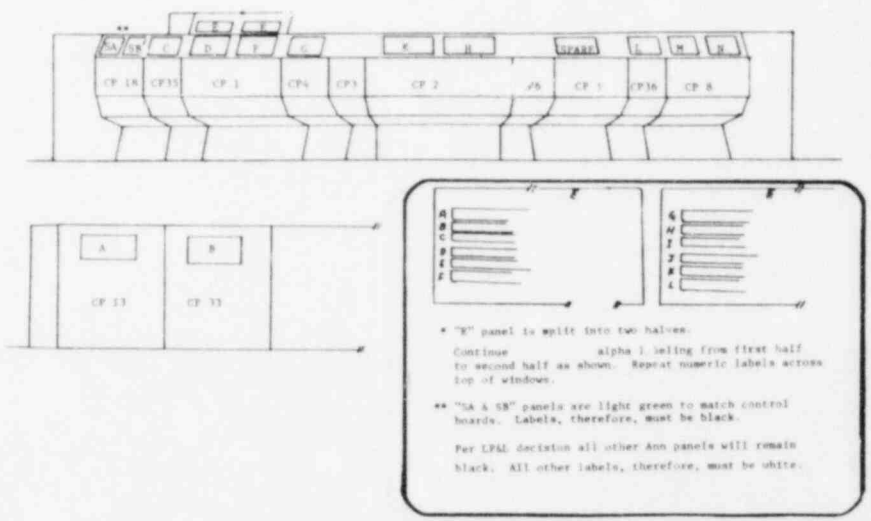
FIGURE 2.11-1

CONTROL ROOM LAYOUT, LOCATING ANNUNCIATORS AND ALARM ZONES





ANNUNCIATOR PANEL (TYPICAL)



	DRAWING No. SK-1		
DATE 8/22/62	LOCKHEED MISSILES & SPACE COMPANY, INC. A SUBSIDIARY OF LOCKHEED AIRCRAFT CORPORATION SUNNYVALE, CALIFORNIA		
DWN			
APVD			
APVD	Annunciator Panel (Typical)		
ENGRG			
CHKR	A Thru N (Rev D per record only)		
APVD	SIZE C	CODE IDENT	PO #403683 for EMDRAC LMSC / REV D
APVD	SCALE		SHEET

FIGURE 2.11-2

2.12 FIRE PROTECTION CONTROL PANEL (MCRP) AND LOCAL FIRE DETECTION CONTROL PANEL

2.12 MASTER REMOTE CONTROL PANEL (MRCP) AND LOCAL FIRE DETECTION CONTROL PANEL

The MRCP in the Control Room provides audible and visual fire alarms and reflash capability for all the zoned detection systems.

The MRCP is electrically supervised for continuity, loss of power, short circuits, ground faults, etc. When a malfunction occurs, audible and visual trouble alarms are activated in the Control Room.

Electrical power supply to the MRCP is furnished from the 125 volt dc system.

The operating status of all fire pumps and controllers, automatic sprinkler and water spray systems, heat and smoke detection system, and chemical extinguishing systems are continuously monitored on the MRCP to make sure that all equipment will be available for immediate response to a fire.

Local Fire Detection Control Panel (FPE-3 and 3A) is one unit located next to the MRCP in the Control Room and provides audible and visual fire indication for detection systems in the Reactor Auxiliary Building, Turbine Building, Reactor Containment Building, Fuel Handling Building and the Dry and Wet Cooling Tower areas.

The fire detection electrical wiring is electrically supervised for continuity, loss of power, etc. When a malfunction occurs, audible and visual trouble alarms are activated.

"Fire" and "Trouble" signals are transmitted to the MRCP and to the computer displays, which are located in the Control Room.

Figures 2.12-1 2.12-2 and 2.12-3 show the proposed enhancements of MRCP and FPE-3, 3A. Ten findings were reported against these panels and were discussed below.

B-3, Finding 1, Priority 3

"There are two indicator lights directly below label indicating remote panel location. One is labeled ALARM and lights red when the remote panel receives signal from a fire detector in that area. The other is labeled TROUBLE and lights amber when a trouble signal is received. The problem is that an audible alarm is sounded when either a fire or trouble signal is received, but the red alarm indicator lights only when a fire signal is received."

Response

There are two audibly distinct alarms in the MRCP. One is a steady tone, the other is a warbling tone. Thus, the operator can distinguish between trouble and fire without looking at the panel. Also the MRCP will be relabeled, and the word ALARM will be changed to FIRE prior to Licensing. 1

B-3, Finding 20, Priority 1

"Operators report that alarms are not flashed and then converted to steady when acknowledged (as are the Main Control Room annunciators alarms). The result is that if a second (or third, etc.) alarm occurs, the operator can easily lose track of which was previously acknowledged, i.e., a "new" alarm is not discriminable from an "old" alarm. This problem has already been realized during testing and maintenance operations with the panel."

Response

Fire panel reflash capability will be provided on the MRCP prior to Licensing. If a fire occurs, then the main fire indication, the individual local panel fire indication, and the individual zone indication, all will flash until acknowledged by the operator. Should a second fire occur the main indicator as well as the individual zone indicator will flash. After acknowledgement the fire zone remains lit in a steady mode until reset. | 1

B-4, Finding 11, Priority 2

"Fire Protection panel pushbutton controls will be operated during relamping. Buttons must be pressed to re-insert after lamp replacement. Pressing causes activation. Halon will be discharged. Panel key switch looks like it disables the panel. It does not. Method of actually disabling Halon is difficult due to backup power."

NRC Review Team Comment: There is no key switch on the panel.

Response

The subject MRCP pushbuttons has been changed. The buttons will no longer be lit; therefore inadvertent actuation during relamping will not be a problem. Separate indicators are also provided.

B-6, Finding 7, Priority 3

"Labels do not provide adequate information to the operator to pinpoint the fire area. This differs from HED 121 (B6, 29) because labels are located on indicator lights in 121 and labels are placed between FIRE and TROUBLE."

NRC Review Team Comment: This also applies to local panels e.g., A 888-M223 in relay room; labels FPM17, FPM18, FPM19.

Response

Refer to B-6, Finding 28 below.

B-6, Finding 29, Priority 3

"Inadequate information displayed on indicator lights. Label reads, for example, RAB 30. This means area 30 in the Reactor Auxiliary Building, but the operator must look at a drawing to locate area 30."

Response

Refer to B-6, Finding 28 below.

B-6, Finding 28, Priority 3

"Labels are misleading. Left hand portion of panel is divided according to location of five local panels.

The label "FPE-1 RAB EL.-4" identifies the location of FPE-1 (local panel) as in the Reactor Auxiliary Building at -4 ft. elevation. This label implies that the detectors are located in the RAB -4 Ft. EL. also, but this is not true. FPE-1 local panel covers detectors located at -4 ft. EL. and -35 ft. EL. FPE-2 RAB EL. +21 local panel covers detectors located at +21 and +35 ft. elevation. FPE -3 RAB EL. +46 local panel covers detectors located at +46 ft. EL. (the Main Control Room), the Fuel Handling Bldg., the Turbine Bldg., and the RCB. FPE -4 SERVICE/CHILLER BLDG. local panel covers detectors located in these two bldgs., plus the Water Treatment Bldg."

Response

In order to help the operators identify the location of a fire, a tabular road map will be lettered on the MRCP top hat prior to Licensing. An example of this chart is shown on Table 2.12-1. As can be seen the chart serves as a directory showing the actual fire zone alarmed, as well as the location of the local fire panel. A cross-reference to the fire zone drawings in also provided to further assist the operators. Other fire panel enhancements, primarily labels, will also provide location information and the plant monitoring computer can also aid in locating a fire. In addition, drawings of the fire zones will be provided in the Control Room/Technical Support Center. 1

B-6, Finding 27, Priority 3

"A fire in the plant can affect cables and therefore instrumentation on the control panels. There is no way at present for the operator to know which instruments would be affected by a fire in a particular area."

Response

No corrective action is required due to changes already underway in order to comply with Appendix R to 10CFR50. For example, there will always be at least one train of safe shutdown equipment including instrumentation and control available due to various protective measures including such measures as re-routing cables, new PAC panels, wrap, sprinklers etc.

B-6, Finding 36, Priority 3

"The word TURBO is used in labeling. Turbo is a prefix and should not be used as a substitute word for turbine."

Response

Per the Control Room glossary, turbine will be abbreviated TURB during the enhancement of the fire panels.

B-8, Finding 15, Priority 3

Fire Panel - Grouping

"Indicators for Fuel Handling Building Fire and Trouble are located in two columns."

Response

The indicators will be rearranged prior to Licensing such that fire zones in the same building are grouped together as shown on Figures 2.12-1 and 2. | 1

B-8, Finding 31, Priority 3

Fire Panel - Grouping

"Arrangement of system indicators and pushbuttons at top of each of the panels and bottom of FPE-3 CR local pad is inconsistent. Example, POWER ON is at far right on Master Panel, Fire Protection System and far left on FPE-3 Control Room local panel."

Response

The arrangement of indicators and pushbuttons on FPE-3 and on the MRCP is being changed to be as consistent as possible as can be seen on Figure 2.12-1, 2 and 3. These changes will be implemented prior to Licensing. | 1

TABLE 2.12-1

MASTER REMOTE CONTROL PANEL - FIRE DETECTION SYSTEM
DIRECTORY OF FIRE AREAS

FPE-1 RAB EL. -4 (COL. H-3A)

FIRE AREA	FIG.NO	ELEVATION	AREA DESCRIPTION
RAB 30	X-4	EL. -4.0	Administration Area (Health Physics)
*RAB 31	X-4	EL. -4.0	Corridor and Passageways
*RAB 32	X-13	EL. -35.0	Wing Area
	X-13	EL. -4.0	Wing Area
RAB 33	X-3	EL. -35.0	Shutdown Cooling Heat Exchangers A&B
RAB 34	X-3	EL. -15.0	Valve Operating Enclosure A&B
RAB 35	X-3	EL. -35.0	Safety Injection Pump B
RAB 36	X-3	EL. -35.0	Safety Injection Pump A, A/B
RAB 37	X-3	EL. -35.0	Emerg. Feedwater Pump MD A
RAB 38	X-3	EL. -35.0	Emerg. Feedwater Pump MD B
*RAB 39	X-3	EL. -35.0	General Equipment Area
RAB 40	X-13	EL. -35.0	Emerg Diesel Gen Fuel Oil Tank A
RAB 41	X-13	EL. -35.0	Emerg Diesel Gen Fuel Oil Tank B

* FIRE AREA HAS MORE THAN ONE ZONE. SEE LOCAL PANEL FPE -1

FPE -2 RAB EL. +21 (COL.K-11A)

FIRE AREA	FIG.NO	ELEVATION	AREA DESCRIPTION
*RAB 8	X-5	EL. +21.0	Switchgear Room
RAB 8D	X-5	EL. +21.0	Computer Battery Room
RAB 8E	X-5	EL. +21.0	CEA Drive MG Sets
RAB 8F	X-14	EL. +21.0	H&V Fan Room
RAB 9	X-5	EL. +21.0	Aux Control Panel LCP43
RAB 11	X-5	EL. +21.0	Battery Room BS
RAB 12	X-5	EL. +21.0	Battery Room ABS
RAB 13	X-5	EL. +21.0	Battery Room AS
RAB 17	X-5	EL. +21.0	CCCW Heat Exchanger 'B'
RAB 18	X-5	EL. +21.0	CCCW Heat Exchanger 'A'
RAB 19	X-5	EL. +21.0	CCCW Pump A
RAB 20	X-5	EL. +21.0	CCCW Pump AB
RAB 21	X-5	EL. +21.0	CCCW Pump B
RAB 22	X-5	EL. +21.0	Drumming Station
RAB 23	X-3	EL. +35.0	Hold-up Tank Area
	X-5	EL. +21.0	Corridor & Common Passageways
RAB 24	X-14	EL. +21.0	Decontamination Area & Hot Mach. Shop

TABLE 2.12-1 (Cont'd)

FIRE AREA	FIG.NO	ELEVATION	AREA DESCRIPTION
RAB 27A	X-10	EL. +7.0 FT	HVAC Equipment Room
RAB 27B	X-10	EL. +7.0 FT	Electrical Area
RAB 27C	X-10	EL. +7.0 FT	I&C Room
RAB 27D	X-10	EL. +7.0 FT	Communications Equip Room

* FIRE AREA HAS MORE THAN ONE ZONE. SEE LOCAL PANEL FPE-2

FPE-3 & 3A RAB EL. +46.0 (Col. J-10A)

FIRE AREA	FIG.NO	ELEVATION	AREA DESCRIPTION
RAB 1A	X-6	EL. +46.0 FT	Control Room
RAB 1B	X-6	EL. +46.0 FT	HVAC Equipment Room - Northeast
RAB 1C	X-6	EL. +46.0 FT	Emergency Operation Facility
*RAB 2	X-6,15	EL. +46.0 FT	HVAC Equipment Room - West
	X-6	EL. +69.0 FT	HVAC Equipment Room - Northwest
*RAB 3	X-6	EL. +46.0 FT	HVAC Equipment Room - Southeast
	X-21	EL. +35.0 FT	Corridor
RAB 3A	X-6	EL. +69.0 FT	Elevator Machine Room & HV Fan Room
*RAB 7	X-21	EL. +35.0 FT	Relay Room
*RAB 25	X-14	EL. +21.0 FT	Equipment Access Area
		EL. +35.0 FT	
Turbine Bldg.	X-16	EL. +15.0 FT	Switchgear Room
*RCB	X-13,X-14, X-15	EL. All	Annulus & Elec Penetration Area
*Fuel Handling	X-11	EL. All	Fuel Handling Building
CT1 & CT3 Tower 'A'	X-2	EL. +21.0 FT	Dry Clg. Tower 'A' & Wet Clg.
CT2 & CT4 Tower 'B'	X-4	EL. +21.0 FT	Dry Clg. Tower 'B' & Wet Clg.

1

*FIRE AREA HAS MORE THAN ONE ZONE. SEE LOCAL PANEL FPE 3 & 3A

FPE-4 SERVICE/CHILLER BLDG.

FIRE AREA	FIG.NO	ELEVATION	AREA DESCRIPTION
*SB	X-1	GRADE	Service Bldg
WT	X-1	GRADE	Water Treatment Bldg.
*CB	X-1	GRADE	Chiller Bldg.

*FIRE AREA HAS MORE THAN ONE ZONE. SEE LOCAL PANEL FPE 3 & 3A

FPE-5 COMPUTER ROOM (COL. G-10A)

FIRE AREA	FIG.NO	ELEVATION	AREA DESCRIPTION
*RAB 1D	X-6	El +46.0 FT	Computer Room

*FIRE AREA HAS MORE THAN ONE ZONE. SEE LOCAL PANEL FPE 5

DATE	LOCKHEED MISSILES & SPACE COMPANY, INC. A SUBSIDIARY OF LOCKHEED AIRCRAFT CORPORATION SUNNYVALE, CALIFORNIA
DWN	
APVD	MASTER PANELS FIRE DETECTION AND FIRE PROTECTION SYSTEMS-A
APVD	
ENGRG	
CHKP	
APVD	SIZE: CODE IDENT: DRAWING NO: REV: D
APVD	SCALE: SHEET:

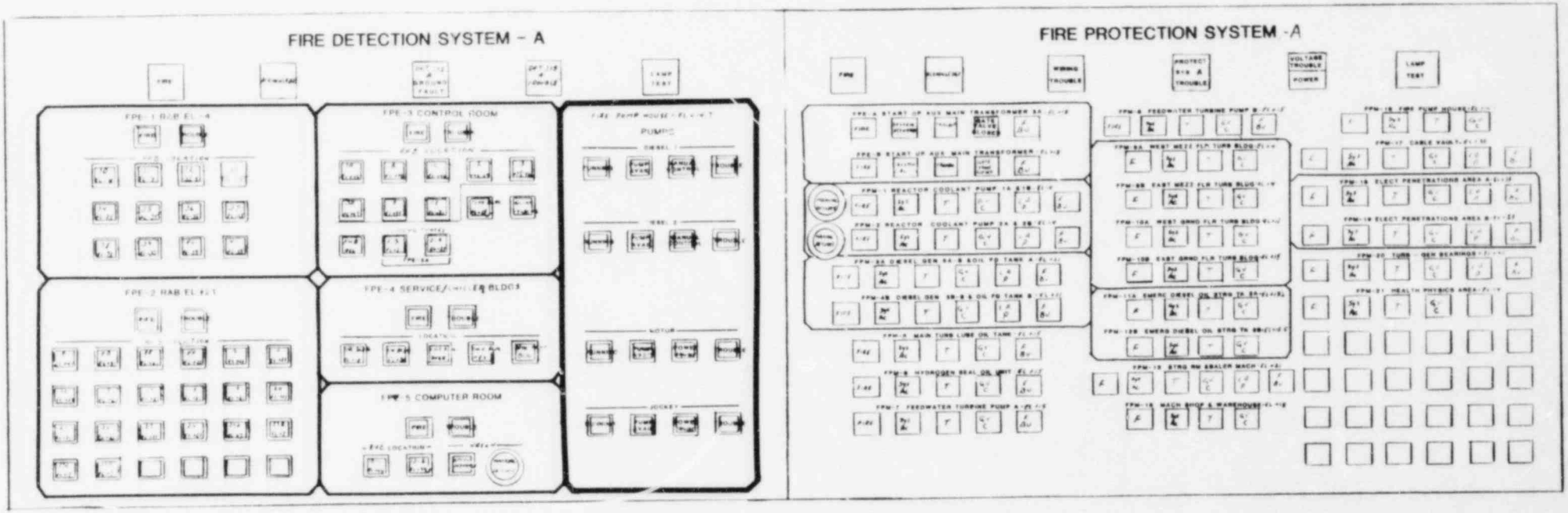
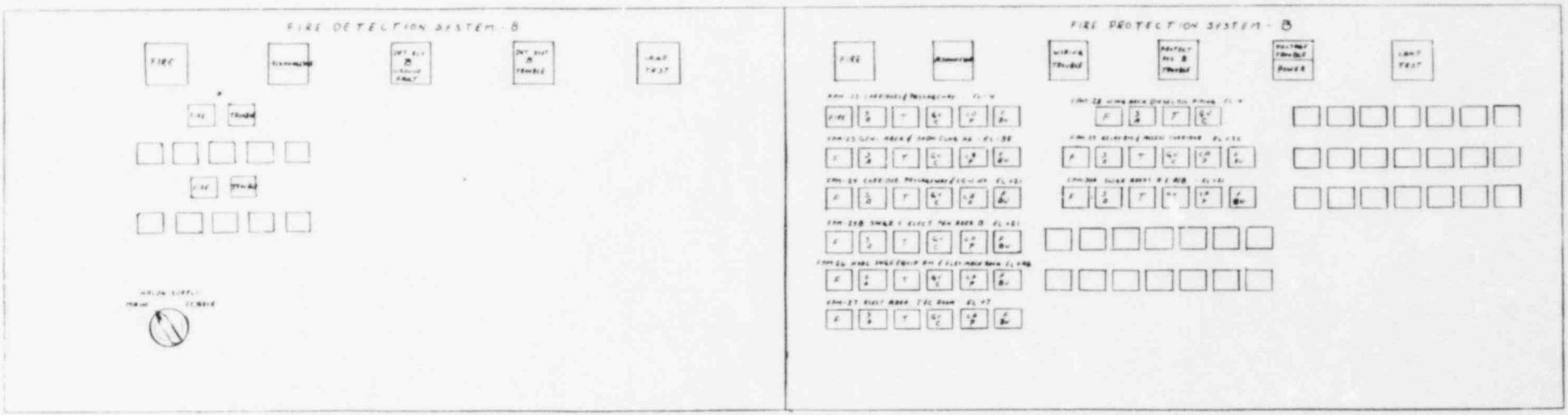


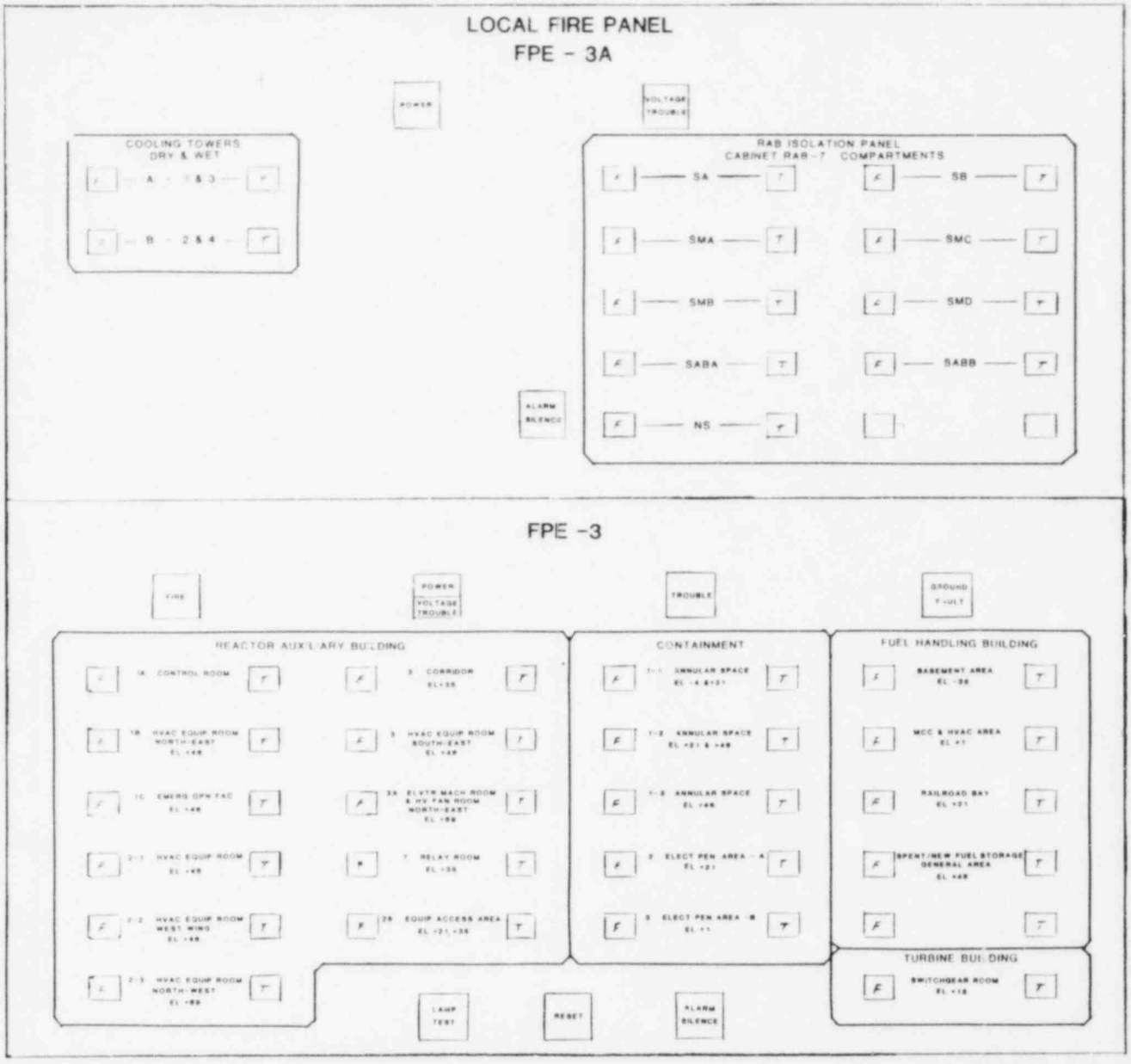
FIGURE 2.12-1

MASTER PANEL FIRE PROTECTION SYSTEM - B



DATE	LOCKHEED MISSILES & SPACE COMPANY, INC. A SUBSIDIARY OF LOCKHEED AIRCRAFT CORPORATION SUNNYVALE, CALIFORNIA
DWN	MASTER PANEL FIRE DETECTION AND FIRE PROTECTION SYSTEMS - B
APVD	
APVD	
ENGRG	
CHCR	
APVD	SIZE C / CODE IDENT UPPER Panels / DRAWING NO -(44 A-C / REV -D
APVD	SCALE / SHEET

FIGURE 2.12-2



DATE	LOCKHEED MISSILES & SPACE COMPANY, INC. A SUBSIDIARY OF LOCKHEED AIRCRAFT CORPORATION SUNNYVALE, CALIFORNIA
DWN	
APVD	
ASVD	
ENGRG	
CHKR	
APVD	SIZE C / CODE IDENT / DRAWING NO / REV
APVD	SCALE / SHEET

NOTES

- Layout dimensions are estimated. Line & Spacing adjustments may be necessary. Details standardized labeling & graphics scheme.
- F = FIRE
- T = TROUBLE

FIGURE 2.12-3

2.13 PLANT MONITORING COMPUTER DISPLAY PANELS (CP-3, 35, 36)

2.13 PLANT MONITORING COMPUTER DISPLAY PANELS (CP-3, 35, 36)

In the Control Room the operators have three separate stations within the Main Control Board, where they can communicate with the Plant Monitoring Computer (PMC). These stations are located on CP-35, CP-3 and CP-36; each consists of four 19 inch color CRT's and an operator's console which includes a plasma display panel, a functional keyboard and a standard ASCII typewriter keyboard. One CRT of each group of four (the top-left one) is dedicated for "Computer Alarm" display. A similar CRT dedicated for "Computer Alarm" is also provided on CP-6. This panel will also incorporate the two QSPDS plasma displays, as well as the Plant Radiation Monitoring CRT (CP-51A). | 1

The operator uses the console to display information on the remaining three CRT's available to him at a particular station. In addition to the three stations on the Main Control Board, the operators can use the three CRT's and console available on the Operator's Desk (console) - of which one (at the seated operator's right) is also dedicated for alarm display - the three keyboards and the plasma display located on the same desk. | 1

The Supervisor's office is also equipped with two CRT's and a console for quick access to important plant information.

The five computer stations of the Control Room provide the operations staff with the computer-generated alarms and with the important plant information available in the Data Base.

For backup to the CRT's and for recording purposes the Control Room is also equipped with 3 hard copy printers.

There is no surface enhancement to be shown on the Plant Monitoring Computer Display Panels; among the findings reported, none requires a surface enhancement of the panels. A representative Display Panel is shown in Figure 2.13-1.

Four findings or Human Engineering discrepancies were reported against the Plant Monitoring Computer Display Panels. These findings and their disposition are discussed below:

B-7, Finding 1, Priority 3

"Four CRT modules with four numeric keypads each. CEAC/CPC modules with one keypad each, megawatt demand keypad (1), operator's console, console phone keypad and CRT keyboards."

Response

Various operator's modules were furnished for different and unrelated purposes. If an error occurs in the "keyboarding" the computer will generate a message. Operation of I/O devices will be given special emphasis in training classes.

B-7, Finding 2, Priority 1

"A 5 x 7 dot-matrix is used on the CRT displays which causes readability problems."

Response

When LP&L designed and purchased the display system, the 5 x 7 dot matrix was the system being used throughout the industry. Although, the 7 x 9 dot matrix is preferred in NUREG-0700 the 5 x 7 dot matrix is still acceptable throughout the industry. LP&L feels that the 5 x 7 dot matrix characters are adequate for the type of information being provided and the speed at which the operator is expected to act on this data. The entire display generator system would have to be completely redesigned to accommodate this change. LP&L does not feel that this apparent problem warrants this extensive change. A Human Factors review of the Computer System man-machine interface will be performed prior to Licensing. | 1

B-7, Finding 4, Priority 1

"The control room printer which will be used to print alarms, critical status information, and trend data does not have a high-speed print capability of at least 300 lines a minute."

Response

This will be evaluated during testing of the computer. If faster printer is required it will be installed by Licensing. Presently a 600 line per minute printer is provided in the Computer Room which is adjacent to the Control Room. | 1

B-7, Finding 5, Priority 1

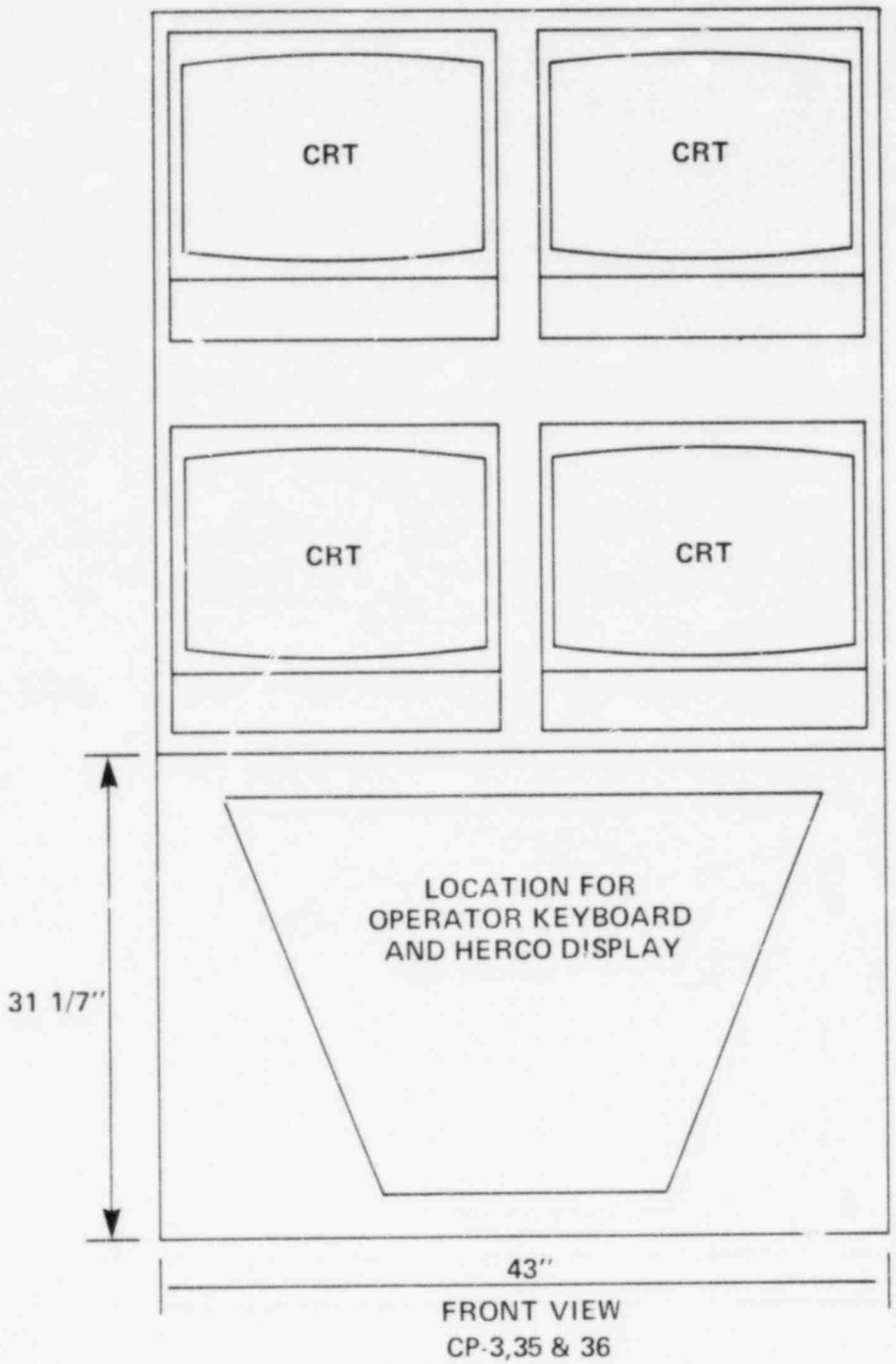
"The computer system does not provide capability to obtain a hard copy of any page appearing on the CRT screen at the request of the operator."

Response

A hard copy device will be provided in the Control Room prior to Licensing. | 1

FIGURE 2.13-1

COMPUTER INTERFACE BOARD



FRONT VIEW
CP-3,35 & 36

2.14 REMOTE SHUTDOWN - TRANSFER AND CONTROL

2.14 REMOTE SHUTDOWN - TRANSFER AND CONTROL (LCP-43 and Transfer Relay Panels)

2.14.1 LCP-43 AUXILIARY CONTROL PANEL

LCP-43 is located outside the Control Room and contains the instrumentation and controls required to perform, monitor and maintain a safe shutdown of the reactor in the event the Control Room becomes uninhabitable.

This auxiliary panel contains the controls and indicators for the Emergency Feedwater System, the Chemical Volume Control System, the Component Cooling Water System and the Shutdown Cooling System. These instruments are duplicates of those in the Main Control Room.

Twenty-eight findings were reported against LCP-43. The disposition of these findings is as discussed below:

B-1, Finding 12, Priority 1

Emergency Shutdown Panel

"Meters and controls are located far too high on this panel. Recommended upper limit is 72." Problem is compounded by poor layout - lack of good associations."

Response

In order to improve the anthropometrics of the remote shutdown panel (LCP-43) a permanent metal deck floor (10 inches high) including ramps will be provided on the front side of the panel.

The layout of controls and indicators is adequate to perform an orderly hot/cold plant shutdown function.

B-1, Finding 13, Priority 1

"There is a temporary wooden platform 8" high, with metal pipe rails, installed in front of the Remote Shutdown Panel."

Response

The temporary wooden platform will be replaced by the permanent metal deck floor (10 inches high) including ramps.

B-1, Finding 21, Priority 1

"The Remote Shutdown Panel room lighting is harsh and creates a shadowing effect on the control panel surfaces. The lower panel is subject to brighter direct lighting while the illumination level of the upper panel portion is noticeably lower."

Response

Refer to Section 5.1, "Lighting".

B-1, Finding 24, Priority 1

"To provide emergency AC lights in the Remote Shutdown Panel Room, there is a period of approximately 15 seconds between the time an offsite power loss occurs and the time diesel generator loading begins. DC battery lighting is not provided during this 15 second period."

Response

Refer to Section 5.1, "Lignting."

B-1, Finding 25, Priority 1

"The PA system speaker for the Remote Shutdown Panel area is too large for the limited/confined area that it covers. The area is approximately 13 1/2 ft square. The speaker cone is approximately 20" in diameter."

Response

Refer to Section 3, "Communications."

B-2, Finding 2, Priority 1

"The Remote Shutdown room has no provision for communications, i.e., no telephone; no sound powered phone."

Response

Refer to Section 3, "Communications."

B-2, Finding 10, Priority 1

There are no sound powered headsets or storage provisions area for them in the Transfer Switch room or in the Remote Shutdown Panel area.

Response

Refer to Section 3, "Communications."

B-4, Finding 1, Priority 1

"On the Remote Shutdown panel, there are five controllers missing; i.e., Emergency Feedwater B Flow Controls (2), Component Cooling Water (1), Emergency Feedwater A (2)."

Response

All five missing controllers will be installed prior to Licensing. | 1

B-4, Finding 14, Priority 1

"On LCP-43, keylock switches have 3 positions: Left = Normal, Right = Bypass. Middle or straightup position is not labeled."

Response

Keylock switches on LCP-43 have 3 positions and two functions (Normal and Bypass). The third or middle position is used to insert the key into the lock and serves no other function.

B-5, Finding 17, Priority 1

"There is a glare problem with the meters (curved vertical) located on the upper part of the Remote Shutdown Panel LCP-43."

Response

New lighting fixtures are being installed (DCN-E-920) to provide a softer quality of light; an additional fixture will reduce the shadowing effect. The results of a Lighting Survey will be provided to NRC 60 days prior to Licensing. | 1

B-5, Finding 27, Priority 1

"Two like measured (Cooling Towers) parameters (temperature) with dissimilar scales immediately adjacent to each other. NUREG 0700, Para. 6.5.1.6.d, Exhibit 6.5-6."

NRC Review Team Comment: Dual scale vertical meters Left Scale 50 - 130 Degrees F range; Right Scale 30 - 110 degree F range.

Response

These two meters are measuring parameters that are not directly related. The left scale is for the component cooling water temperature and the right scale is for the wet cooling tower basins. Labels will identify these two unrelated parameters prior to Licensing. | 1

B-5, Finding 30, Priority 2

"Pre-trip indicators (for Steam Generator Pressure) provide a steady red light indication of impending trip. This is a warning indication but is identical to the normal status indication of micro-switches throughout the plant."

Response

The warning lights are provided as an operator aid to assist him with bringing the plant to cold shutdown without an inadvertent SIAS. The red color choice is pending on the results of the "Control Room color code study" which will be submitted to NRC 60 days prior to Licensing. (An advanced copy of the color study will be sent to NRC in January 1983.) | 1

B-5, Finding 31, Priority 1

"Letdown Flow and Pressure

It appears that the control switches have lights (white) indicating valve selection. It also appears that the white CMC indicators above the switches

show the same information. The red and green CMC above the switch show valve condition. This would be unnecessarily redundant and confusing."

Response

All controls and indications are required. The letdown flow pressure controls consist of three stations on LCP-43 and two valves in parallel.

Station #1 indicates the control mode that was selected in the Main Control Room before the transfer. Operator needs this indication to position selector switch (Station #3) so that the mode of operation remains the same after the actuation of control circuit.

Station #2 indicates the actual position of each valve.

Station #3 is used to select the control mode and to actuate the selected mode of operation

NOTE: All indicating lights are activated by a transfer switch. The control circuit is also transferred to LCP-43 with a transfer switch; however, it is not connected to the control switch (Station #3) until the knob on the control switch is depressed. When the control circuit is connected to the control switch, the white lights in lower portion of Station #3 and on Station #1 go out.

The above functions of indicating lights shall be clarified through enhancement of LCP-43. 1

B-6, Finding 11, Priority 1

"The neutron flux indicator on LCP-43 has no label or scale or meter face identification. This HED applies to both trains on both sides of the panel."

Response

Labels will be provided prior to Fuel Load.

B-6, Finding 13, Priority 1

"There is no permanent panel identification on LCP-43. It is written on with grease pencil."

Response

LP&L will provide the required labels during the ongoing enhancement effort, to be completed prior to fuel load.

B-6, Finding 14, Priority 1

"In the Remote Shutdown panel room there is an unlabeled blue pushbutton on the communication panel."

Response

Blue pushbutton will be removed (DCN-E-933).

B-6, Finding 15, Priority 1

"There is no panel number on the Remote Shutdown Panel communications panel."

Response

Number will be provided prior to Licensing. (DCN-E-933) | 1

B-6, Finding 16, Priority 1

"On LCP-43 there are only a limited number of hierarchical labels at inconsistent locations. Character sizes used for panel and system labels are the same size as component label characters."

Response

Adequate labels will be provided and will replace or complete the existing ones, prior to Licensing. | 1

B-6, Finding 21, Priority 1

Letdown Flow and Pressure

"Labeling on switches and status display faces are inaccurate. Poorly positioned and confusing."

Response

Inaccurate labels are being replaced and those poorly positioned will be re-located prior to Licensing. | 1

B-6, Finding 31, Priority 1

"On LCP-43 there is inconsistent use of abbreviations, i.e., emer. emerg., CR/Contr. Rm."

Response

Following the ongoing enhancement effort, labeling of LCP-43 will use the same standard glossary that is being used for the Control Room panels. Abbreviations will be consistent throughout all main control panels and LCP-43 prior to Licensing. | 1

B-6, Finding 40, Priority 1

"Control Room Exhaust Fan Switch

Labeling on switch face is inaccurately positioned."

Response

Labeling will be corrected prior to Licensing. 1

B-8, Finding 6, Priority 1

"No indication is provided in the Emergency Control Room that all transfer switches have been thrown. In the latter case, there is no indication of which switches have not been thrown (there are approx. 62 switches)."

Response

No special light is required to indicate that all transfer switches have been operated for the following reasons.

1) Unless the transfer switch is operated, there will be no lights on the associated controls that are serviced by that particular transfer switch. The missing lights on the panel will be an indication to the operator that the control circuit related to those lights has not been transferred. A drawing marked to show the transfer switch associated with LCP 43 indications and controls will be provided in the Remote Shutdown Room. 1

2) The fact that not all transfer switches were operated is not an indication that the safe shutdown of the unit is impaired. The transfer of one safety channel SA or SB in addition to four protective channels is sufficient to effectuate the safe shutdown of the plant. This would require operation of approximately half the number of existing transfer switches. (See also response to B-6, Finding 30).

B-8, Finding 9, Priority 1

"The lack of any annunciator panels in the emergency shutdown area was noted by Lockheed analysts. This lack was also of concern to an LP&L operator who stated that an operator using this panel would not know the status of many important systems if he has only the existing LCP-43."

Response

The purpose of an annunciator is to call the operators attention to an abnormal situation (important deviation from normal operating conditions) which may be otherwise overlooked (Guidelines for Near-Term Improvements in NPP Control Room Annunciator Systems, Battelle, 1982).

LCP-43 is designed to be used in abnormal situations (which require immediate shutdown while the Control Room is not habitable) and is furnished with all indicators and displays required for the safe performance of this unique operation (shutdown of the plant). Any additional alarm may only divert operator's attention from his immediate duties governed by the corresponding emergency procedures and by the status indications available on the LCP-43.

B-8, Finding 14, Priority 1

"Meters and controls are located far too high on this panel. Recommend upper limit 72". Problem is compounded by poor layout, lack of good associations."

Response

A permanent metal deck floor will be provided by LP&L, prior to Fuel Load, to improve accessibility of the high located instrumentation (See response to B-1, Finding 12). The layout is adequate for hot/cold plant shutdown and enhancements will be provided. A preliminary draft enhancement drawing is provided in Figure 2.14-1.

B-8, Finding 21, Priority 3

"Panel layout employs "mirror imaging" of groups of panel elements. Layout within each group is generally the same on "A Train" or "B Train" sides; exceptions within groups are elements that are redundant from A to B (example: Boric acid pumps A and B - SA Power, and boric acid tanks A and B gravity feed valves. Groups such as CVCS (B side), emergency feedwater (A & B sides) shutdown cooling (side BC, RCS/Pressurizer). Entire upper portion of panel have layouts that do not reflect functional grouping, operator use, anthropometerics, or reasonable control display relationships.

NRC Review Team Comment: On LCP-43 functional group blocks are mirror imaged, while component (control and indicator) locations within each group have a consistent left to right and top bottom relationship."

Response

The layout of components on panel LCP-43 was rearranged so as to maintain left to right and top to bottom relationship of components within each group.

B-8, Finding 22, Priority 1

"Condensate Storage Pool - Meter

Position of meter does not easily permit the functional grouping of the meter with emergency feedwater system."

Response

The position of meters on LCP-43 has been rearranged per DCN-IC-834.

B-8, Finding 24, Priority 1

Emergency Feedwater to Steam Generator

"Flow meters are physically separated (approximatly 9") from controllers by two other controllers not directly related to the meters."

Response

Position of meters on LCP-43 has been rearranged per DCN-IC-834.

B-9, Finding 10, Priority 3

"On LCP-43, the Charging Pump A/B control is separated from associated displays by the CCW-PUMP A/B Control and Displays."

Response

The charging pump AB Control is located in its associated area of AB safety channel, and the AB safety channel does not contain displays, since display is on either A or B.

2.14.2 TRANSFER SWITCH PANELS

In order to transfer the controls for safe shutdown from the Control Room to the Remote Shutdown Panel, sixty-two transfer switches grouped in six cabinets located on the mezzanine floor (El. + 35) of the RAB have to be operated.

Nine findings were reported against the Transfer Switch Panels and Transfer Switch room. These findings and their disposition are discussed below:

B-1, Finding 1, Priority 1

"Structural steel projects from room ceiling. Operators heads may strike these projections. During transfer from Main Control Room to LCP-43, operator may be rushing through the transfer procedure and may not be wearing a hard hat. He may be injured or incapacitated by hitting projections from the ceiling."

Response

The lower projections will be raised above dangerous levels where possible. All others will be wrapped. All projections will be pointed out to the operators during remote shutdown walk-thrus, and, to the extent possible, a yellow line from the transfer room door to the various transfer switch cabinets will avoid the projections. The modifications will be made prior to Licensing. | 1

B-1, Finding 2, Priority 1

"Locks are present on transfer switch, cabinet, doors, panel and on the transfer room door. Immediate access is needed during emergency in transferring control from Control Room to Emergency Shutdown Panel."

NRC Review Team Comment: No access procedures established.

Response

The locks will be removed from the doors of the transfer switch compartments of auxiliary panels. Doors within the transfer room will not require locks; however, outside doors of transfer room must have locks per security regulations. Access procedures will be incorporated into the remote shutdown walk-thrus. These changes will be done prior to Fuel Load.

B-1, Finding 6, Priority 1

"In the Transfer Relay Room, the operator must operate safety transfer switches and non-safety switches on six separate panels which are widely separated over a distance of approximately 70 feet."

Response

Fire protection regulations and Reg. Guide 1.75 dictate the layout of the relay room in which the transfer switches are located. In order to improve on human factors a 4-inch wide yellow line will be painted on the floor from the door to all the transfer switch cabinets prior to Licensing. In addition, these cabinets will also have a yellow tape border on the outside, as well as the inside of the doors. The time to effect transfer is adequate and will be confirmed during pre-op testing. | 1

B-1, Finding 23, Priority 1

"The Transfer Switch Room battery operated DC emergency lights appear to be inadequate for an operator to perform emergency functions during the 15 second delay period required for AC emergency lighting to come on."

Response

Refer to Section 5.1, Lighting

B-2, Finding 3, Priority 1

"The Transfer Switch room has one telephone near the Train A panel, and none within reach of the Train B panel."

Response

Two additional telephones are being installed prior to Licensing to provide complete coverage of the transfer switch panels per DCN-E-922. Refer to Section 3, "Communications." | 1

B-2, Finding 10, Priority 1

"There are no sound powered headsets or storage provisions area for them in the Transfer Switch room or in the Remote Shutdown Panel area."

Response

Sound powered headsets and storage space for them will be provided prior to Licensing in the Transfer Switch room and in the Remote Shutdown Panel room. Refer to Section 3- "Communications". | 1

B-6, Finding 4, Priority 1

"Access doors over transfer switch panels are not differentiated from other doors. They are scattered among cabinets on 2nd level transfer room."

Response

Doors of the compartments have distinctive physical appearance and will have labeling which enhances identification. This is to be accomplished prior to Fuel Load (see response to B-1-6).

B-6, Finding 10, Priority 1

"In the remote transfer room, switch position and function labels are not provided for some transfer switches (e.g., Panels SB, SA/B, NA/B)."

Response

Labels will be provided prior to Fuel Load, but following the completion of the LCP-43 evaluation.

B-6, Finding 30, Priority 1

"At most transfer switch panels numbering of switches rebegins with 43-1. Hence, switches do not have unique designations. If a switch fails or is forgotten during the transfer operation among 62 switches, there is no unique designator to locate the desired switch."

Response

New and unique labeling will be provided as part of enhancement. The Cabinets are also uniquly numbered. Transfer from Control Room to LCP-43 will be performed under administrative procedure. Normally micro-switches are not lit on LCP-43 but they will light when control is transferred to LCP-43. If a switch fails or is forgotten during the transfer operation, it will be noticed and identified from micro-switch indication. A marked-up print will be provided showing which transfer switch is associated with the components on LCP-43. These changes will be made prior to Licensing. | 1 | 1

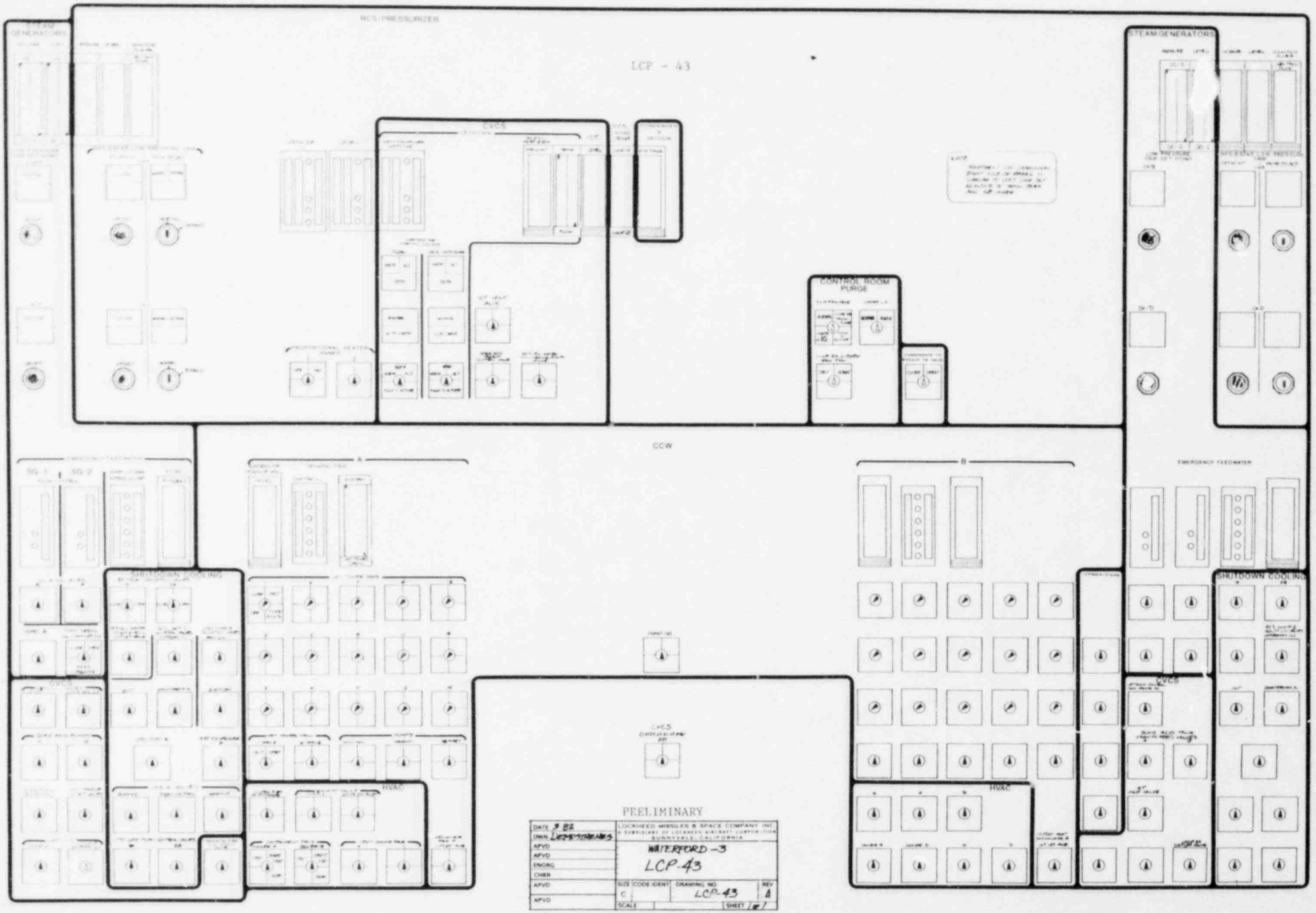

LCP - 43
RCS/PRESSURIZER
STEAM GENERATORS
CVCS
CONTAINMENT PURGE
CCW
EMERGENCY FEEDWATER
SHUTDOWN COOLING
HVAC
PRELIMINARY
LOCKHEED MISSILES & SPACE COMPANY, INC.
WATERFORD -3
LCP-43
DRAWING NO. LCP-43
REV A
SHEET 1

FIGURE 2.14-1

2.15 GENERIC PANEL FINDINGS

2.15 GENERIC PANEL FINDINGS

1

There are 57 findings and HEDs against the Control Room excluding the Annunciator System which are generically applicable to all the main boards. These can be organized into five groups:

1. Labels, demarcation and color
2. Controls (i.e., micro-switches, keylocks, tags, bulbs)
3. Meters
4. Recorders
5. Physical (i.e., completeness, directness, layout, dimensions)

Generic studies, analyses etc were commissioned to address these findings. Examples include a Control Room glossary; panel enhancement drawings showing hierarchical labeling and demarcation; a micro-switch coding study; a color code study; meter, keyswitch and recorder reviews. The enhancement drawings referenced in Sections 2.1 through 2.10 are applicable to this section.

2.15.1 LABELS, DEMARCATION AND COLOR

B-3, Finding 17, Priority 1

"CONT is used as the abbreviation for control on CP-7 and CP-8. However, in the plant abbreviation list "CONT" means Contract, Continuous, Controller, and Containment."

Response

Refer to B-6, Finding 38 below.

B-3, Finding 18, Priority 1

"CNTMT is widely used as the abbreviation for Containment and is not included in the plant abbreviation list provided."

Response

Refer to B-6, Finding 38 below.

B-6, Finding 37, Priority 1

"Abbreviations are sometimes confusing and sometimes inconsistent. NUREG-0700, Para. 6.6.3.3 recommends consistency. Examples include:

COND - used for condenser and condensate
CONT - used for containment and control
VA - consistently used for valve but may be confused with vacuum"

Response

Refer to B-6, Finding 38 below.

B-6, Finding 38, Priority 1

"Labels on annunciators and associated controls and displays have inscriptions which are not consistent, e.g.,
On Panel - MSR DR COL TK 1A
On Annunciator - MSR DCT 1A"

Response

A glossary of all control board abbreviations has been prepared. Abbreviations on panels and annunciators are being changed as part of the enhancement effort to be consistent with the glossary. For example, containment will always be abbreviated "CNTMT." The panel changes will be completed by Hot Functional Testing and the annunciators will be completed prior to Licensing. 1

B-6, Finding 9, Priority 1

"Labels are missing from controls and displays throughout the Control Room. Many permanent labels have become detached (e.g., CP-8)."

Response

Permanent labels will be provided by Hot Functional Testing as part of the human factors enhancement effort currently underway. Control labels will be directly inscribed on the panel surface with a protective coating applied. Other information will be provided under the switch lenses. Special "wedgetts" have been developed to permanently affix meter labels. 1

B-6, Finding 17, Priority 1

"No hierarchical labeling. Lack of hierarchical labeling results in the need for redundant labeling, a lack of visual grouping of functionally related components."

Response

Refer to B-6, Finding 45 below.

B-6, Finding 19, Priority 1

1. "Labels are sometimes placed above, but mostly placed below components. NUREG-0700, Para. 6.6.2.1 recommends labels be placed above components."

2. "Hierarchical labeling scheme, integrated with graphics, required labeling above."

3. "Hand action on a control covers the label, increasing error potential."

Response

Refer to B-6, Finding 45 below.

B-6, Finding 23, Priority 3

"Labels are not placed above the panel elements they describe (e.g., on CP-8, CP-13)."

Response

Refer to B-6, Finding 45 below.

B-6, Finding 32, Priority 1

"Functional labeling is not used in the Control Room and at the Remote Shutdown Panel."

Response

Refer to B-6, Finding 45 below.

B-6, Finding 41, Priority 3

"Lettering on labels is often too small for recommended legibility at applicable viewing distances."

NRC Review Team Comment: e.g., Hagen controllers on CP-18

Response

Refer to B-6, Finding 45 below.

B-6, Finding 45, Priority 1

"There are many unnecessary temporary labels which should be replaced by permanent labels in the Control Room and the RSP room."

Response

As seen in the enhancement drawings, functional, hierarchical labeling (above the components) and demarcation lines are being permanently provided as part of the human factors enhancement effort. The enhancement effort will be completed for the main boards by Hot Functional Testing. LCP-43 and the fire panel enhancement will be completed prior to Licensing. Adequate sized labels are being provided. It should be noted that many panel and wiring changes were needed to clear the way for organized demarcation and labeling. Also project documents are impacted by modifications to control and display inscriptions. | 1

B-6, Finding 46, Priority 1

"There is incomplete use of demarcation in the Control Room and remote shutdown panel; e.g., LCP-43, CP-1, CP-2, CP-18, CP-33. Some demarcation is ineffective, inaccurate, or confusing; e.g., CP-13."

Response

Refer to B-8, Finding 20 below.

B-8, Finding 16, Priority 1

"Association between control and related displays is poor. Association of related panel components is poor. Functional groupings are frequently not apparent. Associated display/controls are frequently scattered on a panel section."

Response

Refer to B-8, Finding 20 below.

B-8, Finding 20, Priority 1

"On CP-8 enhancement techniques, such as spacing, demarcation, and color shading, are not used for setting apart groups of controls and displays."

Response

The association between controls and displays, as well as functional groupings, wherever found to be unsatisfactory, have been corrected by design change notices. As noted in the previous response updated demarcation and enhancement techniques such as hierarchical labeling are being provided by Hot Functional Testing for main boards and by prior to Licensing for LCP-43. | 1

B-5, Finding 29, Priority 1

"There appears to be a primary color code convention in the Control Room: Red - flow; Green - no flow; Amber - tripped; White - advisory only. Many exceptions exist, however, as with the use of red lights on controller buttons; colors (mixed) on various module push switches; red "TRIP" buttons."

NRC Review Team Comment: Color code conventions are violated at many locations in the Control Room.

Response

A study of control panel component colors is underway and recommendations regarding standardization will be provided. The goal of this study is to minimize, to the extent feasible, unacceptable exceptions to the existing color convention. Several factors are involved. For example, the problems of negative transfer of learning should be avoided; vendor module operating manuals make reference to button colors which, if changed could impact that documentation and training. Many issues must be investigated. Eventually a color code convention will be established which satisfies the primary Human Factors criteria of reducing potential operator error. The present color convention can be outlined as follows:

Red - in service, open position
Green - not in service, inactive, closed position
Amber - taken out of service automatically, unavailable
White - alarm, test, advisory message

An advanced copy of the color code study will be provided to NRC in January 1983 and the final version of the study will be submitted 60 days before Licensing. Corrective action to the control panels is expected by Fuel Loading. However, feasible corrective actions to vendor modules will not be completed until startups following the first refueling. 1

B-6, Finding 42, Priority 1

"Labels using white letters on black, or black letters on silver, do not have as good a contrast as the recommended black letters on white; e.g., on LCP-43, CP-1."

Response

The enhancement program will improve color contrast. For example, white letters will be used on micro-switches with red or green background. Black letters will be used on white or yellow background. Also silver plates are being removed from the panels. These changes will be completed prior to licensing. 1

2.15.2 CONTROLS

B-4, Finding 5, Priority 1

"No attempt appears to have been made to utilize control coding.

1. Pumps, breakers and valves generally are operated by identical appearing micro-switches.

2. Proportional valves (less-more) are usually controlled by selector switches (Turbine-generator temperature controls); but some (SG startup-shutoff valves, aux steam to condenser valves, gland steam spillover bypass shutoff valves) are controlled by micro-switches."

Response

Refer to B-6, Finding 1 below.

B-6, Finding 34, Priority 1

"Multiple types of micro-switches with little or no visual indication of how they operate or how they differ from each other."

Response

Refer to B-6, Finding 1 below.

B-6, Finding 47, Priority 3

"CMC switches are of several types but are not coded for easy recognition of type, e.g.,

1. spring return to center

2. selector type which stop in position selected

3. maintain position off - spring return from start."

Response

Refer to B-6, Finding 1 below.

B-6, Finding 1, Priority 1

"Component/Instrument tag numbers are not shown on controls, (e.g., valve no.). Cross reference to procedures, P&IDs, and to Plant Auxiliary operators may be more difficult and prone to error. Error is more likely because of inconsistent terms on labels among the plant equipment, documentation, and control panels."

Response

Micro-switch coding will be applied prior to Licensing. Figures 2.15-1 and 2 illustrates the symbology to be applied which differentiates the associated process component; more-less, open-close; spring return direction; breaker type, and tag numbers from the Emergency Operating Procedures. | 1

B-4, Finding 20, Priority 3

Micro-switches

"According to operator, some spring-return micro-switches which allow partial opening of valves (bezel marked "more-less") must be turned and held for up to 10 seconds. Knob size and torque requirements make this difficult. This is an apparent violation of NUREG-0700, Para. 6.4.4.5.F."

Response

Several operators have manipulated the subject micro-switches with no operational problems. In addition, LP&L has made a random check on the micro-switch torque throughout the Control Room and has found that the maximum torque measured is within the NUREG-0700 guidelines.

B-6, Finding 24, Priority 2

Tagouts are large and obscure adjacent controls and indicators (e.g., LCP-43).

Response

LP&L will devise a means of tagging out equipment by Hot Functional Testing so that the tag does not obscure adjacent controls and indicators. | 1

B-4, Finding 12, Priority 1

"Many key switches operated by the same key. Was told there were four keys for all key switches, although there will be several sets of keys."

NRC Review Team Comment: It could not be verified that there were four keys for all key switches. Key control procedures are not in place.

Response

A key is assigned to each particular key switch. The same type of keys are used to operate key switches of redundant equipment.

A tabulation will be prepared to identify each type of a key with its associated key switch prior to Licensing. | 1

B-4, Finding 13, Priority 3

"Per NUREG-0700, Paragraph 4.4.3.a, key switches are to be used when unauthorized operation must be prevented or to secure against activation by unauthorized personnel. This is not the case in the Control Room."

NRC Review Team Comment: Keys are also used in administrative control.

Response

The key switches are used to ensure an administrative control of plant operation and to prevent a breach in pressure boundary through erroneous operations of pressure boundary isolation valve by operators.

B-4, Finding 16, Priority 1

"The locked position is not identified for some keylock switches."

Response

The "locked" position of the key switch is the position in which the key can be removed from the key switch by Hot Functional Testing. | 1

All key switches operating equipment will be provided with locked position indication on the keyswitch.

The exception to this convention are synchronizing switches where indication of locked position is not considered to be necessary.

B-4, Finding 7, Priority 2

"Pushbuttons do not provide a "click" on operation as required by NUREG-0700, Paragraph 6.4.3.1.b (according to operator reports). "Click" provides confirmation of intended control action."

NRC Review Team Comment: There is no tactile click to denote switch contact when the pushbuttons are depressed. The pushbuttons depress to bottom of travel with constant resistance.

Response

There are several pushbuttons which have no audible or tactile "click" when operated. These pushbuttons have immediate visual or audible feedback not generated within the button. Good engineering does not rely on locally generated feedback, but feedback from the process. A broken wire on the pushbutton would cause the function to fail even though the operator has been given tactile feedback. Operating experience in power plants indicates that pushbutton operation for critical tasks is not performed as part of a rapidly developing sequence, but rather as a single function to be verified prior to proceeding.

B-5, Finding 8, Priority 1

"Operators report that panel indication of status of solenoid-operated devices are driven by status of the solenoid (i.e., energized or de-energized) and not the actual status of the actuator service. A false indication may result, therefore, if the device "hangs up." NUREG-0700, Paragraph 6.5.1.1.e.1 requires that actual as opposed to commanded status be indicated." | 1

Response

This HED is incorrect. The position of limit switches on the process valves is what is indicated.

The indicating lights on micro-switch control stations indicate the position of the valve. The indicating lights are operated through the contacts of limit switches that are physically mounted on the valve movement.

B-5, Finding 37, Priority 1

"Operator reports that while a valve is cycling, some micro-switches will show both "open" and "closed" lamps on; others will show both lamps off. Neither method displays the "from and to" status."

Response

When valve is cycling in intermediate position of the travel span, both red and green lights will be "on" in conformance with valve position indicating criterion, as outlined in B-5, Finding 35, below. This is a normal situation for the control valves that are automatically modulating process flow.

The situation where both red and green lights are off when valve is in a modulating mode of control is contrary to the valve position indication criterion. | 1

B-5, Finding 35, Priority 1

"Operator reports that when some valves are actuated, both micro-switch indicator lamps go off until the valve cycle is complete. No indication is given of direction of travel. Further, if a breaker trips when the valve is first operated, both indicator lamps will go out, giving false indication that the valve is traveling."

Response

The criterion for valve position indication is as follows:

1. Only green light is on, the valve is in the fully closed position.

2. Only red light is on, the valve is in the fully open position.

3. Both, green and red lights are on, the valve is in intermediate position.

This criterion for valve position indication is applicable to all process valves.

In few rare occasions where the valve is a solenoid valve mounted directly on the line of small diameter and is normally furnished with position contacts that cannot fully satisfy this criterion an exception is taken for intermediate position of the valve where both red and green lights will be off. However, the travel of the solenoid valve stem is of extremely short duration (approximately one second) and, therefore, the above exception in position indication cannot cause any operational problem.

Wherever the direction of valve travel or exact valve position indication is required, a valve position meter, with 0 to 100% valve open position scale is provided.

If the power supply breaker trips, the indicating lights will go out for a longer time than one second. This condition is a direct indication of loss of power on any circuit.

B-5, Finding 36, Priority 1

"Micro-switch Lamps

Some micro-switches have No. 755 lamps (6.3 volts); some have No. 756 lamps (14.0 volts). Bulbs have identical size and shape; No. 755 has number printed on base. No. 756 has number engraved in base. Wrong lamps may be inserted during relamping. If 755 is is socket for 756, bulb life is under 20 minutes, in our test. If 756 is in socket for 755, brightness will be unacceptably low, indications will be missed. Specifically, No. 756 lamps are used in the electrical mimic CP-1, No. 755 lamps are used in CP-8."

Response

The reason for the two different lamp types is that one is used for the ac circuits, the other is used for the dc circuits. The proper replacing of lamps will be controlled through, administrative procedures which will be implemented prior to Licensing. LP&L is also studying different colored bezels. 1

B-4, Finding 9, Priority 1

"On the CP-1 Turbine Generator and Feedwater panel, the CP-8 Engineering Safeguard System Panel, and the CP-18 HVAC and Containment Isolation Panel, the switch/indicator lights are not dual filament or dual bulb and there is no lamp test capability."

Response

Refer to B-4, Finding 10 below.

B-4, Finding 10, Priority 1

"Micro-switch Lamps

No lamp test feature is provided. Dual lamp indications are rare. These characteristics violate NUREG-0700, Paragraph 6.4.3.3.c.1. A lamp "off" signal is used throughout panels for positive display information."

NRC Review Team Comment: The only lamp test provisions are on four Channel Reactor Protection and Engineered Safety Feature panels and on the Fire Protection Panel (FPE-3).

Response

The general industry practice does not require the test capability for the indicating lights on control panels nor an across-the-board use of dual filament bulbs.

The equipment monitoring lights normally have a dual indication; either a red or green light is on all the time. The case where both red and green lights are off on the same station is a clear indication of abnormality to the operator.

In the case of single indication, such as amber or white lights, dual bulbs are used to provide a back-up for a burned-out bulb until the bulb is replaced.

LP&L experience with existing plants has not identified any operational problems with detection of burned-out bulbs and their replacement.

Introduction of an additional, expensive circuitry to the control panels for the purpose of performing tests for indicating lights is considered to be unwarranted on account of its extremely high cost and detrimental effect that it may have on overall reliability of the control circuits inside the panels.

As part of the shift turnover procedure, the operators will conduct a control panel walkdown; any indicators which are not properly lit will be identified and investigated.

2.15.3 METERS

B-6, Finding 44, Priority 1

"The snap-on labels which attach to the bottom and top of the vertical meters are interchangeable and subject to mix-up. Since there is no "keying" mechanism, any label can be attached to any meter. A mix-up of labels, at some point in time, seems inevitable. The "snap-on" design is poor. Labels are already falling off, slipping, etc."

Response

The labels will be permanently affixed to the wedgetts as part of the enhancement effort. This action will be implemented prior to Licensing. | 1

B-5, Finding 11, Priority 1

"Labels attached to the meter bezels do not adequately describe the parameter the meter is measuring. If the meter is indicating level, the word level should be included in the title. If it is pressure, then PRESS, etc. The only parameter the scale should show is the units of measurement."

Response

The meter labels are being enhanced and corrected. This is being accomplished as part of the enhancement effort by Hot Functional Testing. Meter scale changes, as required, will be completed prior to Licensing. | 1

B-6, Finding 25, Priority 1

"Meter labels (Wide/Narrow Range Meters) do not include the designators, "wide range" or "narrow range" as appropriate. Labels should be accurate."

Response

Labeling will be enhanced to Hot Functional Testing to include "wide range" and/or "narrow range" as appropriate. | 1

B-5, Finding 16, Priority 1

"Pressure is displayed on many different scales: PSI absolute, PSI atmospheric, PSI difference, PSI, inches Hg, inches water. Confusion is most likely if different pressures must be integrated or compared during operating evaluation of status of problem diagnosis."

Response

All engineering units on scales of indication are in accordance with accepted engineering practices. After further review it was concluded that no change is required. Scales are appropriate for the parameter being measured.

B-5, Finding 12, Priority 1

"Questions exist on the scales labeled (%) percent as to the real intent of the unit measurement. Does the percent label refer to the "percent capacity" of the tank (before it overflows) or the "percent full" range established by engineering?"

Response

Initially any indication beyond 100% is out of range and may be considered as overfill in the case of tank level measurement. All meter displays show the working range of a tank within the meter band.

All percent scale meters are measuring tap-to-tap on the reference leg. If the fluid level is below the lower tap, then the operators consider the tank empty. If the fluid level is above the upper tap, then the operators consider the tank to be full, which will usually initiate high-level alarm.

B-5, Finding 21, Priority 3

"In many cases, despite ample space on a meter scale for the full valve numeric designations, scale values are shown with multipliers, e.g., X100 or X10. Operator may err in reading. This is especially likely if he is transitioning between Actual, X10 and X100 or X1000 or $X10^3$, 10^6, etc. There is no consistent pattern presented across the control panels."

Response

HED Committee has concluded that there is only some nuisance factor with the reading of these multipliers. A review is in progress which will identify those scales which may cause operator confusion or may be awkward. The identified scales will be replaced or modified in accordance with NUREG-0700 guidelines prior to Licensing. | 1

B-5, Finding 23, Priority 1

"Many scales, varied ranges and graduation increments. Many are very confusing and difficult to interpolate. HFE practice and NUREG-0700 recommend graduations in increments of 1, 2, 5 or 10 multiples thereof. Recommended practice also calls for no more than 9 graduations between numbers. Also, graduation marks should be highlighted at major intervals."

Response

Refer B-5. Finding 22 below.

B-5, Finding 22, Priority 1

"Discriminability of minor and intermediate scale markings is poor. Their dimensions violate the guidelines of NUREG-0700, Para. 6.5.1.5."

Response

LP&L has evaluated the meter scales and those that are a problem will be corrected prior to licensing. | 1

B-6, Finding 20, Priority 1

Meter Labels

"Meters with single scale have pointer on left (scale number on right) and are labeled on the bottom. Meters with dual scale are labeled on the bottom for the scale with pointer on the right. i.e., the left-pointer scale is labeled on the bottom when single; labeled on the top when double. (The latter convention is good, but it conflicts with the poor convention on single scales.)"

Response

Meters will be labeled correctly and consistently by Hot Functional Testing as part of the enhancement effort. | 1

B-8, Finding 13, Priority 1

"There are two types of dual scale meters:

1. Displaying two parameters, and

2. Displaying one parameter and one setpoint.

Because of their identical appearance, clustered installation, and subtle label differences, the operator could mistake a setpoint scale for a parameter reading - especially under current labeling practices. The reverse interpretation may also occur."

Response

Refer B-5, Finding 9 below.

B-5, Finding 9, Priority 1

"Many dual scale meters use one side for parameter status, the other side for setpoint. It appears that the term "setpoint" is generic and does not differentiate between:

1. Setpoint as desired status (from which actual status deviated $\pm$).

2. Upper limit - representing either a caution alarm or trip point.

3. Lower limit - representing either a caution alarm or trip point.

The operator would be aided by differentiating among No. 2 and No. 3."

Response

The setpoint is an indication at which value of a parameter the ESF actuation will take place. To distinguish it from the parameter scale a thin (translucent) blue film will be added at the border of the setpoint scale.

B-5, Finding 14, Priority 3

"Single scale meters display preferred format with pointer on one side, and touching tic/graduation marks, with numbers on the opposite. Pointer, therefore, does not cover numbers and reading accuracy is permitted by adjacency of pointer and graduation marks. Dual scale meters break these conventions by repeating numbers on either side. A preferred design would place numbers in the center with graduation marks on either side for adjacency to respective pointers. The natural (and preferred) result of this is that dual scale meters must share common scale index. Mixing scales makes interpolation difficult and can lead to clutter and error."

Response

The pointer of the indicator comes close to the graduation marks but does not cover them. Therefore accurate readings can be determined. Corrective action is not required.

B-5, Finding 34, Priority 3[1]

"There is a lack of operating zone markings on meters throughout the Control Room."

Response

Refer to B-5, Finding 33 below.

B-5, Finding 33, Priority 3[1]

"No visual aid to tell operator if value is out of tolerance or in tolerance. No meter banding is used (i.e., green zone, red zone, warning zone)."

Response

LP&L will provide temporary zone marking on meters for which it would be beneficial to have operating zones indicated, prior to exceeding five percent power. LP&L will provide meter banding in selected cases prior to startup following the first refueling after operational experience confirms the proper ranges for the meter banding. | 1

B-5, Finding 10, Priority 3

"Most meters fail to the bottom of the scale rather than to off-scale."

Response

This finding applies to meters that are calibrated based on 0-10 volt signals. If a meter suddenly goes to bottom of the scale, then the operator will check redundant or diverse parameters and quickly realize the meter has failed. There are never any zero readings on these meters. | 1

2.15.4 RECORDERS

B-5, Finding 44, Priority 1

"Strip Chart Recorders

Scale ranges vary widely among the strip chart recorders, according to measured parameters, e.g., 0-100; 0-200; 0-30000; 465-615; 0-600, etc. At present, one standard paper scale is installed in recorders."

NRC Review Team Comment:

All recorders presently have the wrong paper."

Response

The recorders were ordered with a minimum 12 month supply of the proper chart paper. The NRC audit reviewed recorders that had a standard factory test chart loaded. Each recorder will receive its proper chart prior to Hot Functional testing. | 1

B-5, Finding 42, Priority 3

"Strip Chart Recorders

Many different scales are needed on the various strip chart recorders. Assuming that correctly scaled paper will be installed, the problem arises that during paper replacement, the incorrect roll (with mismatched scale) will be installed. The potential result will lead to reading errors. This error has been reported at other plants."

Response

Each recorder is provided with a minimum 12 month supply of its proper chart paper. Each style of chart has a unique identification number which will be affixed to the mating recorder. This will assist in insuring that the proper replacement chart is installed by Hot Functional Testing. | 1

B-5, Finding 41, Priority 3

"Strip Chart Records

Recorders fail to comply with several points of NUREG-0700, para. 6.5.4.1.

1. No provision for tearing off record strip.

2. No provision in design or location to facilitate annotation of records.

3. No easy selection of paper speeds or fast runout speed are provided."

Response

1. There is no tear-off attachment to the recorder. However, the record strip can be cut off with the remainder of the roll remaining in the recorder.

2. The recorder chart platen is designed for easy marking of charts, and prevents distortion of the paper by its design.

3. 3/4 inch per hour is the only speed provided for plant historical data. Fast runout is not provided since 2 hours is all that is generally needed. The plant computer has software for pre-selected events that provides 2 hours of pre-event historical data and 4 hours of on-line storage post event. 1

B-5, Finding 19, Priority 3[1]

"Strip Chart Recorders

Scale labels do not indicate that values must be multiplied by 100 or other factors; i.e., scales are inaccurate. (Re: 0700, 6.5.1.4(b), pg. 6.5-6)."

Response

A review is in progress which will identify those scales which may cause operator confusion or may be awkward. The identified scales will be replaced or modified in accordance with NUREG-0700 guidelines prior to Licensing. 1

B-5, Finding 43, Priority 3[1]

"Strip Chart Recorders

1. As installed, there is a mismatch among scales on recorders between the (hard) parameter scale on right side and on the paper. In many scattered cases, a third scale appears as a decal on the left side of the window - representing a second parameter. This results in increased scale conflict.

2. In some cases, the decal scale is not aligned with the major line divisions on the installed paper.

NRC Review Team Comment:

Item 1 recorders are dual pen recorders."

Response

The decal scale is provided as an operator aid, facilitating the recognition of parameter values. The decal scale is aligned with the required values upon 1

calibration. The recorders observed were not calibrated. Where dual recorders with different scales are required the chart paper will have alternating or superimposed cycles for each scale installed by Hot Functional Testing. 1

B-5, Finding 40, Priority 3

"Chart Recorders

Recorders are used for trending historic information. The window sizes of the recorders being installed on CP-8 do not afford easy visual access to information being tracked."

NRC Review Team Comment:

"The recorders must be pulled out of the vertical panel to read the time history record on the chart."

Response

This "time window" visible from the front of the recorder is approximately two hours, which is sufficient for most operator needs. With a simple operator action, an additional twelve hours are visible by withdrawing the recorder. This is an infrequent action during all modes of reactor operation.

B-5, Finding 39, Priority 1

"Strip Chart Recorders

Scales are for recorders that feed left to right. The recorders feed right to left. (Graduation markings are on the side of scale away from paper). Momentary (or most current) readings are difficult because of paper roll inset and position of stylus. Hard scale does not have separate pointer, therefore, operator must refer to paper trace which is poorly associated with hard scale."

Response

The scale markings are placed away from the chart paper so that the pointer does not obscure the scale markings. The stylus is being adjusted to bring the stylus to paper contact into a position which is readily visible to the operator without requiring manipulation. All pens for the Control Room are fitted with arrow indicators which overlap the hard scale. Some recorders viewed during the audit were not yet fully assembled and were still in their shipping configuration. The decal scale also has an arrow indicator which is not adjacent to the decal scale, but which is well associated with the chart scale and readily visible to the operator. The hard scale and chart scale are properly aligned as part of the initial calibration of the recorder.

2.15.5 PHYSICAL ITEMS

B-1, Finding 8, Priority 1

"There is a hole in the Control Room floor with a protruding pipe that presents a tripping hazard."

Response

There will not be any holes in the Control Room floor prior to Licensing. 1

B-1 Finding 14, Priority 3

"The dimensions of the control board (console) are such that readability and access for the shorter potential operators is not accommodated. Based on a review of civilian population anthropometric data, it is estimated that the 5th percentile female will have a functional reach approximately 5 inches above the start of the vertical plane of the control boards. Result: Some important controls may be out of reach, e.g., Turbine Trip; Lockout relay trip on CP-1; Safety Actuation on CP-8. Upper ends of many vertical meter scales may be very difficult to read."

Response

Refer to B-1, Finding 15 below.

B1, Finding 15, Priority 3

"The Main Control Board layout in general is not designed to accommodate the 5th percentile female. Many displays even exceed the recommended viewing envelope for the 50th percentile male."

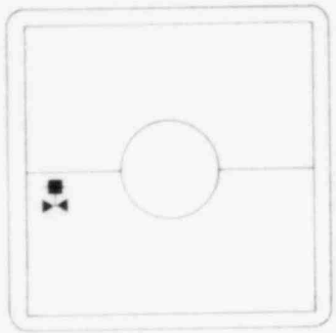
Response

Photograph 2.15-2 shows that the shortest operator (5'-2" male) can in fact reach the highest controls on CP-1. Manual operation of these controls is infrequent, deliberate and generally unhurried. 1

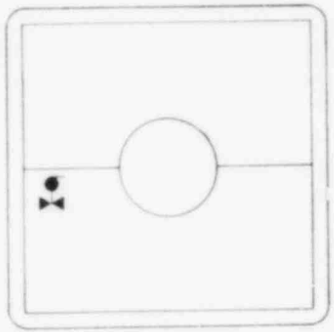
Likewise, the most significant displays are felt to be readable especially within all but the most extreme upper ranges. Often recorders showing the same parameter are located below the meters and the plant computer displays can and will be used during normal operation.

During startup testing and emergency procedure validation any significant readability or control problems will be identified. Anthropometric problems will be evaluated based on the increased potential for operator error, and the criticality of the resulting error. A report will be submitted to NRC 60 days prior to Licensing. As necessary, studies to determine feasible corrective action will be made. Possible fixes might include physical relocation, allocation to the plant computer, a change to larger meter scales with increased letter size to enhance visibility for very high (70") meters, etc. 1

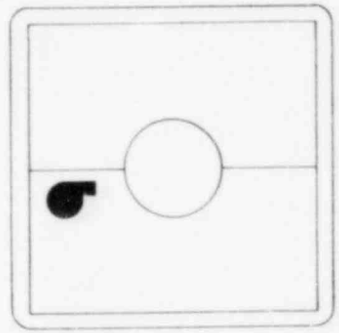
MICROSWITCH CODING SYMBOLOGY



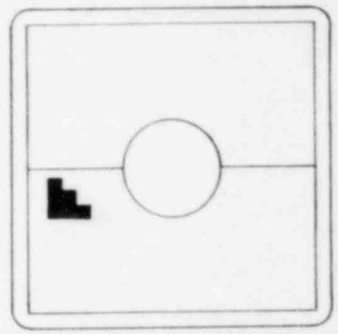
HYDRAULIC VALVE



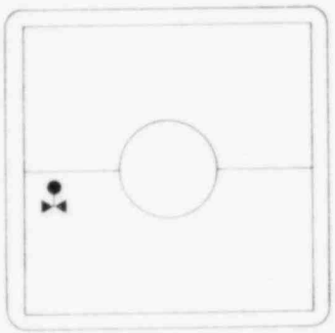
SOLENOID VALVE



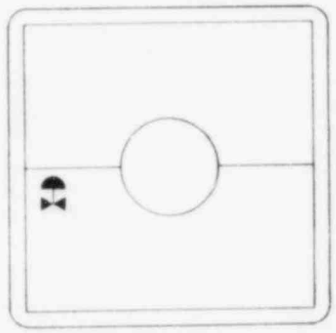
PUMP



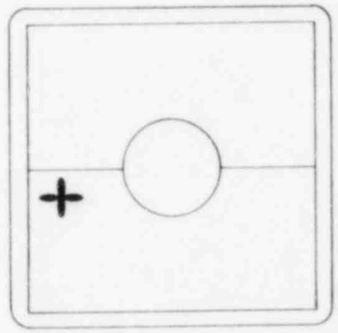
POSITIVE DISPLACEMENT PUMP



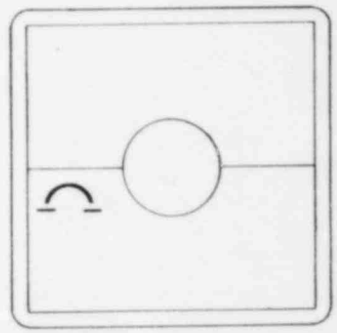
MOTOR VALVE



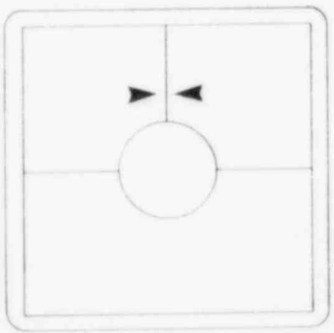
AIR VALVE



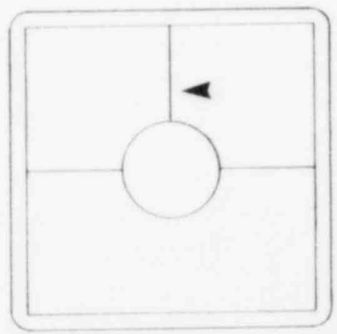
FAN



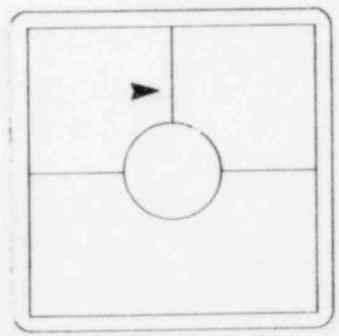
BREAKER



SPRING RETURN, BOTH SIDES



SPRING RETURN FROM RIGHT



SPRING RETURN FROM LEFT

FIGURE 2.15-1

FIGURE 2.15-2

3.0 COMMUNICATIONS

3.0 COMMUNICATIONS

The Waterford-3 Plant Communications System has the capability of providing intraplant communication, offsite commercial telephone service and offsite emergency communications.

Intraplant communications is accomplished by a Private Automatic Branch Exchange (PABX) Telephone System which is interconnected with South Central Bell, a high level voice paging system, radio communication system and a sound powered phone system.

The PABX telephone utilizes modern electronic type switching equipment capable of simultaneously supporting thirty extension stations located strategically throughout the plant. Failures in the PABX are annunciated in the MCR and Remote Shutdown Panel Room.

The Paging System consists of four independent channels powered by two preamps and five power amplifiers. To improve reliability, the speaker load is divided evenly into nine zones each covered by two channels. Voice paging announcements, site alarms, and plant evacuation signals are broadcast throughout the site by this system. Plant evacuation signals are in accordance with 10CFR50, Appendix E and fire alarm signals meet appropriate NFPA standards.

Three radio communication systems are provided for operation and maintenance (O&M) plant security and offsite communications. The O&M and plant security systems utilize separate FM frequencies. The offsite communications system operates on LP&L's assigned FM frequency and is capable of communicating with Sheriffs and Civil Defense Offices.

Communications between the MCR and the plant staff working in remote areas of the plant is accomplished using the sound powered phone system. There are eleven independent sound powered phone circuits. In addition to high reliability, this system also serves as backup to the normal PABX system. The sound powered phone system requires no external power source. The MCR and the Remote Shutdown Panel Room are both equipped with PABX dial telephones, paging, radio and sound powered phone facilities. | 1 | 1

The technical support center is provided with its own dedicated telephone and sound powered phone system.

The following findings pertain to the communication system:

B-1, Finding 25, Priority 1

"The PA system speaker for the Remote Shutdown Panel area is too large for the limited/confined area that it covers. The area is approximately 13 1/2 ft square. The speaker cone is approximately 20" in diameter."

Response

The subject speaker has been removed and has been replaced by a surface mounted cone type speaker (8 inch diameter) with integral volume control. | 1

B-2, Finding 1, Priority 1

"No provisions have been made in the Control Room for the operators to be able to block incoming calls routed to the Control Room by the Universal Non-Answering system, and the Predetermined Non-Answering system. These calls are presently transferred to the Control Room when the plant telephone operator is off duty."

Response

Prior to Licensing LP&L will provide a provision for blocking incoming calls to the Control Room by having all calls routed to security during off-duty telephone operator hours. | 1

B-2, Finding 2, Priority 1

"The Remote Shutdown room has no provision for communications, i.e., no telephone; no sound powered phone."

Response

A multi-button key set and sound powered telephone monitor/patchboard panel, both identical to the Control Room equipment will be provided prior to Licensing (DCN-E-915). | 1

B-2, Finding 3, Priority 1

"The Transfer Switch room has one telephone near the Train A panel, and none within reach of the Train B panel."

Response

Two additional telephones will be installed prior to Licensing to provide complete coverage of the transfer switch panels. (DCN-E-922) | 1

B-2, Finding 4, Priority 1

"The vertical handsets on the Main Control Board are located at knee level on front of the benchboard. In this location they are easily knocked off their cradles. No form of protection is provided."

Response

Guards will be installed prior to Licensing to minimize the possibility of an operator accidently knocking a handset from the cradle. (DCN-E-569) | 1

B-2, Finding 5, Priority 3

"The ring level telephones in the Control Room is not adjustable."

Response

The ring level is internally adjustable. The ring level will be established prior to Licensing. | 1

B-2, Finding 6, Priority 1

"The Control Room does not now have a priority access system for communications, i.e., PA System Procedures are not established."

Response

LP&L will have procedures established for the PA system prior to fuel load.

B-2, Finding 7, Priority 3

"Sound Powered Phone Module

1. Panel location requires operator to kneel for use.

2. Panel is mounted at 15° angle forward of vertical and is not easily readable from standing position."

Response

A design change for the sound powered telephone monitor/patchboard panels has been issued which will make operator use and readability easier. The circuit selector will now be located above the jack outlets at (DCN-E-915). Refer to Figure 3-1. This change will be made prior to Licensing. | 1

B-2, Finding 8, Priority 1

"There is no index which identifies stations/circuits on the sound powered telephone patch panels on the wall in back of back rack areas behind CP-25 and end of CP-14."

Response

An index will be provided for each sound powered telephone monitor/patchboard panel in the Control Room by Hot Functional Testing. (DCN-E-915) | 1

B-2, Finding 9, Priority 1

"There is no provision for storage of sound powered telephone headsets in the Control Room. Present storage is in the maintenance area of an adjacent service building."

Response

Provisions for Control Room storage of headsets will be provided prior to Licensing. | 1

B-2, Finding 10, Priority 1

"There are no sound powered headsets or storage provisions area for them in the Transfer Switch room or in the Remote Shutdown Panel area."

Response

Sound powered headsets and storage provisions for such will be provided in the relay room and the remote shutdown panel room.

B-2, Finding 11, Priority 3

"The sound powered phones selector in the back-panel area has different jack and selector designations than those in the Control Room area. Designations are temporarily stamped on a metal plate.
Examples:

a) Control Room jacks read 1, 2, 3, etc.

b) Back-panel jacks read J1, J2, etc."

Response

The design of the sound powered monitor/patchboard panels will be standardized throughout the Control Room prior to Licensing. (DCN-E-915) | 1

B-4, Finding 19, Priority 1

"On the sound powered telephone rotary selector switch, it is difficult to see the position selected. The pointer is obscured by the switch. On the 12 position rotary selection switch, 11 positio s are marked as used and the 12th positiion is blank and not used."

Response

Changes will be made to the sound powered telephone monitor/patchboard panels enhance operability and readability prior to Licensing. | 1

B-6, Finding 22, Priority 3[1]

"Sound Powered Phone Module

Poor Labeling - component relationship: vertically oriented and numbered circuit directory above a 3 row, 4 column jack matrix above a rotary circuit selector switch. See NUREG-0700, pg. 6.6-3 to 6.6-8, Para. 6.6.2.1."

Response

Refer to B-6, Finding 43 below.

B-6, Finding 43, Priority

"On the sound-powered phone patch panel stations, there are,

1. No identification labels on sound powered patch panel stations.

2. Illegible selector position indicator.

3. Illegible plug and selector position labels.

4. Poor accessibility of panel."

Response

A new arrangement, labeling and index will be provided for the sound power phone modules prior to Licensing (ref. DCN-E915). Refer to Figure 3-1. 1

In addition to the above communications HEDs dispositions some of the items not available for review at the time of the Control Room audit (refer to Section 18 of the NRC report) have been evaluated and are discussed below along with dates for review and evaluation of procedures and instructions not in place at the time of the audit.

2.0 Items A.1, A.3, and A.4

The Normal Operation Communication Procedure will be prepared and reviewed by February 1983. This procedure will include a description of communication equipment available and instruction for its use.

Items A.2

Emergency Planning Communication Procedure (EP2-010) is in place.

Control Room priority interrupts for communications system access are as follows:

(a) Public Address System

Control Room operators have public address system voice priority by operation of the control board telephones in the "page" mode by using the button located on top of the phone. Use of the "page" mode silences all other ongoing public address announcements in the plant and assigns priority to the Control Room operator for broadcasting emergency messages or instructions.

Control Room operators have public address system alarm priority by operation of the communications control panel site evacuation or fire alarm pushbuttons. This panel is located in the Shift Supervisor's Office. Operation of either alarm silences ongoing public address announcements in the plant and broadcasts the alarm. Additionally, these alarm signals have priority over the Control Room operator voice signals described in (a) above. An enable/disable switch has been provided on the communications control panel to momentarily return priority to Control Room operator voice signals when necessary.

(b) Telephone System

Control Room operators have unrestricted access to the telephone system including all intraplant extensions and offsite central office trunks. Telephones are provided on the control board, at the operator's desk and in the shift supervisor's office. The Shift Supervisor also has access to WATS lines. 1

(c) Sound Powered Telephone System

Control Room operators have priority access to all circuits (11 provided) in this system from the Sound Powered Telephone Monitor/Patchboard Panels located on the main control board.

(d) Radio System

Control Room operators have priority access to the Operations and Maintenance Radio System. A remote deskset has been provided in the main Control Room at the operator's desk for this purpose.

2.0 Item B

UHF transceivers will be used in the Control Room during startup and pre-operational testing. Digital equipment vendors will be contacted and asked to submit any data concerning their equipment's susceptibility to radio frequency signals both past and present. If it is determined that UHF transceivers will cause a problem, then they will not be permitted in the Control Room after Licensing and radio desksets which are handwired to the UHF transmitter/receiver will be used. | 1

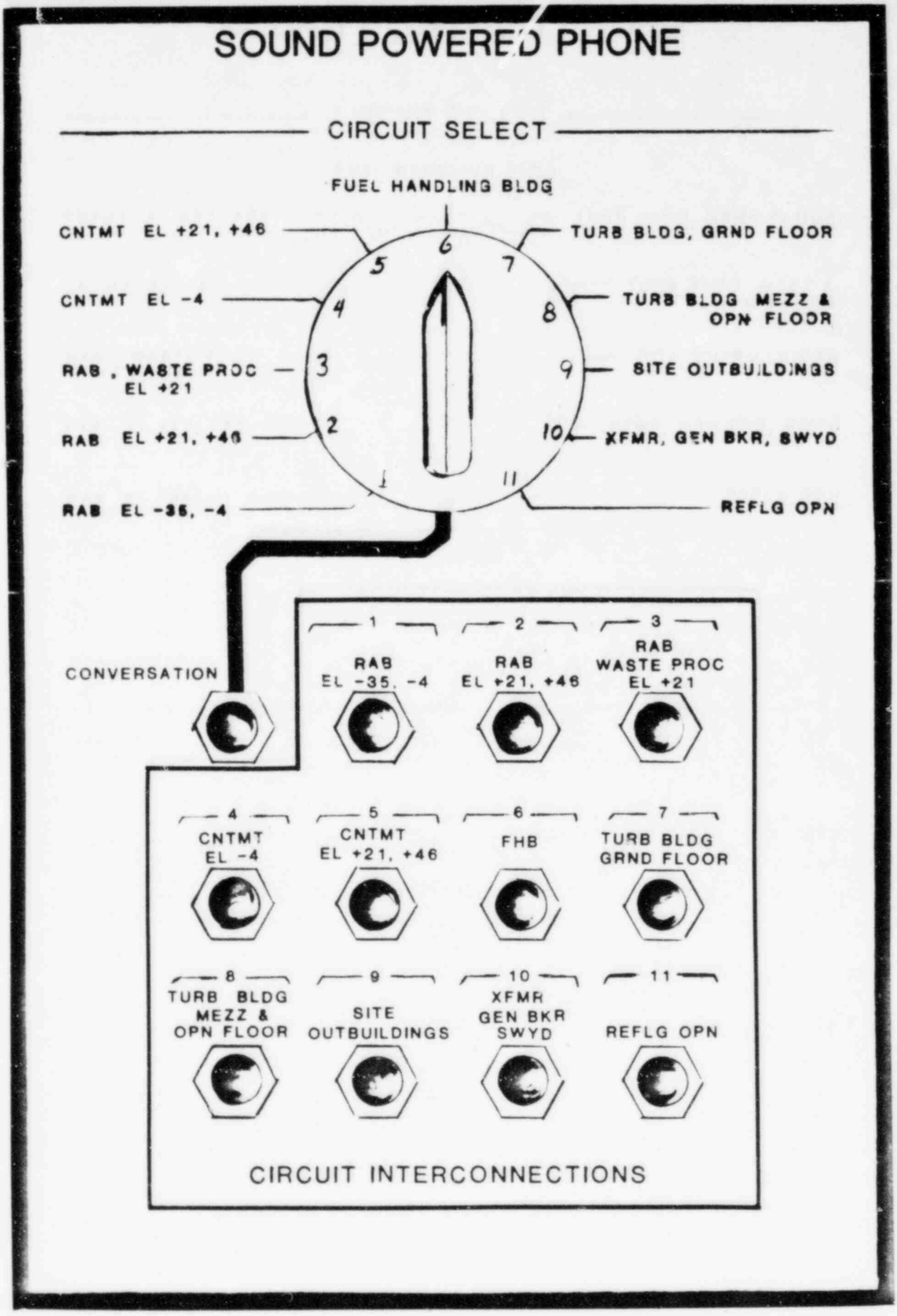
2.0 Item C

A survey of the Public Address System is planned for January 1983. The survey will provide data on the degree of voice and alarm signal coverage and the ability of the voice and alarm signals sound pressure level to overcome the ambient noise level throughout the plant site.

2.0 Item D

A survey of walkie-talkie area coverage throughout the plant will be conducted 60 days prior to fuel load as part of system checkout. | 1

FIGURE 3.1-1



SOUND POWERED PATCHBOARD
TERMINAL BOX
FRONT PLATE DETAIL

4.0 PROCESS COMPUTER

4.0 PLANT MONITORING COMPUTER

The Waterford-3 Plant Monitoring Computer System's primary purpose is to aid the operators in the safe and reliable operation of the plant. The system meets this goal by providing pertinent plant information for maintenance, operations, engineering and management personnel within the plant as well as provide information for the Emergency Response Facilities established for Waterford-3.

The NRC Audit Report expressed concern over the lack of available information to properly evaluate the computer system. Presently, procedures to control access to the data base are written and approved. The Data point indices which identify the points in the system will be produced as these procedures are used. However, operators will normally not use books to find information in the computer. The system is a CRT based system which provides the operator with the information needed without the use of list or indices. The main purposes for hard copy devices are historical records, maintenance documentation, and engineering functions.

At the present time many of the CRT display formats exist. By utilizing CRT's for display and having a software based system, LP&L has the flexibility of making the terminology of the computer system consistent with other equipment in the Control Room. The only limitation being the number of characters that can physically be displayed on the CRT screen. This extensive use of CRT's virtually eliminates the need for any other means of data display. In extreme cases of multiple equipment malfunctions or when operators desire a hard copy printers are available.

It was never the intent of the system to replace existing hardwired instruments essential for the safe operation of the plant. All information necessary for the safe operation of the plant is provided independent of the computer. LP&L did however take advantage of the computer system by providing a large amount of information in a very concise and manageable format. Without the use of the computer system it would be very difficult if not impossible to provide an equivalent amount of information in the space available.

5.0 ENVIRONMENTAL FACTORS

5.1 LIGHTING

5.0 ENVIRONMENTAL FACTORS

5.1 LIGHTING

B-1, Finding 20, Priority 1

"The present overhead lighting system with fixtures inset into the ceiling in rows and a special row over the length of the main control board produces:

1. Uneven illumination and reflections/glare off main control panel meters, chart recorder windows, CRT displays and micro-switch face plates. Readability is difficult at each noted location.

2. The light level is too bright at CRTs for comfortable viewing.

3. Surrounding surfaces reflect light and add to glare, e.g., main control panel, tiled walls and floors."

Response

The Control Room lighting switching arrangement allows independent control of the lighting within the control board area. Switch controls are provided in the Control Room. The luminous strip over the control board, each fixture immediately behind the control board and all remaining fixtures within the control board area are to be equipped with 1/2" x 1/2" x 1/2" open cell black louvers to reduce veiled glare on CRT screens, gauges and switches. Additionally, the luminous strip is equipped with opal matt diffusers to reduce glare on switches located on the horizontal slanted section of the control board and reduce glare bands on meters with bezel covers. The entire Control Room will be lamped with F40 T12 RW/3 regal white lamps to further reduce brightness (DCN-E-915). Following the above changes, a survey for both ac and dc lighting will be made and the results submitted to NRC 60 days prior to Licensing. 1

B-1, Finding 21, Priority 1

"The Remote Shutdown Panel room lighting is harsh and creates a shadowing effect on the control panel surfaces. The lower panel is subject to brighter direct lighting while the illumination level of the upper panel portion is noticeably lower."

Response

New lighting fixtures are being installed to provide a softer quality of light and an additional fixture plus a change in the lighting layout will reduce the shadowing effect (DCN-E-920). The Remote Shutdown Panel room lighting will also be included in the lighting survey (see response to B1-1, Finding 20). 1

B-1 Finding 23, Priority 1

"The Transfer Switch Room battery operated DC emergency lights appear to be inadequate for an operator to perform emergency functions during the 15 second delay period required for AC emergency lighting to come on."

Response

Six additional DC emergency lights are being installed in the relay room to provide sufficient lighting for emergency operation during the 15 second delay period required for AC emergency lighting to come on in the unlikely event that there is a loss of offsite power during a transfer to CP-43. (DCN-E-920)

B-1, Finding 24, Priority 1

"To provide emergency AC lights in the Remote Shutdown Panel room, there is a period of approximately 15 seconds between the time an offsite power loss occurs and the time diesel generator loading begins. DC battery lighting is not provided during this 15 second periods."

Response

DC emergency lights are being installed to provide sufficient lighting for emergency operation at CP-43 during a 15 second blackout. (DCN-E-920)

5.2 ACCOMMODATIONS

5.2 ACCOMMODATIONS

B-1, Finding 19, Priority 3

"Tiled/Linoleum floor poses:

1. Potential high noise reverberation.

2. High lighting reflection and general glare.

3. Probable operator fatigue - from lack of floor cushioning.

4. Potential contamination removal problem. (Porous floor is difficult to wash "clean").

5. Austere environment throughout the MCR because of prevailing hard surfaces."

Response

The Main Control Room Area will be carpeted just prior to Licensing with NFPA Class A material per ASTM E-84 (i.e., max. flame spread rate of 25) and a Flooring Radiant Panel Test result which exceeds 0.45 Watts/cm^2). Presently, we are seeking quotations from several potentially qualified suppliers. The carpeting will also be selected to provide cushioning, patching capability, low static and to improve the Control Room aesthetics. | 1

B-1, Finding 17, Priority 3

"Chairs in the Control Room need to be replaced. At time of last visit, there were two new chairs in the Control Room. The others were mended with electrical tape, had sagging cushions, and were worn out."

Response

New chairs will be provided prior to Licensing. | 1

B-1, Finding 7, Priority 1

"It was pointed out that maintenance personnel walk over to the operators console and use the desk top to fill out their paperwork. There is no space available to them at this time to write and fill out forms. From time to time, others with legitimate business will also need a desk area."

Response

During normal operation the maintenance personnel will do the major portion of their paper work outside the Control Room. Generally when inside the primary viewing area clip boards will suffice. In the back panel area maintenance carts can be used.

B-1, Finding 9, Priority 2

"The console was designed to accommodate one operator. The second operator is required to stand directly in front of the control panels at all times (an LP&L requirement). Opinions seem to be that this is an unrealistic requirement and will change once the plant is operational. Desk space should be provided for this second operator at the operator's console. There is very little storage space at the console for paper, pencils, staplers and all the other small but necessary items. There is no storage space for books, logs, etc. Presently, books are standing on end on top of the desk, obscuring the operator's view of the control panels."

Response

LP&L is presently re-evaluating the operator's console. The number of operators, required desk and storage space as well as the SPDS displays will be considered during our review. Results of this review will be submitted to NRC by Hot Functional Testing. | 1

B-1, Finding 10, Priority 2

"The present set-up with a desk for the supervisor and a table with two large CRTs to monitor radiation represents an inefficient and ineffective use of space in the supervisor's office. During an emergency, there will be a shift supervisor, a shift technical advisor and possibly the plant supervisor using this office space, which now is designed to accommodate one person.

Response

LP&L will evaluate the Supervisors' office as part of a Control Room Livability review which will also cover items identified in Section A.1 of NRC audit report. Results of this review will be submitted to NRC by Hot Functional Testing. | 1

B-1, Finding 11, Priority 2

"There is limited storage space in the Control Room proper. Presently CWDs, FSARs and system descriptions are stored in the Supervisor's office. A print cabinet to store 40 prints was ordered but no other bookcases or file cabinets are in the Control Room. There will be a need for additional storage. A roll cart has been ordered to keep near the control panels. The plan is to keep procedures on the top table of the roll cart where there is sufficient room to open the procedures out flat and to keep spare parts and expendables such as printer paper, ink, fuses, bulbs, etc., on the bottom shelf of the cart."

Response

The study of Control Room livability (see response to B-1, Finding 10 above) will also address storage of procedures; drawings, system descriptions, FSAR, files, recorder paper, ink, bulbs, keys, fuses, pens, pencils, etc. The design of the roll cart will also be reviewed. The results of this study will be provided to NRC by Hot Functional Testing and the recommendations implemented prior to Licensing. | 1

B-1, Finding 18, Priority 1

"There was no protective gear in the Control Room. In the room to be used as the Emergency Operation Facilities, there were packs containing breathing apparatus-masks and tanks. These should be in the Control Room. There was no protective clothing available."

Response

Self Contained Breathing Apparatus (SCBA) are presently stored in the Technical Support Center. Prior to Licensing these SCBAs and their spare bottles will be moved into a permanent storage locker in the Main Control Room. These SCBAs are on a monthly preventive maintenance and inventory check. 1

B-1, Finding 26, Priority 3

Habitability

"A room is needed where Control Room personnel not on duty can go to study, drink coffee or rest. Have been told that off-duty personnel will spend quite a bit of time studying and reading work related materials. No provision has been made for a place of this type."

Response

The Control Room envelope has been provided with kitchen facilities. The technical support center is also in the Control Room envelop which provides meeting and study areas.

6.0 SUMMARY AND CONCLUSIONS

6.0 SUMMARY AND CONCLUSION

Based on the previous sections of this report and its cover letter it can be concluded that Louisiana Power & Light Company has successfully initiated and is well into the implementation of a control room design review and upgrade that satisfies TMI Task I.D.1. Our control room efforts are part of a broad program which we have undertaken to ensure considerations of human factors in the design and operation of our Waterford-3 nuclear power plant. We believe that all human engineering discrepancies that have been determined to be significant or are easily correctable are being properly addressed in a timely manner.

While most corrective actions include design changes, a number of potential human factors problems are addressed by training, or procedure or computer enhancements, as well as combinations of solutions. Some human engineering discrepancies have been evaluated and determined to be insignificant or not truly discrepancies from acceptable human factors criteria.

We hope to have conveyed that LP&L has a sound appreciation of human factors engineering principles in our efforts to improve the ability of the operators to prevent or mitigate accidents by:

1. Improving the information provided to them

2. Enhancing and thus making the main control panels more intelligible

3. Upgrading the enviornment in the control room

4. Correcting significant human engineering discrepancies

5. Improving procedures and training

6. Making best use of the power and flexibility afforded by the Waterford-3 Plant Monitoring Computer.

LP&L believes that the efforts documented in this report will lead to a significant risk reduction and enhance the safe operation of the plant. While quantification of the reduction to risk is beyond the scope of this report, it is the unanimous concensus of the engineers who were part of our control room task force that the potential for human error has been reduced and will continue to be reduced by the other related projects which are ongoing or planned, such as, the simulator, the emergency procedure validation effort, SPDS, annunciator response manual, maintainability efforts, nuclear training group efforts, other relevant TMI action items, implementation of Regulatory Guide 1.97, etc. Finally we wish to thank the NRC staff and consultants for their efforts especially in the identification of additional findings during the Waterford-3 Control Room Audit.