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HUMAN-FACTORS ENGINEERING CONTROL-ROOM DESIGN REVIEW/AUDIT; WATERFORD 3 SES GENERATING STATION, LOUISIANA POWER AND LIGHT COMPANY

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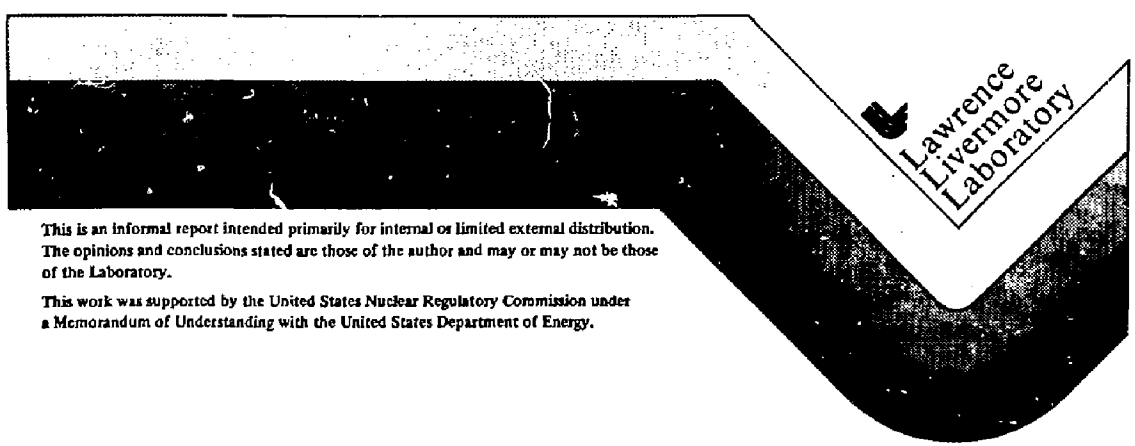

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DRAFT AUDIT REPORT

HUMAN FACTORS ENGINEERING
CONTROL ROOM DESIGN REVIEW/AUDIT
WATERFORD 3 SES GENERATING STATION
LOUISIANA POWER AND LIGHT COMPANY

Introduction

A human factors engineering design review/audit of the Waterford-3 control room was performed at the site on May 10 through May 13, 1982. The report was prepared on the basis of the HFEB's review of the applicant's Preliminary Human Engineering Discrepancy (PHED) report and the human factors engineering design review performed at the site. This design review was carried out by a team from the Human Factors Engineering Branch, Division of Human Factors Safety. The review team was assisted by consultants from Lawrence Livermore National Laboratory (University of California), Livermore, California.

All sections of the report are numbered to conform to the guidelines sections of NUREG 0700.

Section A of this report contains a list of those items that could not be evaluated during the on-site audit. The condition of construction or installation of these items at the time of the site visit was not sufficiently finalized to permit review.

Section B describes the findings which summarize the team's observations of the control room design and layout and of the control room operator's interface with the control room environment.

Section C of this report contains a list of items which the review team determined not to be valid discrepancies for the reasons stated, or were satisfactorily corrected prior to the audit.

Section D is the log of photographs taken by the NRC Audit Team during the site visit.

Throughout the report, the following notation applies:

- Findings which are marked with an asterisk (*) are verbatim transcripts of discrepancies that were reported in the Louisiana Power and Light (LP&L) PHED report submitted April 26, 1982.
- Numbers in the upper right corner of the text (e.g., 2-C1) are from the LP&L identification code used in the PHED report (see Table 1).

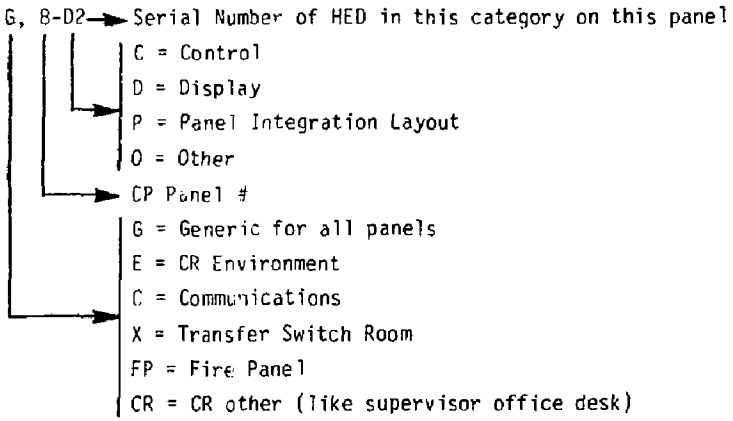
- Numbers in parentheses in the lower right corner of the text (e.g., (38)) are the serial ID numbers of the discrepancies in the LP&L PHED Report.

- HED numbers which begin with A (e.g., A064) are discrepancies that were also noted in the LP&L PHED Report.

- HED numbers which begin with B (e.g., B162) are discrepancies that were identified by NRC review team members during the control room review.

Observed human factors design discrepancies were given a priority rating of 1, 2 or 3 (high, moderate or low), based on the increased potential for operator error and the possible consequences of that error. Priority rating 1 and 2 discrepancies should be corrected prior to issuance of an operating license. Priority rating 3 discrepancies should be evaluated and proposed actions reported as part of the long-term detailed control room design review in accordance with the guidance provided in NUREG 0700. Note that some priority 3 ratings include a superscript 1 (i.e., 3^1). Since priority 3^1 discrepancies involve simple corrective actions relative to the potential for improving operator performance. These 3^1 discrepancies should be corrected prior to issuance of an operating license.

TABLE 1 - LP&L HED Identification Code



HUMAN FACTORS ENGINEERING
CONTROL ROOM DESIGN REVIEW/AUDIT
WATERFORD 3 SES GENERATING STATION
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A. SYSTEMS AND ITEMS NOT AVAILABLE FOR HFEB REVIEW

This section lists those systems and items which were not available for review either in whole or part during the HFEB site visit of May 10 through May 13, 1982. These systems and items must be reviewed and evaluated by the applicant and any discrepancies that are identified must be reported to the NRC and corrected prior to issuance of an operating license.

1.0 Control Room Workspace

A. The Remote Shutdown Panel and Transfer Switch areas had no operating or communications procedures in place and had no provisions for storing them.

B. The Control Room document organization, labeling, and storage system was not in place.

C. It was not possible to evaluate the system and procedures for communications between the control room operating crew and the shift supervisor.

D. Normal and emergency procedures and operator reference materials were not in place and could not be evaluated.

E. Operator protective equipment and emergency equipment storage facilities were not in place.

F. The Control Room environment during operations could not be evaluated.

G. Remote shutdown panel environment factors could not be evaluated.

2.0 Communications

A. Communication procedures and instructions were not in place to allow evaluation of:

1. Public Address system management use and procedures

2. Emergency response communications procedures

3. Normal operations communications procedures

4. Communication systems management, use, and procedures

5. Control room priority interrupts for access to communications systems

2.0 Communications, cont.

B. The effects of UHF transceivers on digital equipment and control systems or of the susceptibility of other equipment to electromagnetic interference could not be evaluated.

C. The paging system was not operational and could not be evaluated.

D. There has been no survey of walkie-talkie area coverage throughout the plant.

7.0 Process Computers

A. Procedures to control access to the process computer software and data base were not available for evaluation.

B. Data point indices for operator use were not available for evaluation.

C. The adequacy of CRT displays could not be evaluated because software was not completely developed.

D. The adequacy of how and where alarm messages will be recorded and printed could not be evaluated.

E. The consistency of terminology between printed alarm messages and annunciators could not be evaluated.

F. Procedures to provide operator access to the high speed printers from the control room were not available for evaluation.

8. HFEB REVIEW/AUDIT TEAM FINDINGS

B-1 CONTROL ROOM WORKSPACE

PHOTO	REV.	PRIORITY	HED	FINDING	
W-7	LRP RGR JEW	1	A002	1*	Transfer Room Projections From Ceiling X-03 Structural steel projects from room ceiling. Operators heads may strike these projections. During transfer from main control room to ECP-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. (81)
W-10	LRP RGR JEW	1	A003	2*	Door and Panel Locks X-01 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. (77) NRC Review Team Comment: No access procedures established.
CP-2	JM	2	B501	3	A wide range hot leg temperature (T_H) recorder is not provided on CP-2.
CP-2	JM	2	B502	4	A sub-cooling monitor is not provided on CP-2.
	JM	1	B503	5	To reset reactor safety injection, the operator must go to a back panel in the control room for the master reset and down to next elevation below the control room for the slave reset.

B-1 CONTROL ROOM WORKSPACE, cont.

PHOTO	REV.	PRIORITY	HED	FINDING	
W-11	RGR	1	B114	6	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.
A-1	ARS	1	A004	7*	Functional Accommodations - Maintenance CR-16 It was pointed out that maintenance personnel walk over to the operator's 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. (118)
A-7	ARS	1	B410	8	There is a hole in the control room floor with a protruding pipe that presents a tripping hazard.
A-2	ARS	2	A005 A008 A010	9*	Operator Console CR-L1 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. (113.1)
A-3	JM	2	A007	10*	Supervisors Office - Furniture Layout CR-L5 The present set-up with a desk for the supervisor and a table with two large CRTs to monitor radiation represent 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. (117)

B-1 CONTROL ROOM WORKSPACE, cont.

PHOTO	REV.	PRIORITY	HED	FINDING	
	JM	2	A009 A015	11*	Functional Accommodations - Storage CR-L2 There is limited storage space in the control room proper. Presently CWDs, FASARs 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. It is questionable as to whether all procedures will fit on the top table of the roll cart - probably not. Also, a storage space needs to be provided for spaces (sic) and expendables other than those on the bottom shelf of the cart. (114.1)
P-27	LRP RGR JEW	1	A011	12*	Emergency Shutdown Panel 43-P1 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. (104.1)
P-27	RGR	1	B211	13	There is a temporary wooden platform 8" high, with metal pipe rails, installed in front of the Remote Shutdown Panel.
M-1	JM	3	A013	14*	Generic Control Board Dimensions CR-69 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 5 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. (137)

B-1 CONTROL ROOM WORKSPACE, cont.

PHOTO	REV.	PRIORITY	HED	FINDING	
M-7	JM	3	B506	15	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.
M-4	JM	2	A014 A022	16*	CP-4 Vertical Meters G-D14 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 engineer 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. (5.1)
M-2	JM	3[1]	A016	17*	Functional Accommodations - Chairs CR-L3 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. (115)
	JM	1	A017	18*	Protective Gear CR-L7 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. (119)
	JM	3	A018 A021 A025 A026 A028	19*	Floor E-02 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. (33.4)

B-1 CONTROL ROOM WORKSPACE, cont.

PHOTO	REV.	PRIORITY	HED	FINDING	
M-6	JM	1	A019 A020 A024	20*	Illumination E-01 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 microswitch 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. (32.2)
P-34	RGR	1	B214	21	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.
M-5	JM	1	A023	22*	EFAS Switches 7-C1 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. (8.5)
P-14	RGR	1	B118	23	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.
LCP-43	RGR	1	B215	24	To provide emergency AC lights in the Remote Shutdown Panel room, there is a period of approximately 15 seconds between the time an off-site power loss occurs and the time diesel generator loading begins. DC battery lighting is not provided during this 15-second period.

B-1 CONTROL ROOM WORKSPACE, cont.

PHOTO	REV.	PRIORITY	HED	FINDING	
P-26	RGR	1	B127	25	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.
	JM	3	A027	26*	Habitability CR-L8 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. (120)

B-2 COMMUNICATIONS

PHOTO	REV.	PRIORITY	HED	FINDING	
	LRP JEW	1	B205 B308 B106 C210 C211	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.
	JEW	1	B316	2	The Remote Shutdown room has no provision for communications, i.e., no telphone; no sound powered phone.
	RGR	1	B115	3	The Transfer Switch room has one telephone near the Train A panel, and none within reach of the Train B panel.
W-5 I-38	LRP JS	1	B204 B809 B307	4	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.
	JEW	3	B309	5	The ring level for telephones in the control room is not adjustable.
	RGR	1	B107	6	The control room does not now have a priority access system for communications, i.e., PA System Procedures are not established.
W-6 I-38 I-24	LRP RGR JEW	3	A029 B808 B310	7*	Sound Powered Phone Module C-P1 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. (34)

B-2 COMMUNICATIONS, cont.

PHOTO	REV.	PRIORITY	HED	FINDING	
P-11	LRP	1	B208 C213	8	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.
	LRP	1	B206	9	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.
	RGR	1	B116	10	There are no sound powered headsets or storage provisions area for them in the Transfer Switch room or in the Remote Shutdown Panel area.
P-12	RGR	3	B108	11	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.

B-3 ANNUNCIATOR WARNING SYSTEMS

PHOTO	REV.	PRIORITY	HED	FINDING	
	JM	3	A031	1*	Fire Panel - Labeling FP-04 There are two indicator lights directly below label indicating remote panel location. One is labeled ALARM and lights red when the remote panel receives a 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. (111)
	ARS	3	B401	2	Many auxiliary system annunciators require the control room operator to direct an auxiliary operator to a given plant location to obtain specific information.
A-4	ARS	2	B403	3	A separate first-out panel is not provided for the reactor system.
A-5	ARS	2	B404	4	A separate first-out panel is not provided for the turbine/generator system.
	ARS	2	C315	5	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.
	ARS	1	C321	6	The auditory signals are not reliably discernible above average ambient noise. (10db(A) differential above ambient is recommended.)
M-8	JM	1	A032	7*	Annunciator Panels B-P1 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. (23)

B-3 ANNUNCIATOR WARNING SYSTEMS, cont.

PHOTO	REV.	PRIORITY	HED	FINDING	
A-10	ARS	3	B412	8	The Diesel Fire Pump Annunciators on CP-4 CVCS panel appear to be poorly located.
M-13	ARS	3	B413	9	The annunicators for Reactor Cooling Pump Seal Water and Component Cooling Water appear to be inappropriately located on the CP-18 HVAC and Containment Isolation Panel.
M-9	ARS	3[1]	B406	10	*Each annunciator panel is identified by a temporary label placed below the panel.*
M-10	JM	1	A034	11*	Annunciators G-D28 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. (112)
	ARS	1	B407	12	The operator aids/tools necessary for lamp replacement are not provided.
	ARS	3[1]	B409	13	No distinctive coding and administrative procedures are currently in place for annunciator tiles that must be "ON" for an extended period during normal operations.
M-9	JM	1	A033 A035 A036	14*	Annunciators G-D5 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 drawings/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. (41.1)
	ARS	3	B408	15	Cues for prompt recognition of annunciators that are out-of-service are not presently available.

B-3 ANNUNCIATOR WARNING SYSTEMS, cont.

PHOTO	REV.	PRIORITY	HED	FINDING	
	JEW	1	B313	16	The Annunciator 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).
A-11 A-14	ARS	1	B414	17	CONT is used as the abbreviation for control on CP-7 and CP-8. However, in the plant abbreviation list "CONT" means Contract, Continous, Controller, and Containment.
A-12 A-13	ARS	1	B415	18	CNTMT is widely used as the abbreviation for Containment and is not included in the plant abbreviation list provided.
M-12	JM	2	B513	19	The annunciator controls for annunciator panel B on CP-33 are located on CP-13.
	JM	1	A037	20*	Fire Panel - Alarms FP-D10 Operators report that alarms are not flashed and then converted to steady when acknowledged (as are the main control room annunciator 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. (134)
	JM	2	B512	21	Alarmed annunciators automatically silence after 10 seconds without requiring any operator action.
M-11	JM	2	B511	22	There is no separate silence control in the annunciator control groups.
A-8 A-9	ARS	1	B411	23	Repetitive groups of annunciator control pushbuttons do not have a consistent arrangement of pushbuttons at each panel location.

B-4 CONTROLS

PHOTO	REV.	PRIORITY	HED	FINDING	
P-20	RGR	1	B121	1	On the Remote Shutdown panel, there are five controllers missing: Emergency Feed-Water B Flow Controls (2); Component Cooling Water (1); Emergency Feed-water A (2).
P-15	LRP RGR JEW	1	A038 A039 A040	2*	Dry Cooling Tower Fans - Microswitches 33-C2 1. In order to turn the 4-position microswitch 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 microswitches. 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 microswitch 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. (55.2) NRC Review Team Comment: Items 2 and 3 are not discrepancies. (See Page C-2.)
P-10	LRP	1	B202 B302	3	The Containment Spray Activation System pushbuttons near the front of the CP-7 benchboard are vulnerable to inadvertent actuation. The pushbuttons are not guarded.
P-2	LRP RGE JEW	1	A043 A042	4*	Reactor Trip Pushbuttons 8-C8 Reactor trip pushbuttons on CP-2 and CP-8 do not have protective housing as described in NUREG-0700, page 6.4-4. (22)

B-4 CONTROLS, cont.

PHOTO	REV.	PRIORITY	HED	FINDING	
P-3 P-4 P-5	LRP RGR JEW	1	A044	5*	Controls - Coding G-C12 No attempt appears to have been made to utilize control coding. 1. Pumps, breakers and valves generally are operated by identical appearing microswitches. 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 microswitches. (73)
W-20	JEW	3	B322	6	Some keyswitches 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.
	LRP RGR JEW	2	A045	7*	All Pushbuttons G-C11 Pushbuttons do not provide a "click" on operation as required by NUREG-0700, Para. 6.4.3.1.b (according to operator reports). "Click" provides confirmation of intended control action. (51) 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.
W-4	JEW	1	B306	8	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.
W-1	RGR	1	B101	9	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.

B-4 CONTROLS, cont.

PHOTO	REV.	PRIORITY	HED	FINDING	
P-7	LRP RGR JEW	1	A046	10*	Microswitch Lamps G-C8 No lamp test feature is provided. Dual lamp indications are rare. These characteristics violate NUREG-0700, Para. 6.4.3.3.c.1. A lamp "off" signal is used throughout panels for positive display information. (48) 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).
P-6	LRP RGR JEW	2	A047	11*	Fire Protection Panel - Pushbuttons FP-C1 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 keyswitch looks like it disables the panel. It does not. Method of actually disabling Halon is difficult due to backup power. (52) NRC Review Team Comment: There is no keyswitch on the panel.
P-34	LRP RGR JEW	1	A048	12*	Keyswitches G-C3 Many keyswitches operated by same key. Was told there were four keys for all keyswitches, although there will be several sets of keys. (27) NRC Review Team Comment: It could not be verified that there there were four keys for all keyswitches. Key control procedures are not in place.
	DS JS	3	A139	13*	Keyswitches G-C14 Per NUREG-0700, Para. 4.4.3.a, keyswitches 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. (87) NRC Review Team Comment: Keys are also used in administrative control.

B-4 CONTROLS, cont.

PHOTO	REV.	PRIORITY	HED	FINDING	
P-34	RGR	1	B217	14	On LCP-43, keylock switches have 3 positions Left = Normal Right= Bypass Middle or straightup position is not labeled.
P-8 P-34	LRP	2	B225	15	On CP-4, some keyswitches have different key orientation from the key teeth down convention used in the control room.
P-9	RGR	1	B230	16	The locked position is not identified for some keylock switches.
W-2	JEW RGR	1	B304 B102	17	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.
W-3	RGR	2	B103	18	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").
W-6	LRP	1	B207	19	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 selector switch, 11 positions are marked as used and the 12th position is blank and not used.
	LRP RGR JEW	3	A050	20*	Microswitches G-C15 According to operator, some spring-return microswitches 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. (102)
	RGR	3	B104	21	On CP-33 when the Containment Hydrogen Detector 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.

B-5 VISUAL DISPLAYS

PHOTO	REV.	PRIORITY	HED	FINDING	
	DS JS	1	A056	1*	Pump Motor Amps C-D12 Motor amperage is not displayed and is considered necessary by operators. NUREG 0700, Para 6.5.1.1.b requires that necessary information be presented. (45)
CP-33	DS JS	3	A128	2*	Dry Cooling Tower Fans - Labels 33-D2 Of the 15 dry cooling tower fans on the A side and 15 on the B side, 9A and 9B 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. (57)
I-10	DS JS	1	A051	3*	Safety Injection Tank Display 8-D2 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 both instruments would remain accurate? (12)
M-17	DS JS	1	A052	4*	Safety Injection Tank Pressure 8-D3 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. (13) NRC Review Team Comment: Also see A053, A051.
M-17	DS JS	1	A053	5*	Safety Injection Tank Pressure 8-D1 Meters seem to be duplicates. 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 both instruments would remain accurate? (36) NRC Review Team Comment: Also see A051, A052.

B-5 VISUAL DISPLAYS, cont.

PHOTO	REV.	PRIORITY	HED	FINDING	
M-17	DS JS	1	A054	6*	Safety Injection Tank Pressure 8-D5 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. (68) NRC Review Team Comment: This and A055 are a repeat of A052, A053.
M-17	DS JS	1	A055	7*	Safety Injection Tank Pressure 8-D6 Repeats measurements of C-42. Since both transducers operate from the same side of the valve, additional reliability to the reading/comparison is questionable. (69) NRC Review Team Comment: This and A054 are a repeat of A052 and A053.
	DS JS	1	A057	8*	Indicators on Microswitch Controls G-C6 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, Para. 6.5.1.1.e.1 requires that actual as opposed to commanded status be indicated. (46) NRC Review Team Comment: Also see A130.
I-8	DS JS	1	A058 A082	9*	Meters - Combined Scales G-D20 Many dual scale meters use one side for parameter status, the other side for set point. It appears that the term "set point" is generic and does not differentiate between: 1. Set point as desired status (from which actual status deviates +). 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 #2 and #3. (82.1)

B-5 VISUAL DISPLAYS, cont.

PHOTO	REV.	PRIORITY	HED	FINDING	
I-30	DS JS	3	B710	10	Most meters fail to the bottom of the scale rather than to off-scale.
	DS JS	1	A059 A130	11*	Labels G-D15 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. (71.1)
	DS JS	1	A060	12*	Meter Displays Measuring in Percent (%) G-D16 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? (72)
CP-1	DS JS	1	A061	13*	Turbine Steam Inlet - Meters 1-D7 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". (99.1)
	DS JS	3	A081	14*	Dual Scale Meters G-D10 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. (42)

B-5 VISUAL DISPLAYS, cont.

PHOTO	REV.	PRIORITY	HED	FINDING	
CP-1	DS JS	1	A062	15*	Meters 1-D5 Both meters dispay 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. (95) NRC Review Team Comment: One meter is Running Bus; other is OAC GEN VOLTS.
	DS JS	1	A063	16*	Measurement Units G-D27 Pressure is displayed on many different scales: PSI absolute, PSI atmospheric, PSI difference, PSI (unmodified) inches Hg, inches water. Confusion is most likely if different pressures must be integrated or compared during operating evaluation of status of problem diagnosis. (103)
P-21	RGR	1	B124	17	There is a glare problem with the meters (curved vertical) located on the upper part of the Remote Shutdown Panel LCP-43.
I-35	DS JS	3[1]	B713	18	There is extraneous information on meter faces located on CP-13 (e.g., circular meters indicating phase angle, vibration, and speed).
	DS JS	3[1]	A065	19*	Strip Chart Recorders G-D17 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). (74)
I-17	DS JS	1	A066	20*	Dual Meters - Neutron Flux Level Start-Up 2-D3 Log scale appears inverted - possibly an assembly error. Major divisions are correct; intermediate and minor are not. (4)
	DS JS	1	A068	21*	High Numeric Value Meters G-D9 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, etc. There is no consistent pattern presented across the control panels. (39)

B-5 VISUAL DISPLAYS, cont.

PHOTO	REV.	PRIORITY	HED	FINDING	
I-11	DS JS	1	A059	22*	Meters G-D23 Discriminability of minor and intermediate scale markings is poor. Their dimensions violate the guidelines of NUREG 0700, Para. 6.5.1.5. (85)
	DS JS	1	A070	23*	Meter Scales G-D25 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 and multiples thereof. Recommended practice also calls for no more than 9 graduations between numbers. Also, graduation marks should be highlighted at major intervals. (89)
CP-2	JS	1	B806	24	On CP-2, one PZR LVL meter scale states DC Volts; the other PZR LVL scale states % but units are not indicated.
I-8	DS JS	3	A071 A072	25*	Pressurizer Pressure 7-D2 1. These critical meters use multiples (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 Set Point meters display in 50 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. (10.1)
CP-7	DS JS	1	A073	26*	CP-7 Containment Pressure 7-D4 Wide range measures from 0-40 psi. Narrow range measures from 0-30 psi. Mixed scales on same meter make easy interpolation/ reading difficult. (11)

B-5 VISUAL DISPLAYS, cont.

PHOTO	REV.	PRIORITY	HED	FINDING	
P-43	LRP RGR JEW	1	A074	27*	Cooling Towers 43-D3 Two like measured parameters (temperature) with dissimilar scales immediately adjacent to each other. NUREG 0700, Para. 6.5.1.6.d, Exhibit 6.5-6. (127) NRC Review Team Comment: Dual scale vertical meters Left Scale 50 - 130 Degrees F range Right Scale 30 - 110 degree F. range.
CP-4	DS JS	1	A077	28*	Chart Recorder 4-D5 The two recorders adjacent to D-5 records 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. (65)
I-32	DS JS	1	A078	29*	Color Coding G-027 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 exit, however, as with the use of red lights on controller buttons; colors (mixed) on various module push switches; red "TRIP" buttons. (136) NRC Review Team Comment: Color code conventions are violated at many locations in the control room.
	JEW RGR LRP	2	A079	30*	Steam Generator Pressure 43-D5 Pre-trip indicators provide a steady red light indication of impending trip. This is a warning indication but is identical to the normal status indication of microswitches throughout the plant. (129)
	LRP RGR JEW	1	A080	31*	Letdown Flow and Pressure 43-D6 It appears that the control switches have lights (white) indicating value 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. (130)

B-5 VISUAL DISPLAYS, cont.

PHOTO	REV.	PRIORITY	HED	FINDING	
I-34	DS JS	1	B712	32	The Pressurizer pressure and set point dual meter is loosely mounted on CP-8. This condition could allow vibration of the meter which in turn could cause erroneous readings.
	DS JS	3[1]	A083	33*	Meter Banding G-D22 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). (84)
I-36	DS JS	3[1]	B714	34	There is a lack of operating zone markings on meters throughout the Control Room.
	DS JS	1	A085	35*	Microswitches G-C10 Operator reports that when some valves are actuated, both microswitch 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. (50)
W-1	DS JS JEW	1	A086	36*	Microswitch Lamps G-C7 Some microswitches 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 in 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. (47)
	DS JS	1	A087	37*	Microswitches G-C9 Operator reports that while a valve is cycling, some microswitches will show both "open" and "closed" lamps on; others will show both lamps off. Neither method displays the "from and to" status. (49)

B-5 VISUAL DISPLAYS, cont.

PHOTO	REV.	PRIORITY	HED	FINDING	
	DS JS	1	A088	38*	Rod Bottom Mimic Display 2-D4 Numbered rod bottom indicator lamp caps are not keyed to prevent installation in improper location or improper orientation. (66)
I-12	DS JS	1	A089	39*	Strip Chart Recorders G-D6 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. (14)
I-13	DS JS	3	A090	40*	Chart Recorders G-D3 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. (31) NRC Review Team Comment: The recorders must be pulled out of the vertical panel to read the time history record on the chart.
I-13	DS JS	3	A091	41*	Strip Chart Records G-D13 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. (53)
	DS JS	3	A092	42*	Strip Chart Recorders G-D19 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. (76)

B-5 VISUAL DISPLAYS, cont.

PHOTO	REV.	PRIORITY	HED	FINDING	
	DS JS	3[1]	A093	43*	Strip Chart Recorders G-D18 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. (75) NRC Review Team Comment: Item 1 recorders are dual pen recorders.
I-37 W-16	DS RGR JS JEW	1	A094 B715 B223 B319	44*	Strip Chart Recorders G-D11 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. (43) NRC Review Team Comment: All recorders presently have the wrong paper.
	DS JS	1	A095 A084	45*	Hydrogen Analyzer 33-D4 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. (107.1)

B-6 LABELS AND LOCATION AIDS

PHOTO	REV.	PRIORITY	HED	FINDING	
	DS JS	1	A096 A127	1*	All Controls G-C5 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. (40.1)
I-18	DS JS	1	A097 A113	2*	Valve Status Indication 4-C43 These status indicators do not have labels to indicate status, i.e., valve position close-open. (60.1) NRC Review Team Comment: Refers to CP-4 Charging Pumps Header discharge valve and PZR Aux Spray valve.
	DS JS	1	A098	3*	Refueling Water to Charging Pump 4-C4 This switch is not labeled. (61)
	RGR JEW LRP	1	A099	4*	Transfer Switches X-02 Access doors over transfer switch panels are not differentiated from other doors. They are scattered among cabinets on 2nd level transfer room. (80)
I-23	DS JS	1	A100	5*	Dual - Actuation Pushbuttons 1-D4 Association of dual action controls and association of "think" button and applicable controls are not shown. (94)
	DS JS	1	A101	6*	Turbine Steam Inlet - Meters 1-D7 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". (99.2)

B-6 LABELS AND LOCATION AIDS, cont.

PHOTO	REV.	PRIORITY	HED	FINDING	
1-22	DS JS	3	A102	7*	Fire Panel - Labeling FP-D6 Labels do not provide adequate information to the operator to pinpoint the fire area. This differs from HED 121 because labels are located on indicator lights in 121, and labels are placed between FIRE and TROUBLE indicators on the local panels, i.e., FPE-3. (122) NRC Review Team Comment: This also applies to the local fire detection and fire protection (water control) panels, e.g., 7888-M223 in relay room; labels FPM17, FPM18, FPM19.
I-14 I-15	DS JS	1	A103	8*	Labeling - Mimic Plant Electrical System 1-D3 Circuit breaker indicators (not micro-switches) are not labeled. Bus sections are not labeled. (93)
P-18 I-41	DS RGR JS	1	B702 B120 B717	9	Labels are missing from controls and displays throughout the control room. Many permanent labels have become detached (e.g., CP-8).
W-9 W-12 W-11	JEW	1	B314	10	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).
P-30	RGR	1	B212	11	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.
	JS	1	B814	12	On the mimic on CP-1 and on CP-2, there are sets of indicator lights that are either not labeled or not inscribed.
P-29	RGR	1	B128	13	There is no permanent panel identification on LCP-43. It is written on with grease pencil.
P-24	RGR	1	B125	14	In the Remote Shutdown panel room, there is an unlabeled blue pushbutton on the communication panel.
	RGR	1	B941	15	There is no panel number on the Remote Shutdown Panel communications panel.

B-6 LABELS AND LOCATION AIDS, cont.

PHOTO	REV.	PRIORITY	HED	FINDING	
P-28	RGR	1	B130	16	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.
I-39 I-40	DS JS	1	A104	17*	Labeling - Redundancy G-D2 No hierarchical labeling. Lack of hierarchical labeling results in the need for redundant labeling, a lack of visual grouping of functionally related components. (30)
I-1 I-2 I-3 I-4 I-5 I-6	DS JS	1	A106 A122 A107 A136	18*	ESFAS Switches 7-C1 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 polished (silver) metal. Glare and poor contrast make readability poor. (8.3)
	DS JS	1	A109 A105	19*	Labeling G-D24 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, requires labeling above. 3. Hand action on a control covers the label, increasing error potential. (88.2)
	DS JS	1	A110	20*	Meter Labels G-D26 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.) (90)
P-16	LRP RGR JEW	1	A111 A119	21*	Letdown Flow and Pressure 43-D7 Labeling on switches and status display faces are inaccurate. Poorly positioned and confusing. (131)

B-6 LABELS AND LOCATION AIDS, cont.

PHOTO	REV.	PRIORITY	HED	FINDING	
P-24	LRP JEW RGR	3[1]	A108	22*	Sound Powered Phone Module C-P2 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. (35)
B-1 B-2 B-3	PSW	3[1]	B602 B813 B122	23	Labels are not placed above the panel elements they describe (e.g., on CP-8, CP-13).
P-25	RGR	2	B129	24	Tag outs are large and obscure adjacent controls and indicators (e.g., LCP-43).
	DS JS	1	A112	25*	Wide/Narrow Range Meters G-D8 Meters labels do not include the designators, "wide range" or "narrow range," as appropriate. Labels should be accurate. (38)
I-19	DS JS	1	A114	26*	Equipment Drain Tank 4-D2 Meter C-12 is not adequately labeled to show parameter being measured. (62) NRC Review Team Comment: One is meter labeled PSIG and another is labeled only %. This discrepancy also applies to the Holdup Tank and the Reactor Drain Tank.
	DS JS	3	A116	27*	Fire Panel FP-D1 A fire in the plant can affect cables and therefore instrumentation on the control panel. There is no way at present for the operator to know which instruments would be affected by a fire in a particular area. (108)

B-6 LABELS AND LOCATION AIDS, cont.

PHOTO	REV.	PRIORITY	HED	FINDING	
I-21	DS JS	3	A117	28*	Fire Panel - Labels FP-D2 Labels are misleading. Left-hand portion of panel is divided according to location of 5 local panels. The label "FPE-1 RAB EL.-4" identifies the location of FPE-1 (local panel) as in the reactor auxiliary Bldg. at -4 ft. elevation. This label implies that the detectors are located in the RAB -4ft. 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 2 bldgs., plus the water treatment bldg. (109)
I-21	DS JS	3	A118	29*	Fire Panel - Labeling FP-D5 Inadequate information displayed on indicator lights. Label reads, for example, RAB 30. This means area 30 in the Reactor Auxiliary Bldg., but the operator must look at a drawing to locate area 30. (121)
	LRP RGR JEW	1	A120 A131	30*	Transfer Switches X-C1 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. (79) NRC Review Team Comment: Switches on Panels SB, SA/B, SA, NA/B.
P-23	RGR	1	B126	31	On LCP-43 there is inconsistent use of abbreviations i.e., emer./emerg., CR/Contr. Rm.
I-43	DS JS	1	B719	32	Functional labeling is not used in the control room or at the Remote Shutdown Panel.

B-6 LABELS AND LOCATION AIDS, cont.

PHOTO	REV.	PRIORITY	HED	FINDING	
I-20	DS JS	1	A121	33*	Boric Acid Pump Selector 4-C1 The combination and sequential arrangement of the pump selector sets as now exist and displayed on the face plate of the charging pumps selector is difficult to follow. There is no clear relationship between this switch selection arrangement and the pump switches it refers to above it. (6)
	DS JS	1	A126	34*	All Micro Switches G-C1 Multiple types of micro switches with little or no visual indication of how they operate or how they differ from each other. (25)
	DS JS	1	A129	35*	Holdup Tanks Vent 4-D4 This vertical meter is mislabeled. It is now labeled (Hold Up Tank D). It should be labeled (Hold Up Tanks Vent Header Pressure). (64)
I-21 I-22	DS JS	3	A132	36*	Fire Panel - Labeling FP-D8 The word TURBO is used in labeling. Turbo is a prefix and should not be used as a substitute word for turbine. (124)
	DS JS	1	A133	37*	Labeling - Abbreviations G-D1 Abbreviations are sometimes confusing and sometimes inconsistent. NUREG-0700, 6.6.3.3 recommends consistency. Examples include: COND - used for condensor and condensate CONT - used for containment and control VA - consistently used for valve but may be confused with vacuum. (29)
	DS JS	1	B703	38	Labels on annunicators 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.
I-27	DS JS	1	B706	39	There is inconsistent labeling on CP-13; e.g. on "Heater" sub panel, 1 & 2 indicates HP, 3 & 4 indicates IP, 5 & 6 indicates LP. On "Heater bypass" sub panel, HP indicates HP, IP indicates IP, LP indicates LP.

B-6 LABELS AND LOCATION AIDS, cont.

PHOTO	REV.	PRIORITY	HED	FINDING	
P-19	LRP RGR JEW	1	A137	40*	Control Room Exhaust Fan Switch 43-D8 Labeling on switch face is inaccurately positioned. (132)
	DS JS	3	A138	41*	Labeling G-D21 Lettering on labels is often too small for recommended legibility at applicable viewing distances. (83) NRC Review Team Comment: e.g., Hagen controllers on CP-18
I-31	RGR JS OS	1	B123 B709	42	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.
P-12 P-13	LRP	1	B209	43	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.
	DS JS	1	A140	44*	All Vertical Meters - Snap On Labels G-D4 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. (17)
I-42 P-31 P-17	DS RGR JS	1	B718 B119 B210 B228	45	There are many unnecessary temporary labels which should be replaced by permanent labels in the Control room and the RSP room.
P-32 P-33 A-18	RGR JS ARS	1	B213 B227 B810 B811 B815 B430	46	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.

B-6 LABELS AND LOCATION AIDS, cont.

PHOTO	REV.	PRIORITY	HED	FINDING	
	JS	3[1]	B812	47	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.
I-16	DS,JS	1	A141	48*	Mimic of Plant Electrical Systems 1-D6 Mimic of diagram of power flow to transformers supply power to plant equipment is incomplete and inaccurate. (97)

B-7 PROCESS COMPUTERS

PHOTO	REV.	PRIORITY	HED	FINDING	
M-15	JM	3	A142	1*	Numeric Entry Keyboards G-C2 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. (26)
M-16	ARS	1	B421	2	A 5x7 dot-matrix is used on the CRT displays which causes readability problems.
M-14	JM	1	A143	3*	CRT Displaying CEA Positions 2-D1 Scaled tapes are applied to the face of the CRT, at borders. Scales delinate 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 plate 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. (3)
	JM	1	B514	4	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.
	JM	1	C734	5	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.

B-8 PANEL LAYOUT

PHOTO	REV.	PRIORITY	HED	FINDING	
P-37 P-38	LRP RGR JEW	1	A144 B218 B219	1*	CP-1 1-P1 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. (1) *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 of bottom sloping panel and the Cond. Vac. Pump exhaust valve control is located at the lower right of bottom sloping panel. 3. *COND to MAKEUP TIE (TK) VALVE is located* in the middle of the right lower sloping panel. 4. Cond. Vacuum Brkr, Cond. B Vac. recorder are located on the upper left vertical panel below annunciators.
M-17	JM	2	A145	2*	Steam Generator and CCW Controls 8-C5 Current arrangement can be improved upon to afford a better grouping of related controls. (20)
P-41	JEW	1	B318	3	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
M-17	JM	2	A146	4*	Steam Generator and CCW Controls 8-C6 Current arrangement can be improved upon to present a more accurate relationship between controls. (21)
	DS JS	3	A147	5*	Pushbutton CP-33 33-C1 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 the cooling tower fan controls on CP-33. (54)

B-8 PANEL LAYOUT, cont.

PHOTO	REV.	PRIORITY	HED	FINDING	
	LRP	1	A148	6*	Indication of Transfer 43-D1 No indication is provided in the Emergency Control Room that all transfer switches have been thrown, or that all transfer switches have not been thrown. In the latter case, there is no indication of which switches have not been thrown (there are approx. 62 switches). (78)
	LRP RGR JEW	1	A149 A167	7*	Steam Generator Pressure 1-D2 On CP-1, steam generator pressure is shown only as combined value on indicator on 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. (91.1,.2) NRC Review Team Comment: Isol. valve controls are on CP-8.
P-38	LRP RGR JEW	1	A150	8*	River Water Supply Valve 1-C1 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. (92).
	LRP	1	A151	9*	Annunciator Panel 43-P3 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 had only the existing LCP-43. (133)
	DS JS	1	A134	10*	Dry Cooling Tower Fans - Labels 33-D1 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. (56)

B-8 PANEL LAYOUT, cont.

PHOTO	REV.	PRIORITY	HED	FINDING	
I-26	DS JS	2	B704	11	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 button for annunciators on CP-33 and a CR Potable Water switch.
	JS	3	B807	12	Some annunciators for CP-18 equipment are on the CP-33 and CP-35 annunciator panels.
I-25	DS JS	1	A067	13*	Dual Scale Meters G-D7 There are two types of dual scale meters: 1) Displaying two parameters, and 2) Displaying one parameter and one set point. Because of their identical appearance, clustered installation, and subtle label differences, the operator could mistake a set-point scale for a parameter reading - especially under current labeling practices. The reverse interpretation may also occur. (37)
P-27	LRP	1	A152	14*	Emergency Shutdown Panel 43-P1 Meters and controls are located far too high on this panel. Recommended upper limit 72". Problem is compounded by poor layout, lack of good associations. (104.2)
	DS JS	3	A153	15*	Fire Panel - Grouping FP-D9 Indicators for Fuel Handling Building Fire and Trouble are located in two columns. (125)
P-37 W-18 W-19 M-18	LRP RGP DS JEW JM JS	1	A154 A157	16*	Panel Integration G-P1 Association between controls 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. (135.1,.2)

B-8 PANEL LAYOUT, cont.

PHOTO	REV.	PRIORITY	HED	FINDING	
W-18	JEW	1	B320	17	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'.
W-19	JEW	1	B321	18	Reactivity is controlled during start up at CP-2, while indication (count rate steps) is provided on panel CP-7 approximately 10' away. The Indicator, when viewed from CP-2, has 2 bands of glare near mid-scale.
I-31	DS JS	1	B708	19	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 (eg., 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.
	ARS	1	B425	20	On CP-8, enhancement techniques, such as spacing, demarcation, and color shading, are not used for setting apart groups of controls and displays.

B-8 PANEL LAYOUT, cont.

PHOTO	REV.	PRIORITY	HED	FINDING	
W-14	LRP JEW RGR	3	A155 A163 A168 A012	21*	Emergency Shutdown Panel 43-P2 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 B), RCS/Pressurizer. Entire upper portion of panel have layouts that do not reflect functional grouping, operator use, anthropometerics, or reasonable control display relationships. (105.2) 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-to-bottom relationship.
	RGR	1	A156	22*	Condensate Storage Pool - Meter 43-D2 Position of meter does not easily permit the functional grouping of the meter with emergency feedwater system. (126)
A-16	ARS	2	B426	23	On CP-8, displays which are observed in a specified sequence are not grouped together. Example: SI TANK PRESS SI TANK LEVEL
	LRP	1	A158	24*	Emergency Feedwater to Steam Generator 43-D4 Flow meters are physically separated (approximately 9") from associated flow controllers by two other controllers not directly related to the meters. (128)
P-40	LRP RGR JEW	1	A159	25*	Boric Acid Gravity Feed Valves 4-C2 The order in which A73 and A77 is arranged, valve B to the left of valve A is poor. This arrangement breaks control board conventions and human expectations. (59)

B-8 PANEL LAYOUT, cont.

PHOTO	REV.	PRIORITY	HED	FINDING	
M-17 M-7	JM	2	A160 A171	26*	EFW Pump Turbine - AB Stop Valve 8-D7 Switch is not located within the appropriate group of controls. A funtionally more appropriate location should be found giving the criticality of the control. (70.1,.2)
	JS	3	B802	27	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 Annunicators: QT Level, QT Press, QT Temp (vent).
P-40 P-39	RGR	2	B221 B220	28	On CP-4 there is an inconsistent left-to-right, top-to-bottom numbering convention, i.e., 1. Boric Acid Tank B & A Gravity Feed valve. 2. Charging Loop 2A and 1A valve controls.
	JS	3	B804	29	On CP-2 the Quench Tank Vent Drain valve controls are not directly below their corresponding meters.
1-27	DS JS	2	B705	30	On CP-13 the Extraction Steam Ho[illegible] controls/displays are layed out in [illegible]og-leg arrangement.
	DS JS	3	A161	31*	Fire Panel - Grouping FP-D7 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. (123)
A-18	ARS	3	B429	32	On CP-33, partial mirror imaging exists; e.g., H_2 Analyzers and H_2 Recombiners.
W-17	LRP RGR JEW	1	A162	33*	Equipment Drain Tank 4-D3 The placement of C-11 and C-12 does not follow pattern set by the adjacent meters, that is (psig) TK vent, followed by (level) DRN TK. (63)

B-8 PANEL LAYOUT, cont.

PHOTO	REV.	PRIORITY	HED	FINDING	
I-9	DS	1	B701	34	On CP-7 Containment Pressure meters, wide range meter is on right; on Pressurizer Pressure meters, wide range is on left.
I-28 I-29 A-16	DS ARS JS	1	B707 B427	35	On CP-1 and CP-8 there are groups of 10 meters in a row, instead of the recommended maximum of 5 in a row.

B-9 CONTROL-DISPLAY INTEGRATION

PHOTO	REV.	PRIORITY	HED	FINDING	
	DS JS	1	A166	1*	Wet Cooling Towers - Meters 33-D3 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. (58) NRC Review Team Comment: Panels CP-8 and CP-33 are across the room from each other.
	ARS	1	B423	2	"PZR SET POINT SMC" displays on CP-7 are separated from the associated controls on CP-2. The Pressurizer Pressure display on CP-2 only goes to 1600 psig.
	DS JS	1	B801	3	Four startup rate-of-change power meters on CP-7 are used in conjunction with the rod insert-withdraw joy sticks on CP-2, about 8' away.
R-1	RGR	2	B224	4	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 off local/remote.
	DS JS	1	A170	5*	Letdown - Indication and Control 2-P1 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. (100) NRC Review Team Comment: Controller and display are approximately 8 feet away from the Valve A, B, and both selectors.
P-42	RGR	1	B222	6	On CP-4, the association between the gross coolant activity recorder and the push-buttons/indicators above it is not clear.

B-9 CONTROL-DISPLAY INTEGRATION, cont.

PHOTO	REV.	PRIORITY	HED	FINDING	
	JS	2	B805	7	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 annunicator tiles are on an adjacent panel not directly above the pump controls.
A-17	ARS	2	B428	8	On CP-8, multiple controls and displays related to the same function are not grouped together, (e.g., SI TANK VENT VA).
W-15	LRP RGR JEW	2	A172	9*	Cooling Water Temp and Press Controls 1-P2 The four referenced elements 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. (96)
W-13	JEW	3	B317	10	On LCP-43, the Charging Pump A/B control is separated from associated displays by the CCW-PUMP A/B Control and Displays.
W-21	JEW LRP	1	A173	11*	Turbine Generator - Temperature Controls 1-C3 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. (101) 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).

C. ITEMS THAT ARE NOT VALID DISCREPANCIES

C-1 CONTROL ROOM WORKSPACE

PHOTO	REV	HED	FINDING		
	ARS	A006	1*	Supervisors Office - Layout There is only one entrance/exit to and from the supervisor's office and this is by the only normally used entrance and exit to the control room. This requires the supervisor to walk into the high traffic area to get out to the control room proper.	CR-L4 (116)

C-3 ANNUNCIATOR WARNING SYSTEM

PHOTO	REV	HED	FINDING		
	JM	A030	1*	Master Remote Fire Protection System It was reported that the area location indicators (RAB 30 LOCATION, ETC.) light only when the ALARM indicator is activated indicating a fire and not when the TROUBLE indicator is activated.	FP-D3 (110)

C-4 CONTROLS

PHOTO	REV	HED	FINDING	
	LRP RGR JEW	A041	1*	Microswitch 1-C2 Inadvertent opening of the exciter field breaker will trip the generator; consequently, the turbine; consequently, the reactor. The switch is unprotected and undifferentiated. (98) NRC Review Team Comment: The exciter is interlocked to the generator breaker and cannot trip the generator exciter field breaker when the generator is ON. No protection or differentiation is needed.
P-8 P-9	LRP JEW RGR	A049	2*	Keyswitches G-C4 Four keys operate all keyswitches on main control boards. NUREG 0700, para. 6.4.4.3e states "operators should not normally be able to remove the key from the lock unless the switch is turned to the OFF or SAFE position". (28) NRC Review Team Comment: The key can only be removed when the keyswitch is in the locked position.
P-15	LRP RGR JEW	A038 A039 A040	3*	Dry Cooling Tower Fans - Microswitches G-C4 1. In order to turn the 4-position microswitch 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 microswitches. 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 microswitch 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. (55.2) NRC Review Team Comment: Item 1 is a discrepancy (see Page B-12).

C-5 VISUAL DISPLAYS

PHOTO	REV	HED	FINDING	
	DS JS	A064	1*	Steam Flow and Feedwater Flow - Recorder 7-D1 Normal flow for steam and feedwater for SG's 1 and 2 are 7.5 x 10^6 lb/hr. Maximum displayable values are 8.0 x 10^6 lb/hr. Indications will be pegged if a line breaks. NUREG 0700, Para 6.5.1.2.d.1 requires that displays include the entire expected parameter range. (44) NRC Review Team Comment: NUREG 0700 specifies expected range of parameters, not abnormal condition ranges.
1-7	DS JS	A076	2*	CP-7 Neutron Flux Level and Power 7-D1 Two different parameters with different scales combined in same meter. (9) NRC Review Team Comment: There are four separate dual scale meters on channels A, B, C, D, indicating Power Level (%) and Rate of Change (dpm). These two paramters are used together as a pair while operating. No operator confusion is expected.

C-6 LABELS AND LOCATION AIDS

PHOTO	REV	HED	FINDING	
	DS JS	A115	1*	Pump Switches and Valves G-C13 In conversations with the operators, it was found that some pump switches also activate/open associated discharge valves. Currently there is no information on the pump controls to inform users which switches incorporate both the valve and pump control. (86) NRC Review Team Comment: This was a misunderstanding as to how the controls actually worked.

C.6 LABELS AND LOCATION AIDS, cont.

PHOTO	REV	HED	FINDING	
	DS JS	A123	2*	Shutdown Heat Exchanger and LPSI Pump 8-D8 The labels currently affixed to C-81, C-82, C-83 and C-84 do not correspond to the equipment descriptions provided in the bill of materials. (15) NRC Review Team Comment: These single scale meters have been removed from the board and replaced with dual scale meters.
CP-8	DS JS	A124	3*	Shutdown Heat Exchanger Outlet Water 8-D9 Label affixed to display does not correspond with equipment description provided in bill of material. (16) NRC Review Team Comment: This meter has been removed from the panel.
	DS JS	A125	4*	A/B Bus Status A-373 8-D11 Label is inappropriate for the display. The display shows whether A or B bus is in use. However, there is no "AB Bus", as the label would seem to indicate. (18) NRC Review Team Comment: The label describes whether the AB Bus is energized from A or B train of the diesel generator system.
CP-8	DS JS	A135	5*	RCS Vent 8-C3 Ebasco's panel drawing which incorporates the Bill of Material numbers for the hardware shows A-375 as "Vent to Quench Tank". Photographs of the Control Board show that "RCS Vent to CNTMT" is installed in A-375. R"RCS Vent to Quench Tank" is installed in space A-383, where documentation indicates RCS Vent to CNTMT should be installed. Error is significant if switch label is incorrect. Switches OK - there is an error in the bill of material. (67) NRC Review Team Comment: There is an error in the bill of material; the switches installed on panel are correct.

C-9 CONTROL DISPLAY INTEGRATION

PHOTO	REV	HED	FINDING	
	JM	A169	1*	Valve Control and Display 8-P3 The STMGEN 2 EFW path one valve controller is located on the left side of CP-8. The display which should be monitored during its operation (C-86) is located on the right side of CP-8 in the uppermost row. It will be difficult for one operator to monitor both the progress of the valve position and the corresponding display. (106)
	JM	A164	2*	Steam Generator EFW Controller 8-P2 The Stm Gen 1 EFW Path 2 controller is located on the right side of the panel CP-8. The corresponding display (C-74) is located on the left side, uppermost row. This makes the operation of the controller a 2-man operation. (19) NRC Review Team Comment: The layout is proper for the actions required by the operator.
CP-8	JM	A165	3*	A/B Bus Status A-373 8-C7 A status light shows the use of either A Bus or B Bus; however, no control is provided to switch busses, if necessary. The breaker controls are located on a back panel, behind the main control board. (24) NRC Review Team Comment: Status lights provide proper indication.

HUMAN FACTORS ENGINEERING
CONTROL ROOM DESIGN REVIEW/AUDIT
WATERFORD 3 SES GENERATING STATION
LOUISIANA POWER AND LIGHT COMPANY

D. WATERFORD 3 PHOTO LOG

	NO.	ID	PHOTOGRAPH SUMMARY
1-1	9	A1	Operator console
1-2	10	A2	Operator console
1-3	11	A3	Supervisor's office furniture
1-4	20	A4	Reactor first out panel (CP-4)
1-5	21	A5	Turbine Generator first out panel (CP-1)
1-6	20	A7	Holes in control room floor
1-7	33	A8	Annunicator control arrangement (CP-8)
1-8	32	A9	Annunicator control arrangement (CP-18)
1-9	36	A10	CVCS (CP-4)
1-10	4	A11	Inconsistent abbreviations
1-11	5	A12	Inconsistent abbreviations
1-12	6	A13	Inconsistent abbreviations
1-13	7	A14	Inconsistent abbreviations
1-14	23	A15	Wide angle of CP-7
1-15	24	A15	Wide angle of CP-7
1-16	25	A15	CP-7
1-17	26	A15	CP-2
1-18	18	A16	Functional grouping (CP-8)
1-19	19	A17	CP-8
1-20	31	A18	Mirror imaging problem (CP-33)
1-21	30	B1	Label problem (CP-8)
1-22	29	B2	Labels placed on meters (CP-13)
1-23	30	B3	Labels (CP-8)
1-24	4	I1	Redundant labeling (CP-7)
1-25	5	I2	Abbreviations easily confused (CP-7)
1-26	6	I3	Abbreviations easily confused (CP-7)
1-27	7	I4	Label locations not consistent, glare problem (CP-7)
1-28	8	I5	Labels for same control and different from CP-7 to CP-8
1-29	9	I6	Labels for same control and different from CP-7 to CP-8
1-30	10	I7	Dual scale meters - different parameters
1-31	11	I8	Cross reference is confusing (CP-7)

	NO.	ID	PHOTOGRAPH SUMMARY
1-32	12	I9	Inconsistent arrangement of wide and narrow range meters (CP-7)
1-33	13	I10	Meters with same parameters (CP-8)
1-34	16	I11	
1-35	17	I12	Scale on strip chart recorder is not directly adjacent to paper (CP-18)
1-36	9	I13	Colors on recorder (CP-1)
1-37	8	I14	Missing labels on control boards and mimics (CP-1)
1-38	9	I15	Missing labels on control boards and mimics (CP-1)
1-39	10	I16	Missing mimic (CP-1)
1-40	11	I17	Inverted intermediate log scale division (CP-2)
1-41	18	I18	No labels or engraving (CP-4)
1-42	19	I19	Inadequate labeling (CP-4)
1-43	12	I20	CVSC charging pump selector is difficult to follow
1-44	21	I21	Master remote control panel
1-45	22	I22	Panel FPE-3
1-46	23	I23	Think button and associated cont[illegible]s (CP-1)
1-47	24	I24	Different arrangements of labels
1-48	25	I25	Dual scale meter with set point on right (CP-8)
1-49	26	I26	Intermingled systems (CP-13)
1-50	27	I27	Controls/displays not arranged L to R or top to bottom (CP-13)
1-51	28	I27	Inconsistent labels
1-52	29	I28	More than 5 in a row (CP-1)
1-53	30	I29	More than 5 in a row (CP-8)
1-54	31	I30	Meters fail on scale (CP-8)
1-55	32	I31	White on black labels (CP-1)
1-56	1	I32	Color on Core Protection Calculator (CP-7)
1-57	2	I32	Color on CRT control panel (CP-6)
1-58	3	I32	Color on electrical mimic (CP-1)
1-59	4	I32	Color on CRT (CP-35)
1-60	5	I33	Side-by-side redundant meters (CP-8)
1-61	6	I33	
1-62	7	I34	Meter loose - vibration causes false readings
1-63	8	I34	Falling phone (CP-7)
1-64	10	I35	Extraneous information on meter faces (CP-13)
1-65	11	I36	No zone markings (CP-7)
1-66	12	I37	All graphic recorders have the same paper (CP-8)
1-67	14	I38	Falling phone
1-68	15	I39	No hierarchical labels (CP-1)
1-69	16	I40	No hierarchical labels (CP-1)
1-70	17	I41	Loose "permanent" labels (CP-8)
1-71	18	I42	Many temporary labels (CP-7)
1-72	19	I43	Labels are not functional (CP-8)
1-73	12	M1	5th percentile reach problem
1-74	13	M2	Chair in disrepair
1-75	14	M3	Vertical meters (CP-4)
1-76	15	M4	Vertical meters (CP-8)
1-77	16	M5	Poor contrast on label
1-78	17	M6	Uneven illumination glare

	NO.	ID	PHOTOGRAPH SUMMARY
1-79	19	M7	Height of displays (CP-8)
1-80	32	M8	Annunicator (CP-8)
1-81	33	M8	
1-82	34	M8	
1-83	10	M9	Annunicator panel (CP-33)
1-84	36	M10	Window display (CP-33)
1-85	30	M11	Lack of silence control (CP-18)
1-86	31	M12	Annunicator control location problem
1-87	37	M13	Misplaced Annunicator tile (CP-18)
1-88	15	M14	Scaled tapes (CP-2)
1-89	16	M15	Core Protection interface module
1-90	17	M15	
1-91	18	M16	CRT screens (CP-36)
1-92	19	M16	
1-93	20	M16	
1-94	21	M16	
1-95	22	M16	
1-96	16	M17	Panel shot (CP-8)
1-97	17	M18	Panel shot (CP-1)
1-98	1	P1	Unguarded Reactor Trip buttons on CP-2
1-99	2	P1	Channel A
1-100	3	P1	Channel D
1-101	4	P2	Unguarded Reactor Trip buttons on CP-8
1-102	5	P3	Pump Control switches have different color coding
1-103	6	P3	CP-2
1-104	7	P4	Less-more selector switches rotary bar handle on CP-1
1-105	8	P5	Less-more selector switches rotary round knobs on
1-106	9	P5	CP-8
1-107	13	P6	Halon switch activates when inserted after bulb replacement
1-108	10	P7	Lamp test on Reactor Protection Engineered Safety Feature panel (CP-7)
1-109	11	P7	Lamp Test button on CP-7
1-110	12	P7	FPE-3 lamp test
1-111	14	P8	Keylock switch - different key orientations (CP-4)
1-112	15	P9	Keylock switch - locked position not labeled (CP-8)
1-113	16	P10	Unguarded pushbuttons near front of benchboard (CP-7)
1-114	17	P10	
1-115	32	P11	No station index at S/P phone patchpanel (CP-25)
1-116	33	P11	Poor label indentification of S/P phone plug sockets and selector switch positions
1-117	34	P11	
1-118	1	P12	Poor labels on S/P phone panel
1-119	35	P13	Inconvenient location of sound powered phone patch panel (wall beyond CP-14)
1-120	36	P13	
1-121	37	P13	
1-122	13	P14	Battery powered emergency lights
1-123	14	P14	
1-124	15	P15	Remote Shutdown Panel

	NO.	ID	PHOTOGRAPH SUMMARY
1-125	16	P15	left
1-126	17	P15	left
1-127	18	P15	left
1-128	19	P15	right
1-129	20	P15	right
1-130	21	P16	Confusing position indicators labeling (LCP-43)
1-131	22	P16	
1-132	23	P17	Temporary labels (LCP-43)
1-133	24	P18	Missing labels on meters (LCP-43)
1-134	25	P18	
1-135	26	P19	Label on switch face (LCP-43)
1-136	27	P20	Missing controllers (LCP-43)
1-137	28	P20	
1-138	29	P20	
2-1	30	P21	Glare on meters (LCP-43)
2-2	31	P21	
2-3	32	P21	
2-4	33	P22	Labels below controls (LCP-43)
2-5	34	P22	
2-6	35	P23	Inconsistent abbreviations Emerg. and Emer.
2-7	36	P24	Unlabeled pushbuttons on RSP
2-8	2	P25	Tagout tags obscure controls (LCP-43)
2-9	3	P26	Large PA speaker horn in RSP room
2-10	4	P27	Temporary platform in front of RSP
2-11	5	P27	
2-12	6	P28	Inconsistent hierarchial labels (LCP43)
2-13	7	P28	
2-14	8	P28	
2-15	9	P28	
2-16	10	P28	
2-17	11	P28	
2-18	12	P28	
2-19	13	P28	
2-20	14	P29	Temporary panel I.D. label (RSP)
2-21	15	P30	No I.D. label on meter scale (RSP)
2-22	16	P31	Temporary label for Communication System Control
2-23	17	P31	Incomplete label
2-24	18	P32	Lack of demarcation for meters and controls (RSP)
2-25	19	P32	
2-26	20	P32	
2-27	21	P32	
2-28	22	P33	Shared Bus controls not demarcated and labels not distinctive (RSP)
2-29	29	P34	Keyswitch - unlabeled intermediate position (RSP)
2-30	30	P37	Functional grouping and C/D relationships (CP-1)
2-31	31	P37	
2-32	32	P37	
2-33	33	P37	
2-34	34	P37	
2-35	35	P37	

	NO.	ID	PHOTOGRAPH SUMMARY
2-36	36	P38	Poor location of Recirc Water Supply Pump Control
2-37	37	P38	(CP-1)
2-38	1	P39	Unconventional vertical layout (CP-4)
2-39	2	P40	Unconventional horizontal layout (CP-4)
2-40	3	P41	Duplicate valves at separate locations or duplicate labels (CP-4)
2-41	4	P41	
2-42	5	P41	
2-43	6	P41	
2-44	7	P41	
2-45	8	P42	Association of backlit pushbutton indicator with recorder not clear (CP-4)
2-46	4	P43	Dual scale meter scales offset (RSP)
2-47	5	P43	
2-48	21	R1	Separated display indicator and control (CP-2)
2-49	22	R1	
2-50	23	R1	
2-51	24	R1	
2-52	18	W1	Different intensity levels of green lights (CP-1)
2-53	19	W2	No position marks for rotary selector switches; toggle switch positions not marked (CP-2)
2-54	20	W3	Rotary switch continuous rotation (CP-4)
2-55	21	W3	Size and shape
2-56	31	W4	Backlit indicators and pushbuttons mixed array (CP-1)
2-57	22	W5	Telephone low on sound powered telephone panel
2-58	23	W5	Knocking phone handset off
2-59	24	W5	Handset on floor
2-60	25	W6	Sound powered telephone panel poor viewing angle for standing operator (CP-35)
2-61	26	W6	Sound powered telephone selector switch arrow not visible
2-62	27	W6	CP-35
2-63	28	W6	CP-35
2-64	29	W6	CP-35
2-66	2	W7	Overhead obstructions
2-67	3	W7	
2-68	4	W7	
2-69	5	W8	Unlabeled switches (Transfer Switches)
2-70	6	W8	
2-71	10	W9	Some J switches do not have switch position labels
2-72	7	W10	No panel or door on Transfer Switches
2-73	8	W11	Long Room
2-74	9	W11	
2-75	11	W12	Panel A-B Transfer has unlabeled switches
2-76	12	W12	
2-77	23	W13	Control display relationships
2-78	24	W13	
2-79	25	W13	
2-80	26	W14	Panel layout - Mirror image and left/right relationships (RSP)

	NO.	ID	PHOTOGRAPH SUMMARY
2-81	27	W14	
2-82	28	W14	
2-83	2	W15	Meters - controls layout (CP-1)
2-84	9	W16	Recorder paper does not match Recorder scales (CP-4)
2-85	10	W16	
2-86	11	W16	
2-87	12	W16	
2-88	13	W17	Left/right sequence of paired recorders (CP-4)
2-89	14	W18	Widely separated controls and displays (CP-2,4)
2-90	15	W18	
2-91	16	W18	
2-92	17	W19	Widely separated control and display
2-93	18	W19	
2-94	19	W19	
2-95	20	W19	
2-96	1	W20	Keyswitch collar color (CP-8)
2-97	3	W21	Meters - controls layout (CP-1)

WATERFORD 3 MOSAIC PHOTO LOG

	ID	PHOTOGRAPH SUMMARY
2-98	X1	FPE-3 panel shot
2-99	X2	FPE-3 left section
2-100	X3	FPE-3 center section
2-101	X4	FPE-3 right section
2-102	X5	CP-13 panel shot
2-103	X6	CP-13 annunciator panel
2-104	X7	CP-33 panel shot
2-105	X8	CP-33 annunciator panel
2-106	X9	CP-15 panel shot
2-107	X10	CP-17 panel shot
2-108	X11	CP-14 panel shot
2-109	X12	CP-18, CP-35, CP-1 mosaic
2-110	X13	CP-18 panel shot
2-111	X14	CP-18 annunciator panel SA
2-112	X15	CP-18 annunciator panel SB
2-113	X16	CP-35 panel shot
2-114	X17	CP-35 annunciator panel
2-115	X18	CP-1 panel shot
2-116	X19	CP-1 annunciator panel
2-117	X20	CP-1 annunciator panel
2-118	X21	CP-4 panel shot
2-119	X22	CP-4 annunciator panel
2-120	X23	CP-36 panel shot
2-121	X24	CP-2 panel shot
2-122	X25	CP-2 core map
2-123	X26	CP-2 annunciator panel
2-124	X27	CP-2 annunciator panel
2-125	X28	CP-6 panel shot
2-126	X29	CP-7 panel shot
2-127	X30	CP-36 panel shot
2-128	X31	CP-36 annunciator panel
2-129	X32	CP-8 panel shot
2-130	X33	CP-8 annunciator panel
2-131	X34	CP-8 annunciator panel
2-132	X35	CP-51 panel shot
2-133	X36	CP-10 panel mimic (left)
2-134	X37	CP-10 panel mimic (center)
2-135	X38	CP-10 panel mimic (right)
2-136	X39	CP-10 controls (left)
2-137	X40	CP-10 controls (right)
2-138	X41	NOT USED
2-139	X42	NOT USED
2-140	X43	NOT USED