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Draft Audit Report, Human Factors
Engineering Control Room Design Review
Saint Lucie Nuclear Power Plant, Unit No. 2

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September 3, 1981

Lawrence
Livermore
Laboratory

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DRAFT AUDIT REPORT

Human Factors Engineering
Control Room Design Review/Audit

Saint Lucie Nuclear Power Plant
Unit No. 2
Florida Power & Light Company

UCID--19121

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September 3, 1981

A human factors engineering preliminary design review of the Saint Lucie Unit 2 control room was performed at the site on August 3 through August 7, 1981. This design review was carried out by a team from the Human Factors Engineering Branch, Division of Human Factors Safety. This report was prepared on the basis of the HFEB's review of the applicant's Preliminary Design Assessment and the human factors engineering design review/audit performed at the site. The review team included human factors consultants from BioTechnology, Inc., Falls Church, Virginia, and from Lawrence Livermore National Laboratory (University of California), Livermore, California.

Observed human factors design discrepancies were given a priority rating of one to three (high, moderate, 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 design review that will be required after issue of NUREG-0700. Note that some priority ratings include a superscript one (e.g., 3¹). Since the resolutions of these discrepancies involve simple corrective actions relative to the potential for improving operator performance, these discrepancies should be corrected prior to fuel loading.

The following sections are numbered to conform to the guidelines of the draft version of NUREG-0700. They summarize the team's observations of the control room design and layout, and of the control room operators' interface with the control room environment.

Finding numbers followed by an asterisk (*) denote discrepancies which were observed during the Preliminary Human Engineering Assessment made by Essex Corporation and submitted to the NRC Human Factors Engineering Branch by Florida Power and Light Co.

A list of those items that could not be evaluated is presented at the end of the nine major sections of this report. The condition of construction or installation of these items at the time of the site visit was not sufficiently finalized to permit review.

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Human Factors Engineering
Control Room Design Review/Audit

Saint Lucie Nuclear Power Plant
Unit No. 2
Florida Power & Light Company

1. CONTROL ROOM WORKSPACE

<u>PHOTO ID</u>	<u>REVIEWER</u>	<u>PRIORITY</u>	<u>FINDING</u>
G1,G2	GL	3	1.* The view of portions of the Radiation Monitoring Panel and the HVAC Panel from the Operator Console is obscured by other boards.
L20,G4	DL,GL	2	2.* There are two large floor obstructions in the form of thick plywood sheets attached to the floor. One is between the control console mockups and one is near the restroom location.
S5	GS	2	3. The temporary phone attached to Panel 202 has a long cord which presents a tripping hazard in an operator pathway. It was noticed that phone cords in Unit 1 presented a similar tripping hazard.
	BP	3	4. The two Control Transfer Panels for the Remote Shutdown Panel are both at distant locations from the shutdown panel. These separated remote transfer locations can delay and complicate transfer of control between the Control Room and the Remote Shutdown Panel
	DL	3	5. The Turbine Backpanel and the DEH Control Cabinet were 53 inches apart. This is less than the 96 inches minimum separation distance recommended for opposing vertical control panels.

* Discrepancy also noted in Florida Power and Light Company report of Preliminary Human Engineering Assessment of the Saint Lucie 2 control room.

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1. CONTROL ROOM WORKSPACE (Continued)

<u>PHOTO ID</u>	<u>REVIEWER</u>	<u>PRIORITY</u>	<u>FINDING</u>
	GS,BP,RP	1	6.* There are no provisions for key storage and no procedures for key access control for keys used in the Control Room and for keys used at the Remote Shutdown Panel.
	GL	1	7. The shift supervisor's office location beyond Panel 206 will not provide him with good voice and visual contact with the main control area.
R2,R3, S2,S3	BP,JP, RP,GS,HV	3	8.* Controls on the vertical boards of some standup consoles are located too high and are beyond the reach of a 5th percentile female operator. Examples: a.) Panel 204: Reactor Channels MB and MD Reactor Trip pushbuttons b.) Panel 201: Reactor Channel MA Reactor Trip pushbutton
	GL	3	9.* Some displays and annunciators were located outside of the visual fields of the extreme height operators. In particular, a line of sight from the viewer to the instrument face made less than a 45 degree angle with the display plane.
G5	GL,GS	1	10. All of the panels had controls which were less than 3 inches from the front edge of the benchboard. The benchboard handrails had not been installed at Unit 2 at the time of the review. It was noted that the Unit 1 benchboard rails obscure the view of many controls and displays from the operator console.
L1,S6,S7 S8,M18 R8,R9, M20	GL,DL, GS,HV, JP,BP,RP JM	3	11.* Displays and controls on vertical panels throughout the control room are located above and below the guideline heights. For vertical panels, controls and displays should be located between 34 inches to 70 inches above floor level. Examples: a.) HVAC Panel b.) Radiation Monitoring Panel

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1. CONTROL ROOM WORKSPACE (Continued)

<u>PHOTO ID</u>	<u>REVIEWER</u>	<u>PRIORITY</u>	<u>FINDING</u>
	GL	1	12. The normal lighting level in the backpanel areas was inadequate. The level at Backpanel 206 was 5.5 ft-candles, which is even less than the minimum requirement of 10 ft-candles for a passageway.
S1,S4, S15,L30	GS	2	13.* Glare was a problem throughout the control room. At the time of the review, no diffusing grid had been placed over the fluorescent lighting as has been done in Unit 1. The glare in Unit 2 had a varying impact from one instrument to the next, with the worst case being nearly total obscuration of displayed information.
	GS	2	14.* There is no direct means of testing the operability of control room emergency lighting.
	GL	1	15. The emergency lighting illumination levels were too low for accurate reading of panel displays and labels. Readings varied from 22.6 to 1.9 ft-candles. The Panel 204 reading was 8.3 ft-candles.
	BP	1	16. The two separate Control Transfer Panels for the Remote Shutdown Panel are not provided with security devices to prevent unauthorized transfer of control between the Control Room and the Remote Shutdown Panel.

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2. COMMUNICATIONS

<u>PHOTO ID</u>	<u>REVIEWER</u>	<u>PRIORITY</u>	<u>FINDING</u>
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THE COMMUNICATIONS EQUIPMENT AND PROCEDURES FOR UNIT 2 WERE NOT COMPLETED AND
COULD NOT BE EVALUATED.

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3. ANNUNCIATORS

<u>PHOTO ID</u>	<u>REVIEWER</u>	<u>PRIORITY</u>	<u>FINDING</u>
V7	HV	2	1.* The function of the annunciator tile labeled ANNUNCIATOR POWER SUPPLY on annunciator Panel K is not clear.
	HV	1	2.* There are no annunciators for the HYDRAZINE system.
	JP	1	3. There is no annunciator or alarm to warn of unauthorized transfer of control from the Control Room to the Remote Shutdown Panel.
J5	JJ	1	4. Some annunciator tiles with multiple inputs do not have reflash capability.
V13, V3	HV	1	5. The annunciator system does not have a separate First Out Panel for the reactor systems. Annunciator Panel C, for the turbine, is the only annunciator panel with First Out reset capability
	HV	3	6. There is a general lack of prioritization in the control room annunciator panels. A consistent prioritization coding scheme, based on importance, severity, or need for operator action, has not been applied.
	HV	2	7. On all annunciator panels, the only indication that an annunciated condition has been cleared is the extinguishment of the light.
	DL	1	8.* The annunciator audible alarms are only marginally louder than the ambient noise in the control room.
	HV	1	9.* The annunciator audible alarm devices for Panels 201, 203, and 205 are located behind the panels, making it difficult for operators to localize the source of an alarm.
	JM	1	10. The annunciator illumination system does not ensure that an indication of alarmed conditions will be provided to the operator if failure of an annunciator light flasher occurs. In case of flasher failure of an alarmed tile, the tile light should illuminate and burn steadily.

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3. ANNUNCIATORS (Continued)

<u>PHOTO ID</u>	<u>REVIEWER</u>	<u>PRIORITY</u>	<u>FINDING</u>
	HV	1	11.* Some annunciators used in startup will be normally lit during full power operation. Examples: POWER HIGH RATE OF CHANGE and TRIP BYPASSED tiles on annunciator Panel L
M3	JM	1	12. None of the annunciator panels in the control room have labeling of their vertical or horizontal axes to aid in matrix location and identification of individual tiles.
V14	HV	1	13. Blank annunciator tiles on almost all annunciator panels are illuminated during normal operation.
M5,V16	HV	1	14.* Many annunciator tile legends are wbrdy. Some tiles have as many as 14 words.
V4, V35	HV	1	15.* Annunciator font size (.2 inches in height) is too small for reliable reading from the operator annunciator control positions.
J4	JJ	1	16. The operator cannot read all of the annunciator tiles on Panels 205 and 206 from the annunciator acknowledge control location because of the oblique viewing angle from the control location.
V16	HV	1	17. The space between legend lines on annunciator tiles is less than 1/2 the character height.
M2	JM	2	18. One annunciator board on the Line Repeat Panel has two redundant sets of controls located within 12 inches of each other.
V12	HV	2	19.* There are no separate silencing controls on any annunciator control systems.
V7,V8,V9 W1,W2	HV,WR	2	20.* The relative location of annunciator control button groups is not the same from panel to panel and the annunciator control buttons are not arranged in the same order in the control group at each panel.
M7	JM	3 ¹	21. Annunciator Panel N contains a tile with a temporary label. The WASTE MANAGEMENT LOCAL ALARM GROUND DETECTED POWER FAILURE tile label is handwritten on the face of the tile.

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4. CONTROLS

<u>PHOTO ID</u>	<u>REVIEWER</u>	<u>PRIORITY</u>	<u>FINDING</u>
	GL,GS	1	1. Some controls needed to perform system operating tasks are not in the control room. Examples: a.) Auxiliary Feedwater Pump Start Bypass control b.) Condensate Pump 2C control
G16	GL	2	2. The Fire Pump 1A and 1B Stop controls on Panel 202 are unnecessary controls on that panel. These controls are not related to systems operations controlled from that panel.
B2	BP,JP	2	3. Some process controllers on Panels 205 and 206 have inoperative OPEN/CLOSE pushbuttons that are disconnected and have no control function. Examples: a.) HIC-3618 b.) HIC-3628 c.) HIC-3638 d.) HIC-3648 e.) SI Loop 2A2 Check Valve Leakage
R12	BP,JP,RP	1	4.* The Turbine Trip pushbutton is not protected to prevent unintentional operation.
R4,R5	BP,JP,RP	1	5.* The SI Loop Check Valve Leakage HIC-3638 process controller operates in reverse of the conventional operation of other process controllers in the control room.
B18,B1	BP,JP	2	6. Some rotary switches do not conform to the OPEN-Right (Clockwise) / CLOSE-Left (Counterclockwise) convention for switch positions. Examples: a.) Generator No. 2 switch on Line Repeat Panel has OPEN-Left / CLOSE-Right positions. b.) Turbine Drain Valve controls on Panel 201 have OPEN-Left / AUTO-Center / CLOSE-Right positions. c.) Loop 2A2 and Loop 2B1 Charging Line Valve controls have RESET-Left / CLOSE-Middle / OPEN-Right positions.

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4. CONTROLS (Continued)

<u>PHOTO ID</u>	<u>REVIEWER</u>	<u>PRIORITY</u>	<u>FINDING</u>
R16	BP,JP,RP	3 ¹	7.* Some keyswitches have a black ring that might be interpreted as a color code while other keyswitches do not. There is no apparent significance of this difference.
	BP,JP,RP	1	8.* The Matrix Relay Hold pushbuttons on the RPS Panel are difficult to depress for the period of time required to perform system tests. The control resistance of these pushbuttons is too high for tasks requiring activation for more than a few seconds.
R1	BP,JP,RP	2	9.* The backlit legend pushbuttons and the backlit legend indicator lights in several arrays on Panels 201 and 202 are identical in appearance, size, and shape. control/display substitution errors are possible. Examples: a.) DEH Valve Test panel b.) Generator Megvar displays c.) Diesel Generator controls and displays
R19,R20	BP,JP,RP	2	10.* Covers on backlit legend pushbuttons and indicators are interchangeable and are not coded to identify their correct location in the control/display arrays.
R13,R14	BP,JP,RP	3 ¹	11.* Some keyswitches do not conform to the keyswitch orientation convention used in the control room. Examples: a.) Minimum Flow Header A Isolation Valve V-3496 switch on Panel 206. b.) DEH Turbine Control OPC switch on Panel 201.
R6,R15	BP,JP,RP	1	12.* Rotary switches and keyswitches have unlabelled positions. Examples: a.) SIAS Block Channel SA and Sg keyswitches on Panel 206 b.) MSIS Block Channel SA and Sg keyswitches on Panel 206 c.) Trip Circuit Reset rotary switches on the RPS Panel

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4. CONTROLS (Continued)

<u>PHOTO ID</u>	<u>REVIEWER</u>	<u>PRIORITY</u>	<u>FINDING</u>
R28	BP,JP	2	13. Some rotary selector switches can be stopped in positions between the detente, operating positions. Example: a.) Seal Cooler Heat Exchanger Isolation Valves HCV-14-11A1, A2, B1, and B2 on Panel 203.
B3,B4,R27 BP		3	14. The handles of rotary control switches on Panel 201 obscure the view of position markings on the switches. Examples: a.) Generator Field Ground Detector b.) Voltage Adjuster c.) Base Adjuster d.) Diesel Generator Ammeter e.) 4.16KV 2B3 Ammeter
R17,R18	BP,JP,RP	3	15.* Status indicator flags on some J-handle and rotary pointer switches are obscured by the switch handle. Examples: (Panel 202) a.) Circulating Water Pump 2A1 control b.) Circulating Water Discharge Valves MV-21-2A1 and 2B1 c.) Screen Wash Pump, 2A and 2B
R21	BP,JP,RP	3 ¹	16.* Rotary selector switches on Panel 201 have pointers engraved in the switch handle that are not marked with a contrasting color to make them readable. Examples: a.) Exciter Supply Breaker b.) Generator Ground Detector c.) Voltage Adjuster d.) Base Adjuster
R7,R10	BP,JP,RP	3	17.* There is unacceptable parallax between the indicator pointer and the green band used to indicate the operating setpoint band on some process controllers. Examples: a.) Pressurizer Pressure PIC 1100-X and 1100-Y on Panel 203 b.) Boric Acid Flow FRC-2210Y on Panel 205 c.) Reactor Makeup Water Flow FRC-2210X on Panel 205 d.) Liquid Waste Flow FIC-6627 on Panel 205

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5. DISPLAYS

<u>PHOTO ID</u>	<u>REVIEWER</u>	<u>PRIORITY</u>	<u>FINDING</u>
S21	GS	2	1. Assuming its label is correct, the AUX FEEDWATER HDR C FLOW/PRESSURE indicator FI-09-2C/PI-09-8C on Panel 202 should display values of two different variables. The installed meter can display only one variable.
L18	DL	1	2. There is no distinction between the three backlit indicators labeled HI POWER TRIP on the RPS Matrix Test Panel nor between the two indicators labeled HI RATE.
G10	GL	2	3. The data channel identification labels for HVAC Panel trend recorders PR-25-1A, PR-25-1B, and PR-25-2 do not indicate which recorder scale to use with each variable displayed on the multi-range, multi-channel recorders.
G6	GL	3 ¹	4.* On Panel 201, the GENERATOR EXCITER FIELD DC VOLTS meter scales are not marked to indicate positive and negative values.
G7	GL	3 ¹	5. On Panel 201, the VIBRATION PHASE ANGLE METER-VBI-22-1 and the ECCENTRICITY PHASE ANGLE METER ECC-22-1 do not have indications of positive or negative above and below zero. Also, their scales are graduated in 10's above zero and in 30's below zero.
G8	GL	3	6.* The upper scale on horizontally oriented meters is difficult for a standing operator to see without crouching. Examples: a.) STEAM GENERATOR DELTA P b.) CORE FLOW c.) COOLANT LOOP TEMPERATURE TCOLD/THOT d.) PRESSURIZER PRESSURE
S16	GS	3	7.* Extreme values at the top and bottom of the scales on vertical meters are obscured due to meter design. Example: a.) CONTROLLED BLD-OFF FLOW FIA-1150 (Panel 203)

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5. DISPLAYS (Continued)

<u>PHOTO ID</u>	<u>REVIEWER</u>	<u>PRIORITY</u>	<u>FINDING</u>
V43,L4	HV	1	8. The LED displays generally have poor readability due to glare, scratchable face plate surfaces, and poor contrast. Example: a.) LINE REPEAT PANEL b.) PANEL 203 c.) MEGAVAR PANEL d.) PRESSURIZER PRESSURE
L14	GS	3 ¹	9. On Panel 204, the CEA Secondary Rod Position display is made up of a high contrast checkerboard pattern of bright yellow on white. This pattern is very disturbing to look at because of color afterimages.
L2,G15	DL	3 ¹	10. Several meters, primarily G.E. circular meters, have confusing scale markings. The scale spacing is non-linear and there are no graduations near the zero marking on the meter scale. Also, it is not clear what downscale meter pointer position indicates a meter failed condition. Example: a.) GENERATOR AMPERES AM-8810B and AM-8810C on Panel 201 b.) GENERATOR KILOVOLTS VM-881
L21	DL	3 ¹	11. Several meter scales have thick black marks to extend major tick marks to the scale numerals. These marks give the misleading appearance of minus (-) signs in front of the meter scale numerals. Examples: (HVAC Panel) a.) PDIS-25-18 b.) PDI-25-15B
G11	GL	1	12.* There are several displays which use unconventional scale graduations. Examples: a.) Panel 201: DIESEL GENERATOR 2B MVARs VARM-1616 b.) Panel 204: WIDE RANGE % POWER JI-001B c.) Panel 203: LOOP 2A COLD LEG TEMP TIC-111 d.) Diesel Gen 2B Frequency

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5. DISPLAYS (Continued)

<u>PHOTO ID</u>	<u>REVIEWER</u>	<u>PRIORITY</u>	<u>FINDING</u>
L5, M6	DL	3 ¹	13. Green FPL tape (denoting equipment turnover to FPL) and meter calibration certification stickers obstruct labels and meter scales in several places and generally clutter the appearance of the boards.
S35	GS	2	14. Some meters in the control room have white bezels while others have black bezels. There is no well defined difference in meaning between the two bezel colors.
S19	GS	2	15. On the Line Repeat Panel there is either a reversal of Green-Left / Red-Right convention of indicator light positions or the colored lamps are incorrectly installed.
S21, S20 S18, S13	GS	3 ¹	16. There is a widespread use of amber and blue colors for electrical system status lights while a red/green/amber convention used on most other systems in the control room.
S13	GS	3 ¹	17.* The CONTAINMENT H2 PURGE CONTROL VALVE FCV-25-8 on the HVAC Panel violates the conventional color coding of indicator lights by using green to indicate OPEN and red to indicate CLOSED.
G12	GL	1	18. On Panel 203, the PRESSURIZER PRESSURE METERS PIC-1105 and PIC-1106 indicate an increase in pressure by a downward movement of the pointer.
L5, S12	DL, GS	3 ¹	19.* On process controller vertical scales, circular meters, and large horizontal trend recorders, the pointers obscure scale numerals. Example: a.) GENERATOR TEMPERATURE TR-22-30
L6	DL	3 ¹	20. The CONDENSATE & STM GEN BLOWDOWN CONDUCT CR-05-1 trend recorder does not have a legend to distinguish between pen colors.
S26	GS	2	21. The 0-5 psi operating band on the CONTAINMENT PRESSURE PIS-07-2B display on Panel 206 is very small compared to the full range of the display scale (0-100 psi).

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5. DISPLAYS (Continued)

<u>PHOTO ID</u>	<u>REVIEWER</u>	<u>PRIORITY</u>	<u>FINDING</u>
L10	DL	1	22.* Throughout the control room, there is a lack of demarcation of the "normal", "safe", "caution", and "danger" ranges on display instruments.
V51,V52	HV	1	23. The Reactor Protection System Trip Status Panel has indicator lights which indicate OPEN on the bottom or left and CLOSED on the top or right. Both of these indicator light positions are opposite of normal convention.
	DL,GS	1	24.* There are no lamp tests in the control room other than those for the annunciators.
L16	DL	3 ¹	25. On Panel 201, the BATTERY 2A and BATTERY 2B status lights are single blue lights. There is no indication whether the light indicates normal or abnormal state when lit.
L3	DL	2	26.* On the HVAC Panel, each of the following systems has three associated indicator lights, two of which are red: CONTAINMENT FAN COOLERS: 2HVS-1A, 1B, 1C, 1D
G13,S17	GL	2	27. Several recorders are supplied with paper which is scaled differently than the scale on the recorder face. For example, the BORON CONCENTRATION RECORDER AP-2203 on PANEL 205, if installed as planned, will have four selectable ranges but will have only a single full range paper (0-2000). Thus, if the operator selects (0-500) range, a reading of 250 will be recorded as 1000, etc. Other examples: a.) Panel 201: GENERATOR FREQUENCY RECORDER F-REC-881 b.) Panel 202: FEEDWATER AND STEAM GENERATOR BLOWDOWN PHR-05-1.
G9	GL	3 ¹	28.* The trend recorders on the HVAC Panel have data legend labels on the glass window which obscure the graph paper. The operator must open the recorder in order to read information.

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5. DISPLAYS (Continued)

<u>PHOTO ID</u>	<u>REVIEWER</u>	<u>PRIORITY</u>	<u>FINDING</u>
	GL	1	29. Multipoint impact recorders have too many data channels on each recorder. Some recorders have as many as 24 data channels. Similar impact recorders in Unit 1 were found to be overprinting their data.
S11	GS	3 ¹	30.* A (0-125) nonlinear scale is used on the REACTOR MAKEUP WATER FLOW FRC-2210X display where a linear scale would do just as well.
V48,V49, V50	HV	1	31. Several displays have no labeling to indicate what units their scales are measured in. Examples: a.) Panel 205: WASTE GAS FLOW RECORDER-FR-6648 b.) Panel 203: PRESSURIZER SPRAY-HIC-1100 c.) Panel 206: REFUELING WATER TANK LEVEL-LR-07-20
L19	DL	3 ¹	32. The % POWER METER on the Reactor Protection System Panel has a broken glass face.

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6. LABELS AND LOCATION AIDS

<u>PHOTO ID</u>	<u>REVIEWER</u>	<u>PRIORITY</u>	<u>FINDING</u>
W20	JM	1	1.* A number of controls and displays on Panel 203 have labels which are either missing or appear to be incorrect.
W19	JM	1	2.* Many trend recorders on Panel 205 and the HVAC Panel have blank labels or labels which do not identify the display's function.
	HV	3 ¹	3. On the back of Panel 201, the AUX and MAIN TRANSFER switches and indicator lights are not labeled.
V41	HV	3 ¹	4. There are missing labels on the Plant Auxiliary Panel for switches and for switch position indicators.
W15	JM	1	5.* Some of the Auxiliary Feedwater Pump and Valve controls have unlabeled "Auto" positions. Example: a.) AUX FW PUMP/2A DISCH to SG2A VALVE
V19	HV	1	6.* The MATRIX RELAY TRIP SELECT rotary control on the RPS Panel has unlabeled positions.
W28	HV	1	7.* On Panel 201 the BATTERY VOLTS 2A meter VM-001 is incorrectly labeled as BATTERY VOLTS 2B.
V56	HV	3 ¹	8. The LOOSE PARTS MONITOR CABINET contains switches whose control functions and positions are not labeled.
V54, V55	HV	3 ¹	9. Several toggle switches on the Reactor Regulating System Panel and on the Reactor Coolant Pump Vibration Monitor Panel have unlabeled switch positions.
V24	HV	1	10. On Panel 206, the key switch positions on the MSIS block switch are not labeled.
B10	BP	2	11. LPSI LOOP <u>2A</u> FLOW METER on Panel 206 is mislabeled. It should read <u>2A1</u> .
B12, B13	BP	1	12. The LPSI HEADER PRESSURE METERS 2A and 2B on Panel 206 are either mislabeled or in the wrong panel locations.

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6. LABELS AND LOCATION AIDS (Continued)

<u>PHOTO ID</u>	<u>REVIEWER</u>	<u>PRIORITY</u>	<u>FINDING</u>
M17	JM	3 ¹	13. The CONDENSER VACUUM DISPLAY (PI-10-7B) on Panel 201 has a mislabeled scale. It should read "Inches Hg Vacuum" instead of "Inches Hg ABS".
V28	HV	1	14. The BORON CONTROL VALVE on Panel 205 is mislabeled. It should read BLENDING VALVE.
L25	DL	3 ¹	15. The FEEDWATER PUMP 2A FLOW label on Panel 202 is incorrect. It should read FEEDWATER PUMP 2B FLOW.
V53	HV	1	16. The functional difference between the dual Steam Generator meters on the four ENGINEERING SAFEGUARDS LOGIC CABINETS is not labeled.
V23	HV	1	17. There is no hierarchical arrangement of labels by system and subsystem throughout the control room.
W10	WR	3 ¹	18.* On Panel 201, component identification labels are not consistently larger than component status (e.g. "start", "stop", "auto") labels.
W44,W45, W46,W47, M19,W36,W17	WR,HV	1	19. Label placement convention is inconsistent throughout the control room.
W35	HV	3 ¹	20.* Labels on Panel 201 have been placed under displays and are often obscured by the overhanging bezel of the display they are intended to identify.
V22	HV	3 ¹	21. The label for the backpanel that contains the L & N PROCESS AND COOLING WATER TEMP. SELECTOR is below the switch array and is obscured.
V25	JJ	1	22.* The WASTE GAS FLOW trend recorder on Panel 205 has no label to indicate what parameter is being monitored.
L17	DL	3 ¹	23. On Panel 202, the labeling for the light pairs representing the UHS CANAL BARRIER VALVES (I-S3-21-13, 14) is ambiguous. There is one label for two light pairs.

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6. LABELS AND LOCATION AIDS (Continued)

<u>PHOTO ID</u>	<u>REVIEWER</u>	<u>PRIORITY</u>	<u>FINDING</u>
W24	JM	3 ¹	24.* On Panel 201, labels for rotary switch control positions are not oriented horizontally and switch position labels are obscured by the control handle. Example: a.) AMMETER CONTROLS FOR BUS 2A1.
W37	HV	1	25.* On Panel 205, there is no indication on two-color trend recorders as to which color represents an actual reading and which represents the set point.
V29	HV	1	26. The REACTOR CHANNEL TRIP BUTTONS on Panel 204 are not labeled as to function. The buttons should be labeled "TRIP".
M8	JM	3 ¹	27. Most of the component labels on the FEEDWATER REGULATING RACK do not contain component identification numbers.
W16	JM	3 ¹	28.* Labels on Panels 205 and 206 are very similar and can be confusing. Examples: a.) BORIC ACID GRAVITY FEED VALVE V-2508 and BORIC ACID GRAVITY FEED VALVE V-2509. b.) HPSI TO HOT LEG 2B VALVE V-3551 and HPSI TO HOT LEG 2B VALVE V-3523
B5	BP	1	29. On Panel 206, there is an error on the HPSI HDR B TO LOOP 2B2 label. It should read LPSI instead of HPSI.
W11, W12, W13	JM	1	30.* Abbreviations are not used consistently in labels. Examples: a.) Panel 206: CCW PUMP 2A (CCW = component cooling water) b.) Panel 203: CCW FROM RCP 2A1 FLOW (FIA-1158) (CCW = core cooling water) c.) Panel 205: COMP COOL'G WATER.

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6. LABELS AND LOCATION AIDS (Continued)

<u>PHOTO ID</u>	<u>REVIEWER</u>	<u>PRIORITY</u>	<u>FINDING</u>
W18	JM	3 ¹	31.* Labeling of units on scales of trend recorders, counters, and process controllers on Panel 202 is inconsistent and often is redundant with the control label. Example: a.) FEEDWATER TO SG 2A REG VALVE BYPASS LIC-9005
W29, W30	HV	2	32.* Pushbuttons on Panels 201 and 203 have two labels which present redundant information. Example: a.) Panel 201: TURBINE TRIP and TRIP b.) Panel 203: RCP 2A1 VIBRATION RESET and RESET.
S38	GL	1	33. On Panel 203, two controllers that are labeled PRESSURIZER LEVEL CONTROL have different functions.
W31, W32	HV	1	34.* Some labels are difficult to read due to insufficient color contrast between label surface and lettering.
W34	HV	1	35.* Engraved labels on all panels in the control room have become obscured by grime.
V6	HV	1	36.* On the Plant Auxiliary Panel, the annunciator control button labels are illegible and the ACKNOWLEDGE buttons are not labeled.
W33	HV	3 ¹	37.* Panels 203 and 206 have labels whose characters are separated by less than the minimum recommended space (1/6 character height).
W9	WR	3 ¹	38.* Line spacing is less than 1/2 character height on almost all labels in the control room.
M13, M14, M15	JM	3 ¹	39. Several controls on Panel 201 have temporary labels to indicate associated circuit breakers.
M12	JM	3 ¹	40. The permanent label for the STATION BATTERY 2B VOLTS meter is incorrect and has been replaced by a temporary label. However, both labels are still in place.

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6. LABELS AND LOCATION AIDS (Continued)

<u>PHOTO ID</u>	<u>REVIEWER</u>	<u>PRIORITY</u>	<u>FINDING</u>
M9	JM	3 ¹	41. On Panel 201, the label for the 480V BUS TIE SWITCH 2AB-2 is handwritten in ink on the panel surface.
V26	HV	1	42. Tag outs on Panel 201 obscure displays located below them on the control panel.
W38	HV	3 ¹	43.* On Panel 201, summary labels and demarcation lines are not used to identify and separate systems surrounding mimics. Labels do not always appear above mimic areas. Example: a.) Electrical distribution buses
J2	JJ	1	44. REACTOR TRIP A and C pushbuttons on Panel 201 are adjacent to the TURBINE TRIP pushbutton. REACTOR TRIP is a safety function and its controls should be readily distinguishable from the TURBINE TRIP control.
R34, R39 R29	BP	1	45. The color coding and shading of control labels on the HVAC Panel is inconsistent with the rest of the control room.
W21, W22, J1	JM, JJ	1	46.* Mimics in general are not consistently color coded. For example, there is an inconsistent use of color in the Power Distribution Mimic on Panel 201. The colors yellow and blue are used for voltages of 6.9KV and 4.16KV and yellow and blue are also used for protective channels B and D.
W25	HV	1	47.* On Panel 205, the annunciator TEST control is color coded red, which is inconsistent with coding of other annunciator controls.
V20	HV	3 ¹	48. The Line Repeat Panel Mimic has incomplete mimic lines and arrows.
W4, W5, W7 R26	JM, GS RP, WR	1	49.* Color codes of labels are generally based upon the power supply for the component instead of the component function. This color code scheme is helpful for maintenance but is not a useful aid for the operator.

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6. LABELS AND LOCATION AIDS (Continued)

<u>PHOTO ID</u>	<u>REVIEWER</u>	<u>PRIORITY</u>	<u>FINDING</u>
W41	WR	3	50. On Panel 201, the 480V BUS BREAKER controls are interspersed with controls which are part of a system mimic. This tends to confuse the mimic arrangement.
W42	WR	2	51. There is a lack of grouping of Diesel Generator controls on Panel 201.

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7. PROCESS COMPUTERS

<u>PHOTO ID</u>	<u>REVIEWER</u>	<u>PRIORITY</u>	<u>FINDING</u>
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THE PROCESS COMPUTER INSTALLATION FOR UNIT 2 WAS NOT INSTALLED AND COULD NOT BE EVALUATED.

There will be significant differences between the Unit 2 Process Computer and the Process Computer system now operating in Unit 1.

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8. PANEL LAYOUT

<u>PHOTO ID</u>	<u>REVIEWER</u>	<u>PRIORITY</u>	<u>FINDING</u>
	JP, RP	3	1.* Controls that are used together are not functionally grouped on Panel 206. Example: CSAS CHANNEL SA, SIAS CHANNEL SA, and RAS CHANNEL SA
S36	GL	2	2. On Panel 203, the Pressurizer Relief Line Temperature and the Safety Valve Discharge Temperature meters are installed in unconventional left to right order (1107,1108,1109,1106).
S25	GS	2	3. On Panel 206 unrelated displays have been placed between related displays for CCW FROM SHUTDOWN, CCW FROM FUEL POOL, and CONTAINMENT SPRAY.
R30	RP	2	4.* The VOLUME CONTROL TANK DISCH VALVE V-2501 and the REFUELING WATER TO CHARGING PUMPS VALVE V-2504 on Panel 205 are spacially separated by other letdown, charging and VCT controls. There is a general lack of logical layout of charging, letdown, and VCT controls on this panel for task oriented optimization.
L26	RP	3 ¹	5. On Panel 203, there is a lack of consistency in the column alignment of similar displays. For example, UPPER CAVITY PRESSURE indicators are not aligned vertically in the same column.
S28, S29 S27	GS, GL	3	6. There is a general lack of system grouping on Panel 202. Examples: a.) The Primary Water Makeup Pump controls and PRIMARY WATER STORAGE TANK LEVEL displays are located on Panel 202. The remainder of the makeup controls and displays are located on Panel 205. b.) The Chemical recorders are located between Auxiliary Feedwater controls and indicators.

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8. PANEL LAYOUT (Continued)

<u>PHOTO ID</u>	<u>REVIEWER</u>	<u>PRIORITY</u>	<u>FINDING</u>
R33	RP	2	7. On Panels 205 and 206 it is difficult to locate and identify specific controls located in large matrices of controls which are identical in appearance. The control arrays do not have aids such as system functional grouping, functional color coding, or demarcation to facilitate operator actions.
V77	HV	1	8.* The CONDENSATE STORAGE TANK HIGH LEVEL and CONDENSATE LOW LEVEL annunciator tiles on annunciator Panel Q are not near or above associated system displays.
G14	GL	2	9. The indicator lights for DIESEL GEN. 2A LOADING status on Panel 201 are not arranged in the conventional operational loading sequence.
V46	HV	3	10.* On Panel 203, some controls are not arranged by importance or frequency of use. Examples: a.) ANNUNCIATOR controls b.) REACTOR COOLANT PUMP controls
L15	DL	2	11. There is a poor grouping of indicator lights in several places on Panel 206. Examples: a.) CSAS CHANNEL SB b.) SIAS CHANNEL SB c.) RAS CHANNEL SB
W48	WR	3	12. On Panel 203, several controls/displays are arranged horizontally on the upright panel while related controls/displays are arranged vertically on the benchboard. Example: a.) Reactor Coolant Pumps 2A1, 2A2, 2B1, 2B2
B5,B6	BP	2	13. There is a reversal from normal left-to-right convention of the indicator lights for the LPSI HDR A TO LOOP 2A1 VALVE and the LPSI HDR A TO LOOP 2A2 VALVE on Panel 206.

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8. PANEL LAYOUT (Continued)

<u>PHOTO ID</u>	<u>REVIEWER</u>	<u>PRIORITY</u>	<u>FINDING</u>
P2	JP	3	14. Columns of similar control switches on Panel 206 are separated by two columns of miscellaneous controls. Examples: a.) Control switches V3612 and V3622 b.) Control switches V3613 and 3623)
	GL	3 ¹	15.* The AUX FEEDWATER HEADER FLOW trend recorders on Panel 202 are arranged in BCA left-to-right sequence instead of ABC.
P7, P5, V42	BP,HV,JP	2	16. There are many locations in the control room where components are not arranged left-to-right and/or top-to-bottom, and are not identified in alphabetical or numerical sequence. Examples: a.) The HOLDUP TANK LEVEL INDICATORS on Panel 205 are arranged from right to left. b.) On Panel 206, the HDR E ISOL VALVE is above the HDR A ISOL VALVE. c.) The Line Repeat Panel MEGAVAR meters are numbered from right to left.
P1	RP,JP,BP	2	17.* The locations of LIQUID WASTE FLOW VALVES FCV-6627Y and FCV-6627X status indicator displays and valve control switch positions violate the upper/left - lower/right layout convention for associated controls and displays in a mixed horizontal and vertical layout. The upper set of indicator lights for valve Y is associated with the right position of the valve control. The lower set of indicator lights for valve X is associated with the left position of the control.
P3, P4	JP	1	18. On Panel 206 the meter for SI TANK 2A2 LEVEL is a narrow range instrument. It should be a wide range meter to be consistent with similar level displays on the panel.
V44, V45	HV	3	19.* The controls for the REACTOR REGULATOR SYSTEM "1" and "2" on Backpanel 204 and the continuous rotary selectors on the LOOSE PARTS MONITOR panel do not meet minimum separation guidelines for controls.

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8. PANEL LAYOUT (Continued)

<u>PHOTO ID</u>	<u>REVIEWER</u>	<u>PRIORITY</u>	<u>FINDING</u>
V37, G17, G18	HV, GL	2	20.* There are excessively long meter strings of more than five vertical meters per string on Panels 201 and 203. Examples: a.) EXPANSION STEAM AREA b.) CONDENSER STEAM AREA
S33	DL	2	21. There is string of 10 J-handles on Panel 203. It is difficult to readily distinguish individual controls in the string.
L28	DL	1	22. The REACTOR COOLANT PUMP 280 control on Panel 203 is located in cluster with the PRESSURIZER BACKUP HEATER BANK controls. The pressurizer heater controls are used frequently. This location of the reactor coolant pump control among frequently operated controls increases the likelihood of accidental shutoff of the reactor coolant pump.
W44, W43	WR	1	23. The CRT display on Panel 204 is difficult to view from the operators position at the ROD POSITION CONTROLS because of the poor viewing angle.
S34	GL	3 ¹	24. Electrical test points for Reactor Coolant Temperature are included in front panel. If they are used only for calibration, they should be placed in other than prime control areas. If they are used for operations, they should be replaced by an appropriate display.

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9. CONTROL/DISPLAY INTEGRATION

<u>PHOTO ID</u>	<u>REVIEWER</u>	<u>PRIORITY</u>	<u>FINDING</u>
R32	BP	2	1. There is little system functional logic to the layout of Panel 205. For example, a normal blending operation would involve the use of the BORIC ACID MAKEUP PUMP 2A, the BORIC ACID MAKEUP FLOW VALVE, the REACTOR MAKEUP WATER STOP VALVE, and the REACTOR MAKEUP FLOW VALVE controls and the indicators for BORIC ACID FLOW, REACTOR MAKEUP WATER FLOW and VOLUME CONTROL TANK LEVEL. These controls and displays are not logically grouped to perform this operation.
S30	GS	2	2. Panel 202 benchboard controls are mirror imaged while corresponding vertical displays are not.
	HV	1	3.* On Panel 203, there is a poor layout of Pressurizer Level and Pressurizer Pressure controls and displays. Pressure controls are to the left of Level controls, while Pressure displays are to the right of Level displays. Furthermore, the LOOP 2A/2B HOT LEG TEMPERATURE display is located between the Level and Pressure displays.
B14	BP	3	4. The SHUTDOWN COOLING HX OUTLETS 2A and 2B (TEMP-TI-3303X and TEMP-TI-3303Y) displays are located at the opposite end of the panel from the SHUTDOWN HX CCW VALVES (HCV-14-3A and HCV-14-3B) controls. These controls and displays are used together during a failed pump condition.
G19	GL	2	5. The right portion of Panel 202 contains 5 different subsystems, (circulating water, condensate, primary makeup, intake, and screen wash), which are not arranged in a logical layout.
G20	GL	1	6. Fisher-Porter controllers are inconsistent with each other. Some are fixed scale/moving pointer, while others are moving scale/fixed pointer. This requires operator to move the set point rotary wheel up to increase on some controls and down to increase on others. Examples: (Panel 205) a.) REACTOR MAKEUP FLOW (FRC-2210X) b.) FLASH TANK LEVEL (FCV-6627Y)

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9. CONTROL/DISPLAY INTEGRATION (Continued)

<u>PHOTO ID</u>	<u>REVIEWER</u>	<u>PRIORITY</u>	<u>FINDING</u>
L23	GS	3	7. The FEEDWATER TO STEAM GENERATOR ISOLATION VALVES (HCV-09-1A,2A,1B,2B) on Panel 206 are widely separated from the FEEDWATER PUMP 2A FLOW (FI-09-1A,1B) and FEEDWATER AND STEAM FLOW SG2A/SG2B displays found on Panel 202.
B15	BP	2	8. The COND PIT SUMP YARD SUMP HIGH LEVEL annunciator tile on Panel 205 should be associated with the CONDENSATE PUMP 2A and 2B controls on Panel 202.

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SYSTEMS WHICH COULD NOT BE EVALUATED

- * Because of the state of completion, it was not possible to evaluate the following General Layout aspects of the Control Room:
 - Furniture and Equipment Layout
 - Document Organization and Storage
 - Spare Parts, Operating Expendables, and Tools
 - Supervisor Access
 - Nonessential Personnel Access

- * Operator consoles were represented by cardboard mock-ups which were only approximate replicas of the consoles to be installed. Thus, no studies of the operator consoles or any associated equipment were possible, preventing evaluation of such items as:
 - Anthropometrics
 - Console Dimensions
 - Desk Dimensions
 - Operator Chairs

- * Unit Integration and Interference between the Unit 2 and the Unit 1 Control Rooms under operational conditions could not be fully evaluated. It was observed that, if present plans are implemented, there will be differences between the two control rooms that may have significant human factors implications.

- * Emergency equipment was not present for evaluation of:
 - Operator Protective Equipment
 - Fire, Radiation, and Rescue Equipment
 - Emergency Equipment Storage

- * The Control Room environment was not in its final state. The following environment topics could not be evaluated:
 - Temperature and Humidity
 - Ventilation
 - Illumination
 - Emergency Lighting
 - Auditory Environment
 - Personal Storage
 - Ambience and Comfort

- * The following Voice Communication Systems items were not available for evaluation under operating conditions:
 - Conventional-Powered Telephone Systems
 - Sound Powered Telephone Systems
 - Walkie-Talkie Radio Transceivers
 - Fixed-Base UHF Transceivers
 - Announcing Systems
 - Point-to-Point Intercom Systems
 - Emergency Communications

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- * No evaluation could be made of the Auditory Signal System including:
 - Use of Auditory Signals
 - Signal Meaning
 - Auditory Coding Techniques
 - Signal Propagation
 - Signal Frequency
 - Signal Intensity
 - System Reliability

- * Numerous controls and displays throughout the control room were missing or represented by photo mock-ups and could not be evaluated completely.

- * The Plant Process Computer was not installed in Unit 2 and could not be evaluated from the Unit 1 computer installation. Items which need to be addressed include:
 - Computer Access
 - Cathode Ray Tube (CRT) Displays
 - Hard Copy Printers

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ST. LUCIE UNIT 2 PHOTOLOG

<u>#</u>	<u>ID</u>	<u>PHOTOGRAPH SUMMARY</u>
1-1	B1	Different Open/Close positions on valve controls.
1-2	B2	Non-functional pushbuttons on a control.
1-3		
1-4	B3	Switch handles obscure position labels.
1-5		
1-6	B4	
1-7		
1-8	B5	Mislabeled indicator. HPSI should read LPSI.
1-9	B6	Correctly labeled LPSI indicator has poor label ordering.
1-10	B10	Label error. 2A should read 2A1.
1-11	B12	Poorly located display. 2A above 2B controls.
1-12	B13	Poorly located display. 2B above 2A controls.
1-13	B14	Separated controls and displays.
1-14		
1-15		
1-16	B15	Poorly located annunciator.
1-17	B16	Control separated.
1-18		
1-19		
1-20		
1-21	B17	
1-22	B18	Switch positions violate convention.
1-23		
1-24	G1	Radiation Monitoring Panel obscured.
1-25	G2	HVAC Panel SA obscured.
1-26	G4	Fixed obstruction on floor between consoles.
1-27	G5	Controls too close to bench board front edge.
1-28	G6	No +/- marks. GENERATOR MEGAVAR and GEN. EXC. FIELD REG.
1-29	G7	Poor scale design on Phase Angle displays. Panel 201.
1-30	G8	Scale obscured from standing position. Panel 203.
1-31	G9	Legend label obscures recorder paper.
1-32	G10	HVAC trend recorder. Confusing.
1-33		
1-34	G11	Incorrect numerical progression. Panel 201.
1-35		Incorrect numerical progression. Panel 201.
1-36		Loop 2A Cold Leg Temperature. Panel 203.
1-37		Wide range % power. Panel 204.
1-38	G12	Unconventional scaling. Increases downward. Panel 203.
1-39		
1-40	G13	Paper scale different from recorder scale.
1-41		
1-42	G14	Unconventional sequencing of display lights. Panel 201.
1-43		
1-44	G15	Inconsistent scale labeling. Panel 202.
1-45	G16	Unnecessary controls. Panel 202.

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#	ID	PHOTOGRAPH SUMMARY
1-46	G17	Too many indicators in a single row. Panel 203. Miscellaneous indicators on wrong side of board. Panel 202. Mosaic shots of Panel 202 right hand side.
1-47	G18	
1-48	G19	
1-49		
1-50		
1-51		Inconsistent meter setting technique. Panel 205.
1-52		
1-53	G20	
1-54	J1	
1-55	J2	
1-56	J3	Separated annunciator and annunciator controls.
1-57	J4	
1-58		
1-59	J5	No reflash capability.
1-60	L1	Controls too high. Line Repeat Panel.
1-61	L2	Zero out of place. Generator Indicators.
1-62	L3	Two red lights. HVAC Panel.
1-63	L4	Glare on LED display.
1-64	L5	Painters obscure scale numerals. Panel 202.
1-65	L6	Trend recorder. Panel 203.
1-66	L7	Too many tick marks. Circ. and intake. Panel 202.
1-67	L8	Small tick mark spacing. Panel 203.
1-68	L10	Lack of normal range demarcation. Panel 202.
1-69	L11	Grid too small. Panel 202.
1-70	L12	((Inconsistent multipliers. Panel 206.)) IGNORE PHOTO
1-71	L13	Label placement reversal. Panel 205.
1-72	L14	Poor visual layout on Control Rod display. Panel 204.
1-73	L15	Confusing light arrangement. Panel 206.
1-74	L16	Confusing indicator. Battery 2A. Panel 201.
1-75	L17	Ambiguous control label. I-S3-21-13,14. Panel 202.
1-76	L18	Incorrect labeling. (note redundancy), RPS Group A.
1-77	L19	Nuc. Inst. Safety Channel Drawer % Power. RPS Group A.
1-78	L20	Fixed obstruction on floor near restroom-to-be.
1-79	L21	Meter scale fix appears like a minus sign.
1-80	L22	Poor color selection. Blue/purple.
1-81	L23	Panels 202-206.
1-82		
1-83		
1-84	L24	Too many SG level displays.
1-85	L25	Incorrect label.
1-86	L26	Non-uniform columns. Panel 203.
1-87	L27	4 safety's grouping inconsistent w/ rest of panels. Panel 204.
1-88	L28	Lack of critical control separation. Panel 203.
1-89	L30	Generic Glare Shots. 5 total.
1-90		
1-91		
1-92		
1-93		

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#	ID	<u>PHOTOGRAPH SUMMARY</u>
1-94	M1	Missing label.
1-95	M2	Redundant controls.
1-96	M3	No annunciator tile coordinate markings.
1-97	M4	Potential shock hazard.
1-98	M5	Annunciator tiles can be interchanged when replacing bulbs.
1-99		
1-100		
1-101	M6	Defeat acknowledge.
1-102	M8	Incomplete label. No component identification number.
1-103	M9	Temporary label.
1-104	M10	No label to indicate state.
1-105	M11	No label to indicate state.
1-106	M12	Mismarked label supplemented by temporary label.
1-107	M13	Temporary labels.
1-108	M14	
1-109	M15	
1-110	M16	No label on dedicated CRT.
1-111	M17	Meter mislabeled.
1-112	M18	Recorders too low.
1-113	M19	Label placement.
1-114		
1-115	M20	Keyboard and controls too high.
1-116	P1	Indicator lights in non-conventional locations.
1-117	P2	Related controls separated by two columns of controls.
1-118		
1-119		
1-120		
1-121		
1-122		
1-123		
1-124		
1-125	P3	Improper narrow range display.
1-126	P4	Proper (cic) combination of wide and narrow range displays.
1-127	P5	Valve B control/indicator above valve A control/indicator.
1-128	P6	Separated hydrazine system displays.
1-129		
1-130		
1-131		
1-132		
1-133		
1-134	P7	Unconventional layout of displays.
2-1	R1	Backlit controls and indicators. Potential substitution error.
2-2	R2	Reactor trip channel MA too high.
2-3	R3	Reactor trip channels MB and MD too high.
2-4		
2-5	R4	Unconventional controller.
2-6	R5	Conventional controller.

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#	ID	<u>PHOTOGRAPH SUMMARY</u>
2-7	R6	Unlabelled switch position.
2-8	R7	Parallax. Green Band and Pointer.
2-9		
2-10	R8	Pushbuttons too high.
2-11	R9	Switch too low.
2-12		
2-13	R10	Controller - Parallax between green band and pointer.
2-14		
2-15	R11	((Controller - set point thumbwheel not guarded.))
2-16		
2-17	R12	Unguarded reactor trip and turbine trip pushbuttons.
2-18		
2-19	R13	Unconventional keyswitch orientation. Key teeth up.
2-20	R14	Keyswitches with opposite key orientation.
2-21	R15	Unlabeled keyswitch position.
2-22	R16	Keyswitch color coding.
2-23	R17	J-handle switch flags partially obscured.
2-24		
2-25	R18	Rotary switch flags obscured by pointer.
2-26	R19	Interchangeable backlit indicator windows.
2-27		
2-28		
2-29		
2-30		
2-31		
2-32		
2-33	R20	
2-34	R21	No color contrast.
2-35	R22	No shape coding of switches.
2-36		
2-37	R23	Reactor controls not installed.
2-38		
2-39		
2-40	R24	Unconventional switch positions.
2-41	R25	Flow controllers not installed.
2-42		
2-43		
2-44	R26	Color coding by electrical source, not by system.
2-45		
2-46		
2-47		
2-48	R27	"B" switch position at bottom obscured by rotary knob.
2-49		
2-50		
2-51	R28	Switch can be left between positions.
2-52	R29	Remote shutdown panel overall view & missing displays.
2-53		
2-54		
2-55		
2-56		
2-57		
2-58	R30	Related controls not grouped.

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#	ID	PHOTOGRAPH SUMMARY
2-59	R31	Separated display and controls.
2-60	R32	Control/Display layout and separation.
2-61		
2-62		
2-63		
2-64		
2-65		
2-66		
2-67	R33	Large matrices of identically shaped controls.
2-68		
2-69	R34	Inconsistent color shading.
2-70		
2-71		
2-72		
2-73	R35	Matrix test controls.
2-74		
2-75		
2-76	R36	Trip status panel mimic.
2-77	R40	Console mock-up
2-78		
2-79	S1	Glare on meter.
2-80	S2	Control too high.
2-81		
2-82	S3	Controls too high (all) .
2-83		
2-84	S4	Bulbs not restrained from falling.
2-85	S5	Phone cable tangled on floor in operator pathway. Panel 202.
2-86	S6	Hi voltage controls too high.
2-87	S7	Controls too low.
2-88		
2-89	S8	Reactor coolant pump backpanel. Control height violation.
2-90		
2-91		
2-92	S9	Lack of consistent control/display arrangement.
2-93	S10	Aux Feedwater displays not together.
2-94	S11	Nonlinear scale is unnecessary. Panel 205.
2-95	S12	Pointer overlaps index.
2-96	S13	2 red lights.
2-97	S14	Indicator lights.
2-98	S15	Glare on LED.
2-99	S16	Obscured scale markings.
2-100	S17	Conflicting scales.
2-101	S18	Inconsistent color coding. White indicates ON.
2-102	S19	Reversal of color convention.
2-103	S20	Inconsistent color coding.
2-104	S21	Outdoor light indicator. Amber color improper.
2-105	S22	Condensate pumps.
2-106		
2-107	S23	Lack of demarcation. Panel 202.
2-108	S24	Useless indicator lights.

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#	ID	PHOTOGRAPH SUMMARY
2-109	S25	Display separation. Panel 206.
2-110	S26	Scale range too wide. Panel 206.
2-111	S27	Lack of grouping.
2-112	S28	Heater drain pumps should be demarcated.
2-113	S29	Bad grouping.
2-114	S30	Bad grouping (not mirror imaged).
2-115		
2-116		
2-117	S31	Single channel indicator in dual channel location.
2-118		
2-119	S32	DEH turbine test control panel.
2-120	S33	Lack of control demarcation.
2-121	S34	Test points on apron.
2-122	S35	Inconsistent bezel coloring.
2-123	S36	Incorrect sequence of meters.
2-124	S37	Inconsistent number of chart recorders for hot and cold legs.
2-125	S38	Same label for functionally different controls.
3-1	V1	Unnecessary annunciator tile.
3-2	V2	Permissive displays on Panel P.
3-3		
3-4	V3	No priority color coding.
3-5	V4	Tile lettering too small.
3-6	V5	Titles too wordy.
3-7	V6	Button labels illegible.
3-8	V7	Inconsistent button arrangement.
3-9	V8	
3-10	V9	
3-11	V11	Tile not above related control.
3-12	V12	No annunciator silencer button.
3-13	V13	No first-out on reactor protection system.
3-14	V14	Lighted blank annunciator tile.
3-15	V15	Wordy annunciator label.
3-16	V16	Insufficient spacing between lines of text.
3-17	V17	High and low controls.
3-18	V18	Low controls on HVAC.
3-19	V19	Unlabeled switch positions.
3-20	V20	Missing line on mimic.
3-21	V21	J-handle obscures label.
3-22	V22	Obscured label.
3-23	V23	Lack of hierarchical label arrangement.
3-24	V24	Unlabeled key switch positions.
3-25	V25	No label to indicate meaning of pen recorder color.
3-26	V26	Tag causes visual obstruction.
3-27	V27	Redundant indicators.
3-28	V28	Incorrect label.
3-29	V29	Unlabeled trip button.
3-30	V30	((Inconsistent keypad arrangement.))
3-31	V31	
3-32	V32	CRT difficult to read from operator console. Unit 1
3-33	V33	Projection display hard to read.

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<u>#</u>	<u>ID</u>	<u>PHOTOGRAPH SUMMARY</u>
3-34	V34	Printout data not readily usable by operator.
3-35		
3-36	V35	View of annunciator panels from operator's position.
3-37		
3-38		
3-39		
3-40		
3-41		
3-42	V36	Labeling convention violated.
3-43		
3-44		
3-45		
3-46	V37	Meter string exceeds 5.
3-47	V38	Separation of related indicators and controls.
3-48		Recorder.
3-49	V39	Non-separation of related displays.
3-50	V40	Mild separation of controls and related displays.
3-51	V41	Missing label.
3-52	V42	"3,2,1" order of displays.
3-53	V43	Glare on digital displays.
3-54	V44	Minimum control separation not achieved.
3-55	V45	
3-56	V46	Controls not arranged by frequency of use.
3-57	V47	Incompatible control/display arrangement.
3-58	V48	Scale units not indicated.
3-59	V49	
3-60	V50	
3-61	V51	CLOSE/OPEN indicators violate orientation convention.
3-62	V52	
3-63	V53	No labels on meters.
3-64	V54	Switch positions not labeled.
3-65	V55	
3-66	V56	
3-67	W1	Inconsistent location of annunciator control buttons.
3-68	W2	
3-69	W3	Inconsistent label placement.
3-70	W4	Multiple colors of labels.
3-71	W5	
3-72	W6	
3-73	W7	
3-74	W8	Abbreviation with periods.
3-75	W9	Line spacing less than 1/2 character height.
3-76	W10	Component position label larger than component label.
3-77	W11	Inconsistent abbreviations.
3-78	W12	
3-79	W13	
3-80	W14	No label to indicate state.
3-81	W15	Auto position not labeled.
3-82	W16	Confusing similar labels.
3-83	W17	Label not on component.

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#	ID	<u>PHOTOGRAPH SUMMARY</u>
3-84	W18	Inconsistent labeling.
3-85	W19	Labels do not explain function.
3-86	W20	Poor arrangement.
3-87	W21	Inconsistent mimic color code between two panels.
3-88	W22	Mimics inconsistent
3-89	W23	Insufficient use of mimics.
3-90	W24	Obscured labels.
3-91	W25	Inconsistent color coding
3-92	W26	Content of labels inconsistent.
3-93	W27	Inconsistent labels.
3-94	W28	Incorrect label.
3-95	W29	Duplicated label.
3-96	W30	
3-97	W31	Insufficient color contrast.
3-98	W32	
3-99	W33	Incorrect spacing between characters.
3-100	W34	Engraved labels not filled.
3-101	W35	Obscured labels.
3-102	W36	Inconsistent label locations.
3-103	W37	No indication of set point.
3-104	W38	Labels not always above mimic areas.
3-105	W39	Poor mimicing.
3-106	W40	Lack of demarcation.
3-107	W41	480 volt system switches left out of mimic.
3-108		
3-109		
3-110	W42	Diesel generator controls not grouped in mimic.
3-111		
3-112	W43	Rod position CRT display not easily visible from control.
3-113	W44	
3-114	W45	Several controls/displays missing on Panel 204.
3-115	W46	Panel 206. Bad label placement.
3-116		(shows W44 tag) "
3-117		(shows W45 tag) "
3-118	W47	Panel 201. "
3-119	W48	Mixed horizontal and vertical arrangement of controls.