LILCO
LONG ISLAND LIGHTING

LONG ISLAND LIGHTING COMPANY
SHOREHAM NUCLEAR POWER STATION
P.O. BOX 618, NORTH COUNTRY ROAD • WADING RIVER, N.Y. 11792

June 11, 1981

SNRC-585

Mr. Harold R. Denton, Director
Office Of Nuclear Reactor Regulation
U.S. Nuclear Regulatory Commission
Washington, D.C. 20555

SHOREHAM NUCLEAR POWER STATION - UNIT 1
Docket No. 50-322

Dear Mr. Denton:

Enclosed herewith are sixty (60) copies of LILCO responses to the NRC Human Factors Engineering Control Room Design Review/ Audit Report for the Shoreham Nuclear Power Station. These responses address NRC findings developed during the human factors engineering preliminary design review of the Shoreham Control Room which was conducted at the site during the week of March 30 through April 3, 1981.

Please note that ten (10) copies of the Atmospheric Control Panel (ACH) equipment list and Wiring Diagram for 1T48*PNL-ACH SH.8 have been enclosed for your review.

If you require additional information or clarification, please do not hesitate to contact this office.

Very truly yours,

J. P. Novarro

J. P. Novarro
Project Manager
Shoreham Nuclear Power Station

CC/mh

Enclosures

cc: J. Higgins

8106150347

A

FC-8935

HUMAN FACTORS ENGINEERING
CONTROL ROOM DESIGN REVIEW

LILCO RESPONSE TO NRC AUDIT FINDINGS
SHOREHAM NUCLEAR POWER STATION - UNIT 1

1. WORKSPACE

NRC Finding 1.1

The computer console obstructs the view of the MXP and VC1 auxiliary panels from the seated operator position at the operator's desk. (3)

LILCO Response

Considering the size of the Shoreham control room, it is impossible for an operator to stand or sit in any one particular location and have the ability to read every meter and indicator from that position. Annunciator systems are arranged such that the operator must go to the area in which the annunciator and feedback controls are located and read the annunciator, assess the feedback instrumentation, and take appropriate action. The degree of interference between the computer console and the VC1 and MXP panels will be determined during the Shoreham long-term control room review to be accomplished after fuel load.

NRC Finding 1.2

The security console is unnecessary in the control room. It obstructs movement and obstructs the view of the MXP panel from the operator desk and the reactor control console. (3) (3.1)

LILCO Response

Considering the size of the Shoreham control room, it is impossible for an operator to stand or sit in any one particular location and have the ability to read every meter and indicator from that position. Annunciator systems are arranged such that the operator must go to the area in which the annunciator and feedback controls are located and read the annunciator, assess the feedback instrumentation, and take appropriate action. The degree of interference between the security console and the HVAC and MXP panels will be determined during the SNPS long-term control room review to be accomplished after fuel load.

NRC Finding 1.3

Construction of the supervisor's office is not complete. The adequacy of visual and voice contact between that office and the control room could not be evaluated. (1)

1. WORKSPACE (Cont'd)

LILCO Response

The Watch Engineer's office will be completed prior to fuel load.

NRC Finding 1.4

Grounding cable covered by a metal sleeve on the floor between the operators' desk and the reactor control console is a tripping hazard. (1) (3.3)

LILCO Response

The ground wire was installed and temporarily stored (and protected) in that position pending installation of the permanent control room desk. The ground wire will be removed from the traveled way prior to fuel load.

NRC Finding 1.5

Tangled and kinked sound-powered phone cords lying on the floor are a tripping hazard. Use of non-kink or self retracting cords is recommended. (1)

LILCO Response

During normal operation, the use of sound-powered phones in the control room is localized at specific panels. Phone cords will be of appropriate length and pose no tripping hazard. LILCO does not believe a change in cord type will be beneficial and, in some cases, may even create a hazardous condition.

NRC Finding 1.6

Controls mounted on vertical boards of Panels 601 and MCB, which are 30 inches from the front edge of the benchboard, are difficult for short persons to reach. Recommended: 24 inches maximum reach distance to any control. (3)

LILCO Response

Although the reach is slightly longer than the maximum recommended value of 29 inches per NUREG-1580, the Shoreham control board is of a dimension similar to other operating nuclear control room panels.

NRC Finding 1.7

The annunciator panels on Panels MXP, VC1, and VC2 and on all of the back panels are not tilted forward to enhance readability. (3)

1. WORKSPACE (Cont'd)

LILCO Response

Prior to fuel load, the storage area for emergency gear to be maintained within the control room will be designated and marked accordingly.

NRC Finding 1.12

No provisions are made for speech transmission or communications while wearing emergency breathing apparatus face masks. (1)

LILCO Response

The MSA Ultraview Facepiece will be equipped with a speaking diaphragm to aid speech transmission. These MSA facepieces will be available for use prior to fuel load.

NRC Finding 1.13

Documentation is stored in temporary shelves on the back side of the computer console. Operators at the operator desk or the reactor control console must walk around the computer console to obtain reference documents. Final design and organization of reference document storage in the control room is unknown. (1)

LILCO Response

Organization and location of reference document storage in the control room is affected by final equipment/instrumentation requirements and location. Final design and organization of reference material in the control room will be completed by fuel load.

NRC Finding 1.14

There are no emergency procedures stored in the Remote Shutdown Room. (1)

LILCO Response

Emergency procedures will be located in the remote shutdown room by fuel load.

NRC Finding 1.15

Procedures are not adequately cross referenced. Could not determine whether adequate procedures exist for:

a) Periodic testing of emergency alarms and communications systems,

b) Periodic testing of sound-powered phone systems,

1. WORKSPACE (Cont'd)

c) Periodic inventory and inspection of emergency equipment,

d) Training and practice in use of emergency equipment. (1)

LILCO Response

a) Periodic testing of emergency alarms and communications systems will be accomplished in accordance with the Station Surveillance Program procedure SP27.319.

b) Periodic testing of the sound-powered phone system will be accomplished in accordance with Tech. Spec. requirement 3/4.9.5.

c) Periodic inventory and inspection of emergency equipment will be accomplished thru the use of the following procedures:

SP62.Ø32.6Ø "Respiratory Equipment Cleaning & Inspection"
SP62.Ø32.7Ø "Control of Respiratory Equipment"
SP69.Ø62.Ø1 "Emergency Response Facilities Equipment Control & Readiness Check"
SP69.Ø64.Ø1 "Inventory of Emergency Kits"

d) Training and practice in the use of emergency equipment will be accomplished thru the use of the following procedures:

SP69.Ø6Ø.Ø1 "Emergency Response Training"
(Unnumbered SP) "Drills & Exercises"
SP62.Ø32.Ø1 "Respiratory Protection Program"

The procedures addressed in Items A thru D, above, will be implemented prior to fuel load.

HUMAN FACTORS ENGINEERING
CONTROL ROOM DESIGN REVIEW

LILCO RESPONSE TO NRC AUDIT FINDINGS
SHOREHAM NUCLEAR POWER STATION - UNIT 1

2. WORKPLACE ENVIRONMENT

NRC Finding 2.1

Permanent control room ventilation system could not be evaluated since it is not operational. The temporary ventilation system has excessive air flow. (1)

LILCO Response

Following completion of the permanent control room HVAC system, workspace environmental measurements will be taken. Based on the results of the measurements, corrections will be made prior to fuel load.

NRC Finding 2.2

The lighting of the operational control room could not be accurately evaluated because ceiling diffuser panels had not been installed below the light fixtures. (1)

LILCO Response

Following completion of the permanent ceiling diffuser panel installation, workspace illumination measurements will be taken. Based on the results of the measurements, corrections will be made prior to fuel load.

NRC Finding 2.3

There are no procedures or plans to conduct periodic lighting intensity surveys in the control room. (3)

LILCO Response

An initial lighting intensity survey will be conducted in the control room prior to fuel load. Maintenance/replacement lighting will be handled as a routine maintenance task as required in accordance with the preventive maintenance procedure.

2. WORKPLACE ENVIRONMENT (Cont'd)

NRC Finding 2.4

The emergency DC lighting in the back panel areas is inadequate. Measured lighting illuminance ranged from less than one (1) foot candle to seven (7) foot candles. (1)
Recommended: 30 foot candles minimum for safety related panels and 7.5 foot candles minimum for non-safety related panels.

LILCO Response

There are three independent lighting systems in the Shoreham Control Room as described below:

a) Normal AC. All fluorescent lighting fixtures, except those directly above the inner ring panels, are powered by normal AC, which is backed up by diesel generator 101 upon loss of offsite power.

b) Inverter AC. The fluorescent lighting fixtures directly over the inner ring panels are powered from the vital bus (inverter) which is powered from either station battery C, or an AC bus that will automatically transfer to diesel generator 103 upon loss of offsite power.

c) Emergency DC. There are approximately 12 incondescent light fixtures throughout the control room which are powered directly from the station battery.

Based on the above, upon loss of offsite power, the fluorescent lights directly over the inner ring panels will stay illuminated while the balance of fluorescent fixtures will temporarily be off for about ten seconds until diesel generator 101 comes on line, at which time they will be re-energized. If a LOCA and loss of offsite power occur concurrently, the lighting feeder breaker will be tripped and the operator will have to manually override the trip function to reclose the breaker.

In addition, eight-hour battery-powered lighting will be provided in the control room and access and egress routes prior to fuel load. This lighting has been addressed in our response to Appendix R, 10CFR50.

NRC Finding 2.5

No emergency lighting is provided in the Remote Shutdown Room. (1)

LILCO Response

In accordance with our response to Appendix R to 10CFR50, eight-hour battery powered lighting will be provided in the remote shutdown room and access and egress routes prior to fuel load.

2. WORKPLACE ENVIRONMENT (Cont'd)

NRC Finding 2.6

Contrast between displays and the panel background exceeded the maximum recommended 1:3 luminance ratio at many locations in the control room: (1)

a) Contrast between dark meter faces and panel backgrounds had luminance ratios ranging from 1:3 to 1:10,

b) Contrast between the CRT displays and the Panel 603 background had luminance ratios of 1:5.

LILCO Response

Following completion of the permanent ceiling diffuser panel installation, luminance ratio measurements will be taken. Based on the results of the measurements, corrections will be made prior to fuel load.

NRC Finding 2.7

Formal ambient noise levels in the control room could not be measured accurately because of construction activities. (3)

LILCO Response

Ambient noise levels within the control room environment will be measured prior to fuel load upon completion of construction activities in the area. Based on the results of the measurements, corrections will be made prior to fuel load.

NRC Finding 2.8

There is no lamp test capability or other positive means of determining failed indicating lights except for annunciator lights. (1) (7.3)

LILCO Response

In the present Shoreham Control Room Design, the indicating lights can be categorized as follows:

1450 Annunciator Windows: All testable, on Main Control Room Panels. Two lights per Window (2900).

400 Weston Meter Illumination Lights: Loss of the single light per meter will cause the projected pointer to disappear. This is the only failure that will cause the pointer to disappear on a single meter, therefore it is readily detectable and does not cause operator miss information.

The safety-related MOV position indication and the Breaker Indications for safety-related pumps will be periodically tested as part of the pump and valve

2. WORKPLACE ENVIRONMENT (Cont'd)

test program.

120 Breaker indications: Loss of a Indicator Light will be readily detectable by comparing the Breaker Control Switch Target which should match the position indicator light. (Three lights per Breaker).

200 safety-related motor operated valve position indication: All safety-related valves are porvided with a blue light that is normally illuminated indicating that control power is available to the valve operator and that the valve operator drive motor thermal overload is not activated. This blue light provides a positive method for the operator to assess whether a valve has the ability to move and aids the operator in determining whether red/green lights are burned out. Also, all safety-related valves have a voltage monitor that will alarm both on the Annunciator and Computer in the Control Room. (Three lights per valve). 140 excess flow check valve indications: All of which are testable separator system. 2869 arranged individually or in pairs, none of which is tested or testable.

There are no pairs or sets of indicating lights associated with component controls in the Control Room where every light in the pair or set would remain non-illumination for any normal or transient operating condition.

Based on the above, there are approximately 7440 lights in the Control Room. 4460 are either tested or are testable. This means that 60 percent are covered by lamp test or testing.

For a plant such as Shoreham, where the Main Control Room is essentially complete, the addition of a lamp test capability would have a extremely serious impact. To provide a lamp test capability for every indicating light in the Main Control Room would require the addition of approximately 1200 four-pole relays, 60 - 70 pushbuttons, and thousands of additional wires in already congested Control Room Panels. The addition of this mass of equipment and wiring would seriously degrade the system reliability and would endanger system independence and separation between redundant Class 1E Trains and between Class 1E and Non-Class 1E Systems.

Therefore, on Shoreham, the operators are required to make a once-per-shift panel board walkdown as part of the shift turnover process to detect failed lamps. In addition, the lamps are being supplied with less than rated voltage, resulting in longer-than-normal bulb life. The walk-down procedure will be implemented prior to fuel load. In addition, pre-tested lamps will be stored in the Control Room for the immediate replacement of any failed indicating light.

As part of the Shoreham long term review, the acceptability of the indicating lights used in the Control Room will be assessed with regard to failure rates and available operating life. If the results of this assessment are not satisfied, alternate methods of moving the required indication will be investigated and implemented, as necessary, during a schedule outage.

2. WORKPLACE ENVIRONMENT (Cont'd)

NRC Finding 2.9

Light bulb replacement and service of all Weston meter displays must be done from the back of the panel cabinet. (3)

LILCO Response

There are no criteria which preclude this type of bulb changeout. During any changeout activity, the number of control room operators required by Plant Technical Specifications will be at the plant controls. In addition, bulb changeout will not result in the creation of an electrical fault condition.

NRC Finding 2.10

Changing light bulbs of indicator lights for switches controlling air and motor operated valves is unwieldy and requires a special wrench/extractor that is difficult to use. (1)

LILCO Response

LILCO will review the bulb extractor to ensure that it is being use properly and if enhancement to the tool is required, those actions will be taken. This review will be accomplished prior to fuel load.

NRC Finding 2.11

Maintenance tags hanging down on vertical panels can obscure indicator lights and labels of switches mounted below. (1) (3.8)

LILCO Response

The hold off/caution/information tags used on the control panels will be positioned so as not to obscure adjacent indicator lights or meters. By use of miniature tags and/or tag holders, LILCO will assure that there are no adverse obstructions. This will be accomplished prior to fuel load.

3. ANNUNCIATORS AND AUDITORY SIGNALS

NRC Finding 3.1

The annunciator panel identification scheme is inconsistent and does not fo conventional sequential order around the main control boards. (1) (5.3)

LILCO Response

As presently designed, each annunciator window within the Control Room has unique number engraved on the window. Corresponding to each number is an " Response Procedure." These procedures will be kept in appropriate location allow for ready access by the operator. An annunciator front panel identification scheme, consistent with the elementary electrical wiring dia will be completed by fuel load. This will include annunciator panel designations, as well as, an identification scheme on each individual annun panel.

NRC Finding 3.2

The controls provided for operator response to the annunciator system provi only SILENCE, ACKNOWLEDGE, and TEST controls. (1)
Recommended: provide SILENCE, ACKNOWLEDGE, RESET, and TEST controls for annunciators.

LILCO Respo e

The current main Control Room annunciator system sequence of operation is standard throughout the LILCO system. A ring-back sequence was deliberatel selected since it was felt that with the large number of alarms in the Shor Control Room, the addition of another color and/or flash rate with additior audible signals would cause operator confusion and possibly cause incoming to go unrecognized. In addition, part of the alarm response procedure that operator follows when responding to an alarm is the verification that the a taken have cleared the alarm. For these reasons, we do not consider it to necessary or desirable to reconfigure or replace the present Control Room annunciator system to provide a ring-back sequence. No further LILCO actic be taken.

3. ANNUNCIATORS AND AUDITORY SIGNALS (Cont'd)

NRC Findings 3.3

No first-out alarm system is provided in the annunciator system to identify trip initiating events. (3)

LILCO Response

The first-out alarm function is provided by the sequence of events log in the plant process computer. We do not consider it to be necessary to reconfigure or replace portions of the present Control Room annunciator system to provide a first out sequence. Enclosure 1 contains a description of the Shoreham sequence of events log.

NRC Findings 3.4

There is no audio or visual annunciator indication to signify that an alarmed condition has cleared. Once an alarm occurs, the annunciator tile remains illuminated until the operator presses the Acknowledge control. Then the tile illumination turns off if the alarm has cleared. (1)

LILCO Response

Duplicate item. See LILCO Response to NRC Finding 3.2.

NRC Findings 3.5

Annunciator tile locations are not identified by a matrix identification scheme with the matrix location code inscribed on each tile. Each tile is number coded but there is no systematic correlation between the number code and the tile location. Tiles are not physically keyed to prevent placement in an incorrect location. (1) (5.3)

LILCO Response

Duplicate item. See LILCO response to NRC Finding 3.1.

NRC Findings 3.6

The flash rate of annunciator displays (approximately 1.5 - 2 flashes per second) is slower than recommended. (3)
Recommended: 3 - 5 flashes per second flash rate.

LILCO Response

LILCO will modify or replace the existing flasher cards in the annunciator logic cabinets to provide the recommeneded 3 - 5 flashes per second. This will be

accomplished prior to fuel load.

NRC Findings 3.7

Failure of an annunciator flasher circuit, which may control flashing indicators on more than one annunciator panel, does not necessarily result in steady illumination of the annunciator tiles that were flashing. If flasher failure occurs, the affected annunciator tiles will stay either in the steady ON or the steady OFF condition, depending on their ON/OFF state at the instant flasher failure occurs. (1)

LILCO Response

This condition exists for any current state-of-the-art electromechanical or electronic flasher since the exact failure mode cannot be predicted. Even having a separate flasher for each point would still not permit the detection of a failed flasher card. The function of the annunciator test pushbuttons is to detect single or multiple failures where there is no predictable failure mode. We do not consider it to be necessary or feasible to provide any special designed circuits or systems to detect the failure of a flasher card since that is a function of the existing test pushbuttons. The annunciators will be tested through this annunciator test feature once per shift during normal operations.

NRC Findings 3.8

Some annunciator legends are difficult to read because of inadequate spacing between characters and because character proportions are too thin. (3)

LILCO Response

Annunciator legend characters will be reviewed and corrected prior to fuel load.

NRC Findings 3.9

It is difficult to distinguish whether dark red colored tiles, amber colored tiles, backlit red tiles, and backlit green tiles of annunciator displays are ON or OFF. (2)

LILCO Response

The determination of the effectiveness of the various lens used for annunciator windows will be determined prior to fuel load.

3. ANNUNCIATORS AND AUDITORY SIGNALS (Cont'd)

NRC Findings 3.1

Annunciator response controls are not easily identifiable from other controls and do not have special markings or demarcation to make them stand out as individual control groups from other controls nearby. The green, red, and black collars around the individual annunciator control pushbuttons are not adequate to distinguish the annunciator controls from other pushbutton controls that are also color coded by use of colored collars. (1) (5.2)

LILCO Response

Annunciator silence buttons equipped with green collars and annunciator acknowledge buttons equipped with red collars will be replaced with black collars to avoid any potential confusion associated with the green/red color schemes on the Control Room panels. This will be accomplished prior to fuel load. Annunciator response controls will be suitably padded or enclosed in demarcation lines to make them stand out as individual control groups. This will be accomplished prior to fuel load.

NRC Findings 3.11

Panels 654 and 655 Annunciator response controls have one more button than is used on the other panels (a RESET button). (1)

LILCO Response

Panels 1H11*PNL-654 and 1H11*PNL-655 were furnished by the NSSS vendor as a package. The annunciator manufacturer and operating sequence chosen are not the same as the other annunciators in the main Control Room. The additional pushbutton is required by the particular operating sequence chosen. Since these are back panels out of the operator line of sight, we believe that the operating sequence is appropriate for the function of the panels and we do not consider a change to be necessary.

NRC Findings 3.12

Annunciator alarm control pushbuttons for Silence, Acknowledge, and Test can be operated in any sequence. (1)

LILCO RESPONSE

The operation of these pushbuttons is in accordance with the design of the main Control Room annunciator system. Any silence pushbutton on panel 1H11*PNL-6Ø1, 1H11*PNL-6Ø2, 1H11*PNL-6Ø3, or 1H11*MCB-Ø1 will silence any audible alarm on these panels. The operator must depress the acknowledge pushbutton associated with a particular annunciator section to cause any flashing window in that section to go to a steady on condition. The operator has the capacity to acknowledge an alarm without first depressing a silence button. In this case,

only the audible alarm associated with that section of the annunciator will be silenced as the flashing windows in that section go to a steady on condition. The test pushbutton has no operational function. It serves only to test the annunciator lamps and logic. Operating the annunciator test pushbutton will not cause any incoming alarms to be lost. They will go to a steady on condition after the test has been cleared by depressing the acknowledge pushbutton.

NRC Findings 3.13

Alarm procedures are not keyed to annunciator panel identifiers and annunciator tile matrix coordinates. They are indexed only to the four digit code on each tile which is not systemically related to the tile location. (1) (5.3)

LILCO Response

Duplicate item. See LILCO response to NRC Finding 3.1.

NRC Findings 3.14

There is no input to the Annunciator Inoperative alarm when the HPCI and RCIC controls are switched from AUTO to MANUAL. (1)

LILCO Response

The Auto/Manual mode switch for the HPCI or RCIC system flow controllers does not make either system inoperative when the switch is in the manual position. Should an accident signal be received while either of these mode switches is in the manual position, the system logic will automatically revert to the automatic mode of operation by bypassing the flow controller.

NRC Findings 3.15

Localizing quality of audible alarms is not adequate. While the frequencies of the annunciator alarms at the RCC benchboard and at the RWC and RCIC benchboard are different, their separation is not sufficient to provide a clear localizing quality. It is difficult to determine which annunciator panel is alarming when only one alarm is sounding. (1)

LILCO Response

The subject annunciator horns on panels 6Ø2 and 6Ø3 have been verified with the LILCO preliminary Control Room Audit to be at least 2Ø dB(A) above the general ambient level (See General Physics Shoreham Preliminary Human Factors Engineering Recommendations, Table 5.5.1). As stated, the frequencies of the alarms are different. Pending the precise definitions of the degree of differentiation required, LILCO feels that the applicable criteria have been met and that the

3. ANNUNCIATORS AND AUDITORY SIGNALS (Cont'd)

subject horns are acceptable as installed.

NRC Findings 3.16

The five coded audible station emergency signals, which can be broadcast throughout the plant by the Gai-Tronics system, have not been assigned to specific station emergency conditions. (1) (3.4)

LILCO Response

The Gai-Tronics alarms panel on the operator's desk will be labeled to indicate alarm type. The alarm designation will be specified in the Shoreham Emergency Plan. This will be completed prior to fuel load.

NRC Findings 3.17

Annunciator alarms on the feedwater and electrical areas of Panel MCB are not loud enough. They are barely audible above the 64 dB(A) ambient background noise level. (1) (5.5)

LILCO Response

The alarms associated with the main control board annunciator system will be set at the 1Ø dB(A) sound differential prior to fuel load.

LILCO RESPONSE TO NRC AUDIT FINDINGS
SHOREHAM NUCLEAR POWER STATION - UNIT 1

4. CONTROLS

NRC Finding 4.1

The Recirculation Master Flow Control at the left end of Panel 6Ø3 is beyond convenient reach of the rector operator manipulating the reactor control rods at the center of Panel 6Ø3 during reactor startup and power level changes. (3) (8.1)

LILCO Response

The Recirculation Master Flow Controller will be relocated down and to the right on the benchboard to improve its control/display relationship. This relocation will be accomplished prior to fuel load.

NRC Finding 4.2

Recirculation Master Flow Controller on the reactor control benchboard Panel 6Ø3 should be grouped on the reactor recirculation benchboard Panel 6Ø2 with the Recirculation A and B Flow Controllers. (3)

LILCO Response

The M/A Transfer Station on the 6Ø2 panel provides individual remote manual control of the scoop tube positioners by the operator when they are in the "manual" mode of operation. Placement of the M/A Transfer Stations in the "auto" mode of operation transfers control to the Master Controller located on the 6Ø3 panel. LILCO believes that the location of the controls reenforces awareness of the action being taken. Placing the Master Controller on the 6Ø2 panel could result in improper operation. Therefore, the Master Controller will remain on the 6Ø3 panel.

NRC Finding 4.3

The IRM range switches on Panel 6Ø3 are laid out in a mirror image arrangement of switch locations, colors, and labels with an unconventional left to right sequence ACEB - HFDB. (3)

LILCO Response

LILCO agrees that the IRM Ranges switches on panel 6Ø3 are laid out in a mirror image arrangement; that is, IRM's A, C, E, G on the left and IRM's H, F, D, B on

4. CONTROLS (Cont'd)

the right. The IRM's are arranged to correlate to their corresponding recorder located just above the range switches on the 6Ø3 panel. Each IRM has a corresponding pen on the adjacent recorder. The range switch is used to control the IRM signals during reactor heat up and cool down operations while maintaining the IRM output within a specified band. Operation outside of that band while in a particular range will result in a reactor scram signal being generated from the particular IRM channel. Since the operation of the IRM's is one of insuring that a particular IRM is within the required band on its corresponding recorder, the sequencing of the IRM range switches from left to right is not crucial to the operation. In fact, misoperation of the IRM's results in a fail-safe condition; that is, generation of a rod block and/or scram signal from the particular channel affected. Since the IRM's are arranged in a manner which represents a good controls/display interrelationship between the range switches and the corresponding recorder, LILCO feels that the present arrangement is satisfactory.

NRC Finding 4.4

J handle controls are too close to the front edge of the Panel 6Ø2 benchboard and are vulnerable to accidental actuation. (1) (6.2)

LILCO Response

The lower row switch locations were selected (then verified by mock up) to limit the vulnerability of these controls to inadvertant operation. In addition, key-locked switches will have their keys located in a key locker, thus preventing inadvertant operation of the switches.

NRC Findings 4.5

A violation of "open-right", "close-left" convention exists on the MAIN TURBINE LO Bailey control on Panel MCB. (2) (6.9)

LILCO Response

The main turbine lube oil temperature controller will be modified to the open-right-close-left manual control pushbutton convention as used on other controllers in the control room. This will be accomplished prior to fuel load.

NRC Finding 4.6

The RCIC Reset keyswitches on Panel 6Ø2 rotate in reverse direction from the normal control room convention of clockwise to reset. (3)

4. CONTROLS (Cont'd)

LILCO Response

Utilization of a key lock switch reenforces awareness of the action about to be taken. Rotation of the key, either right or left, will not impact the operator decision or action. LILCO feels the present arrangement is sufficient.

NRC Finding 4.7

The switch position does not match the label, with label being incorrect on the Hydrogen Recombiner Panel. (1) (6.4)

LILCO Response

Labels will be added adjacent to the hydrogen analyzer power control switches to clarify that the "OFF" position is to the left and that the "Actuate" position is to the right. This will be accomplished by fuel load.

NRC Finding 4.8

The top switches on Panel ACh are too high for easy operation. (2) (6.8)

LILCO Response

The layout of panel 1T48*PNL-ACH has been revised to incorporate the addition of an inerting system for the primary containment. Because of this revision, the two top switches will be relocated to approximately 33 in. above the floor. This change will be completed prior to fuel load.

NRC Finding 4.9

Lack of contrasting color marking makes switch handle arrows on Panel 6Ø2 difficult to see. (1) (6.5)

LILCO Response

The engraved pointers on rotary control switches for the Feedwater Inlet Shutoff valves on Panel 6Ø2 will be painted white prior to fuel load.

NRC Finding 4.1Ø

Inconsistent color coding of throttle valve switches occurs on Panels 6Ø2 and MCB. (1) (6.7)

4. CONTROLS (Cont'd)

LILCO Response

Throttleable valve controls will be color coded green prior to fuel load.

NRC Finding 4.11

An inconsistent use of different types of switches for same function exists between handles on Panel 6Ø2 and pushbuttons on MCB. (3)

LILCO Response

Physical constraints as to available front of panel space on 1H11*MCB-Ø1 required the use of compact Cutler-Hammer E3Ø Series pushbutton switches. These switches were used on balance of plant panels for valve control and indication whenever their functional capabilities would permit. The NSSS vendor did not have the same physical constraints and chose to use a rotary selector switch of his own manufacture. On many of the balance of plant panels the lack of physical space precludes changing the E3Ø switches to rotary selector switches with separate indicating lights. The use of different switches will be addressed by operator training.

NRC Finding 4.12

The Remote Shutdown panel inappropriately uses some green switch handles. Green is used elsewhere to identify throttle valves. (2) (6.1Ø)

LILCO Response

A green handle was inadvertently placed on Service Water Pump control switch 1P41*P-ØØ3D. This green handle should be on motor operated valve 1P41*MOV-Ø31B. The subject MOV will be equipped with a green handle indicating it to be a throttleable MOV and the subject pump will be equipped with a standard black handle to agree with standard panel conventions. This will be accomplished prior to fuel load.

NRC Finding 4.13

There is an inconsistent use of switch handle shapes in several locations (Panel HCB, 6Ø1, 6Ø2). (1)

LILCO Response

An inspection of control panel 6Ø2 revealed three instances of varying shaped control handles. First, the control handles for Feedwater Shutoff Valves MOVØ35A&B have a distinctly larger J handle. This distinction is made since these MOV's are the final remote control block valves in the Feedwater lines supplying the reactor vessel. Since the operator must be aware of the consequences of shutting these valves and stopping feedwater to the vessel, the

size of the handles have been enlarged to highlight to the operator that he has control of these MOV's. Second, the MSIV test switches for the C and D MSIV's are of a different shape than the A and B MSIV's. The handle on the test control switches for the C and D MSIV's on panel 6Ø2 will be changed prior to fuel load to a switch of the same configuration as the test switches for the A and B MSIV's on panel 6Ø2. Third, the switch handle for drain valve B21-MOVØ38 has a larger thumb-type handle which is different from the other drain valves on that section of the control panel. The larger thumb-type handle is not necessary and will be changed prior to fuel load to a handle similar to the other drain valves on that section of the panel such as B21-MOVØ33.

NRC Finding 4.14

The RB SVC WATER override switches under annunciator Panel E on Panel MCB rotate in two directions instead of only in one direction. (2) (1Ø.2)

LILCO Response

The RB SVC WATER override switch will be changed to a two-position switch. This will be accomplished prior to fuel load.

NRC Finding 4.15

The small diameter, flush mounted pushbuttons on Bailey flow controllers are difficult to depress. (1) (6.1)

LILCO Response

LILCO has contacted Bailey to evaluate the difficulty of operation for the Bailey manual/auto pushbuttons. Corrective measures will be instituted prior to fuel load.

NRC Finding 4.16

The backlit pushbutton on MCB use only one bulb per switch and do not have a provision for a lamp test. (1)

LILCO Response

Duplicate item. See LILCO Response to NRC Finding 2.8.

NRC Finding 4.17

The removable handle allows dirt to get into the switches on the MCB. (3) (6.3)

LILCO Response

Within the clean environment of an operating Control Room, leaving switches with their removable handle receptacles exposed has always been an acceptable practice with no adverse effects having been experienced by LILCO.

NRC Finding 4.18

No specific storage hook or clip is provided on Panel MCB for the removable handle that is used to manipulate several switches in the emergency power distribution system. (3)

LILCO Response

During operations, the normal location for the "syn" switch "stet handle" either installed in an MCB switch or in the Nuclear Station Operators desk. LILCO feels this arrangement is sufficient.

NRC Finding 4.19

The REACTOR MODE switch is very difficult to turn. (1) (6.6)

LILCO Response

The Reactor Mode Switch will be adjusted prior to fuel load.

NRC Finding 4.2Ø

There are inconsistencies in key tooth orientation of key operated switches. (3)

LILCO Response

Duplicate item. See LILCO Response to NRC Finding 4.6.

NRC Finding 4.21

The key can be removed from the REACTOR MODE switch in any reactor mode position. Removal of the key locks the mode switch in whatever mode was selected at the time the key is removed. This allows the switch to be locked in the RUN position which may be undesirable. (2)

4. CONTROLS (Cont'd)

LILCO Response

During power operation, with the mode switch in run, the location of the key will be in the mode switch. This will be an administrative directive by fuel load.

LILCO RESPONSE TO NRC AUDIT FINDINGS
SHOREHAM NUCLEAR POWER STATION - UNIT 1

5. DISPLAYS

NRC Finding 5.1

Operators need visual indication on Panel 603 to verify that diesel generators are running. (3)

LILCO Response

LILCO does not agree that there is a need for a D-G speed indicator on panel 6Ø3 since the diesel generators are individually alarmed in the plant process computer (digital points C7610 to C7612) when the diesel generators are above 400 rpm (i.e. running). This information will be displayed on the left hand CRT on panel 1H11*PNL-603 and will be logged on the alarm printer. During a loss of offsite power event, an Operator would not be stationed at the 603 panel. He would be required to verify the proper operation of the diesel generator on the electrical section of the MCB.

NRC Finding 5.2

Control indicator lights for safety-related system components indicate only that the command logic has been completed but do not indicate actual component activation or status. (2)

LILCO Response

On Shoreham the control indicator lights for safety related system components indicate actual component actuation or status with the following exceptions:

a) Residual Heat Removal, Core Spray, and Feedwater testable check valves have actuator positions, not disk position. There are flow indicators in each system which along with reactor vessel level indications can be used to determine valve disk position.

b) Safety-related fan discharge dampers have indirect indication. Position switches of the dampers are interlocked with remotely controlled fan operation so that failure of a damper to open with fan running will trip the fan and give an alarm. With this arrangement, damper and fan modes can be interpreted with minimum instrumentation.

c) Standby liquid control system explosion valves: for position indication a continuity monitor of the firing circuit is used. The continuity circuit in conjunction with pump discharge flow and neutron flux levels can be used

to determine valve position.

d) Modulating control valves and dampers do not have direct positi indication. Direct position indication was not provided becaus be misleading to the operator since the actual modulating valve not indicative of actual system performance. System performanc by process parameter displays, which are available to the opera Main Control Panels.

NRC Finding 5.3

Glare on almost all meter faces and chart recorder windows makes read difficult and fatiguing. (2) (7.1)

LILCO Response

LILCO will verify that there is no glare on meter faces and chart rec after the permanent ceiling light diffuser panels have been installed the results of the survey, corrections will be made prior to fuel loa

NRC Finding 5.4

Meters that have positive and negative values within their ranges do clear indication of positive/negative or lead/lag.

a) At least six meters have "+" markings in both directions from t (meters 126A, 126B, 127A, 100A, 108B for the drain tank levels)

b) Meters indicating reactive power for the diesel generators and have no lead/lag or +/- indications. (1) (7.20, 7.24)

LILCO Response

a) The subject meters will be corrected to an increasing level condition corresponding to an upscale meter deflection and a de level condition corresponding to a downscale deflection. This prior to fuel load.

b) The three diesel generator var meters are scaled 21-0-21. The instructed that an upward deflection corresponds to lagging var downward deflection means leading vars. On this basis, labels added on the side of the meter as follows:

1) For the upper half 0-21 vars the label will read "LAG"
2) For the lower half 0-21 vars the label will read "LEAD"

These labels will be in place prior to fuel load.

5. DISPLAYS (Cont'd)

NRC Finding 5.5

Lettering of scales on MILLION LB/HR LOOP A FLOW and MILLION LB/HR LOOP B FLOW is too small and is difficult to read. (1) (7.22)

LILCO Response

The size of the numerals on the subject meters will be modified to be consistent with those of other adjacent meters. This will be accomplished prior to fuel load.

NRC Finding 5.6

Numerals for exponents on scales of counts per second meters for the SRM A, B, C, and D neutron detectors are too small to read from the center of the reactor operating console and are obscured from view of a standing reactor operator by the meter bezel. (2) (7.11)

LILCO Response

The exponents on the SRM Count Rate meters will be enlarged prior to fuel load. Regarding the obstructed view of the SRM count rate meters, see LILCO Response to NRC Finding 7.1.

NRC Finding 5.7

The meters for KILOAMPS AC M-G SET MOTORS A and B and for KILOAMPS AC GENERATORS A and B on Panel 602 are scaled in decimal notation which is undesireable. (2) (7.27)

LILCO Response

The subject meter scales and labels will be modified to eliminate the use of decimals. This will be accomplished prior to fuel load.

NRC Finding 5.8

The HEATER LEVEL meters within the RFP Water Quality Recirc Line have scales with negative values upscale and positive values downscale from the zero. (2) (7.12)

LILCO Response

The meters will be corrected to an increasing level condition corresponding to an upscale meter deflection. This will be accomplished by fuel load.

5. DISPLAYS (Cont'd)

NRC Finding 5.9

Pressure indicators, MSIV Outbd. Div 1; MSIV Inbd. Div. 2; Main Steam Line A, B, C, D Lo Press; Steam Line Lo Press; Steam Line Lo Pressure, have confusing scale labeling. Positive pressure is measured in PSIG and vacuum is measured in inches of Hg. The meter scales do not coincide with the scale pressure and vacuum range labels. A clear demarcation extending from the meter zero and between the pressure and vacuum scale labels would avoid confusion. (1) (7.7)

LILCO Response

For the five meters in question, a demarcation extending from the meter zero and between the pressure and vacuum scale labels will be added prior to fuel load.

NRC Finding 5.10

The DEGREE F CLEANUP SYS TEMP meter on Panel 602 has scale numerals in blue. This is less readable and different from all other meter faces in the control room. (1) (7.23)

LILCO Response

The bluish tint on the RWCU System Temperature meter will be corrected prior to fuel load.

NRC Finding 5.11

Weston meters have no units designated on the meter scale. Instead, units appear on the meter label. (3)

LILCO Response

The Weston meters do not allow for placing the units on the meter scale. Consequently LILCO has provided the meter units on the label identifying the meter function. To place the units on the meter scale would result in having to compromise the size of the numerals on the meter scale. Thus LILCO has opted to put the units clearly on the corresponding label and to maximize the size of the numerals on the scale.

NRC Finding 5.12

Several meters use non preferred scale-graduations such as PSIG REG HX INLET PRESS on Panel 602, and four meters for TRAVEL SCREEN AMPS on Panel MCB are graduated in units of three, RB VENT CFM EXH AIR FLOW and RB NORM VENT DEGREE F SUPPLY AIR TEMP in units of 5 or 2.5. Graduations of 3, 2.5, 7.5, 15, 80 are not recommended. (2) (7.25, 7.26)

5. DISPLAYS (Cont'd)

LILCO Response

The subject meter scales will be graduated in units of 1, 2 or 5 psig. These scale modifications will be completed prior to fuel load. LILCO will evaluate meters similar to the above examples and make corrections prior to fuel load.

NRC Finding 5.13

There are many instances of adjacent meters having different scales. (2)

LILCO Response

The scales on meters in the control room are determined by the variable being monitored. The location of the meters is normally determined by the system with which they are associated. LILCO believes this to be the most efficient method of operation.

NRC Finding 5.14

Several meters use nonlinear scales without operational justification. These include Service Water Inlet flow on Panel 601 which is logarithmic and others such as Reactor Core Cooling Shutdown Head CLG and SVC Water Inlet Flow which have an expanded scale at high value. (3)

LILCO Response

The scales given as examples are square root scales, not logarithmic. Square root extractors were not used because there was no space remaining in G.E. Class 1E instrument racks (signal is Class 1E). Different racks could not be used due to the mixing of power supplies and the possibility of ground loops. Separate square root extractors were not used so as not to compromise electrical separation and reliability.

NRC Finding 5.15

Pointers on Weston Meters vary in size, shape, and contrast. Contrast generally is too low. This is due in part to construction dust within the meters and to the high levels of room illuminations. (2) (7.2)

LILCO Response

To insure Weston meter pointer size, shape and contrast, a program to periodically clean the Weston meter lenses will be in place prior to fuel load.

5. DISPLAYS (Cont'd)

NRC Finding 5.16

Pointers on some Weston meters are reversed in pointer/scale orientation from the prevailing orientation from the prevailing orientation used in the control room. Examples of pointers reversed from the prevailing orientation include:

KILOVOLTS AC,
KILOAMPS AC,
KILOAMPS AC M-G SET MOTOR,
CRD PUMP AMPS,
and
RUNNING VOLTS on the diesel generators. (2) (7.16, 7.17)

LILCO Response

The RUNNING VOLTS on the diesel generators and main generator, the KILOVOLTS AC GENERATOR A/B, KILOAMPS AC GENERATOR A/B, KILOAMPS AC M-G SET MOTOR A/B and CRD PUMP AMPS A/B are the only meters in the Control Room that have their pointers reversed from the control room pointer convention. They will be corrected by fuel load, with the exception of the RUNNING VOLTS meters.

The Running Voltage meters for the three diesel generators and the main generator Running Voltage meter were purposely designed to have their pointers directly opposite the adjacent Incoming Voltage meter. This allows the operator to more closely monitor the required voltage match prior to synchronizing the subject generator to the system or bus. LILCO feels that this approach is correct and justified.

NRC Finding 5.17

Meters and recorders are not marked with normal operating limits, trip values, and alarm points. (1) (7.4, 7.8)

LILCO Response

A meter banding program will be initiated during the Shoreham pre-operational test program and continue through power assension testing with completion by 100% power. At that point, appropriate control room meters and recorders will be marked to indicate parameter limits based on observed operational values.

NRC Finding 5.18

Bottom indicator scale on Main Turbine Lubricating Oil Temperature controller is a valve position. On this scale 100% denotes 100% closed. On all other valve indicators in the Control Room 100% denotes 100% open. All indicators in the plant should follow the same convention. (1) (4.5)

5. DISPLAYS (Cont'd)

LILCO Response

The main turbine lube oil temperature controller will be modified so that 100% will denote 100% OPEN, which will be consistent with other control room valve indicators. This modification will be accomplished prior to fuel load.

NRC Finding 5.19

Indicator lights on Panel 654 do not comform to the green-blue-red convention; they are in blue-green-red order. (1) (7.13)

LILCO Response

The indicator lights in question on panel 654 will be modified to conform to the green-blue-red convention used on the remainder of the control panels prior to fuel load.

NRC Finding 5.20

Color-coded relay protection and open/closed indicator lights for ACB12-3 and ACB11-10 are in different orders. (3)

LILCO Response

The green, white and red indicator lights for ACB11-10 and ACB12-3 are arranged in the same order. The amber indicators are mirror imaged. LILCO believes that the mirror imaging of the amber indicators in no way distracts the operator from satisfactorily interpreting system status.

NRC Finding 5.21

The CRAC Isolation Valve Manual Override indicator lights have a white lens on the top indicator light and blue lens on the bottom. The lenses for indicator lights on adjacent systems are both white. (1) (7.14)

LILCO Response

The odd blue lens will be replaced with a white lens to conform with the other override lights in the Control Room Emergency Ventilation System (1X61). This will be accomplished prior to fuel load.

5. DISPLAYS (Cont'd)

NRC Finding 5.22

Rod Display legend lights on Panel 603 are too small and too high for a 5th percentile operator to read rod designations and positions. Tall operators find the high information density arrangement confusing. (3)

LILCO Response

The full core display on the 603 panel is state of the art equipment. LILCO believes it to be efficient as it is presently installed.

LILCO RESPONSE TO NRC AUDIT FINDINGS
SHOREHAM NUCLEAR POWER STATION - UNIT 1

6. PANEL LAYOUT

NRC Finding 6.1

There are two unused controls located on the Reactor Recirculation Benchboard (Panel 602). (1) (8.2)

LILCO Response

The subject Reactor Recirculation System discharge valve bypass valve control switches will be deleted from the panel prior to fuel load.

NRC Finding 6.2

The inboard and outboard Nuclear Steam Shutdown System control/display groups and the operationally related Nuclear Boiler Process control/display group are separated from each other by the Reactor Water Cleanup System, the Reactor Core Cooling Isolation System, and the Auto Depressurization System control/display groups. This layout causes unnecessary operator movement between the NSSS and NBP controls and displays during some reactor operation. (3)

LILCO Response

The primary reason for this condition is to satisfy cable separation criteria.

NRC Finding 6.3

The square root extractors are unnecessary equipment located on the vertical boards of Panels 601 and 602. They have no control or display function. (3) (3.2)

LILCO Response

The subject square root analog modules associated with the HPCI and RCIC controls are a passive element to the operation. They provide no indications. LILCO feels they do not in any way distract the operator from satisfactorily manipulating the HPCI or RCIC controls or in interpreting the system status.

6. PANEL LAYOUT (Cont'd)

NRC Findings 6.4

The Emergency Power Distribution System diesel generator control/display groups are not laid out in numerical or functional sequence. (3)

LILCO Response

The Emergency Diesel Generators are arranged to meet applicable regulatory separation criteria. The diesels are fully separated within their individual panel arrangements and each unit carries a distinct numerical designation. LILCO feels that this distinct separation and individual numerical designations limit the potential for operator error.

NRC Finding 6.5

Insufficient demarcation is provided between C/D groups on Panels 601 and 602 that have different functions. (3)
Example: Reactor Water Cleanup system and Reactor Recirculation System.

LILCO Response

Panels 601 and 602 will be reviewed and appropriate demarcation will be provided. This will be accomplished as part of the long term review.

NRC Finding 6.6

Two sound-powered phone jacks are located within the CO_2 Purge System black demarcation box on the turbine Building and Miscellaneous Ventilation Panel (VCI). Jacks should have separate demarcation. (1)

LILCO Response

The two sound-powered phone jacks located within the CO_2 Purge System section of the VC1 panel will be demarcated prior to fuel load.

NRC Finding 6.7

Annunciator control buttons should have standard demarcation pads within the control room which clearly identify and separate them from other panel controls. For example, the alarm control buttons for VC1 and VC2 boards are within the demarcation of the Turbine Building Air Exhaust System. Similar Conditions exist at all alarm controls. (1)

LILCO Response

Duplicate finding. See LILCO Response to NRC Finding 3.10.

NRC Finding 6.8

Multiple systems on Panel MXP include mixed sets of unrelated controls and displays that are not clearly segregated by layout or by lines of demarcation. (2) (9.1)

LILCO Response

The MXP Panel will be enhanced through color padding or demarcation lines prior to fuel load.

NRC Finding 6.9

Vacuum Priming Pump Controls A through D are located vertically on Panel MCB adjacent to unrelated controls which are laid out in a horizontal arrangement. No clear demarcation is provided between the two control arrangements. (2)

LILCO Response

Since the vacuum priming pump controls are arranged in a vertical fashion while the adjacent unrelated controls are laid out in a horizontal fashion, the vacuum pump controls A through D will either be padded or demarcated to highlight their different arrangement. This will be accomplished prior to fuel load.

NRC Finding 6.10

The Reactor Feedwater Pump Turbine controllers are on Panel 603 and are not integrated into the mimic of the RFPT system on the adjacent Panel MCB. (3)

LILCO Response

The reactor feedwater pump and turbines are mimiced on the MCB panel. The feedwater flow controllers are located on panel 603 with the other associated level controls and display instrumentation. Integrating these flow controllers would detract from the effectiveness of the existing mimic while providing no significant operating advantage.

NRC Finding 6.11

The operator has no way of determining Main Turbine Stop Valve and/or Control Valve positions while at the Main Control Board. The operator must go to Panel ECH to obtain this information. (3)

6. PANEL LAYOUT (Cont'd)

LILCO Response

The location of instrumentation and controls on the 603 panel is predicated on operational parameters required by the operator, namely nuclear instrumentation, level, pressure, flow, etc. vs. turbine stop and control valve position. LILCO believes these valve position indications are correctly located on the EHC panel.

NRC Finding 6.12

Service Air Controls (not yet labeled) are located on the Miscellaneous Control Panel (MXP). Associated meter displays are on the Main Control Board (MCB). These controls are safety related and should be on MCB. (2)

LILCO Response

The new service air controls located on MXP are for an emergency bottled air supply to the ADS/SRV's. Beside valve controls being added, two new pressure indicators are being added to the MXP to show pressure in the normally isolated air bottles. The new controls are Class IE Division I and II powered. The meters on the MCB are for the normal plant instrument and service air system, which is a non-class IE system. Because of space limitations and separation requirements, the new controls were added to the MXP panel.

NRC Finding 6.13

Unlabeled controls and displays for Turbine Building Service Water are located on the Miscellaneous Control Panel (MXP). They should be located with the rest of the Reactor Building Service Water System C/D on the Main Control Board (MCB). (2)

LILCO Response

The Turbine Building Service Water System is a complete, separate system from the Reactor Building Service Water System. Because of space limitation and separation requirements, its controls were located on the MXP panel. The systems will be labeled prior to fuel load.

6. PANEL LAYOUT (Cont'd)

NRC Finding 6.14

Reactor Building Standby Ventilation System (RBSVS) Chiller Inoperative Alarm Controls are located on the Turbine Building Air Exhaust Panel which is 10-12 feet from the RBSVS panel and RBSVS annunciator panel A2. (3)

LILCO Response

The Manual INOP switch is provided for the operator to annunciate any maintenance operations that make the system INOP, but are not automatically alarmed. Since this switch is non-IE, it is located in the Turbine Building Air Exhaust Section, which is the closest non-IE section to the RBSVS chiller section. This is done for electrical separation.

NRC Finding 6.15

The spring loaded RESET control switch for RBSVS is located high on the VC2 board and must be held down while the operator moves other controls located much lower on the panel and offset to the left and right. This is unreasonably awkward. (3)

LILCO Response

If all automatic initiation signals have cleared, the reset switch must be held in Reset position only long enough to reset a lock-out relay. If automatic initiation signals have not cleared, then turning reset switch to Reset does nothing. No simultaneous operator actions are required in conjunction with the reset switch operation.

NRC Finding 6.16

On the Hydrogen Recombioner Panel, the Leeds and Northrup recorders are too low to read easily. (2) (7.15)

LILCO Response

The subject recorders will be relocated prior to fuel load.

NRC Finding 6.17

On Panel ACH, meters are more than 70 inches above floor level. (2)

LILCO Response

The three meters located at the top of panel 1T48*PNL-ACH are associated with the atmospheric control system (T48) and their respective controls are located

directly below. Due to physical space constraints and the requirement to maintain electrical separation, the meters were located in their present location. Due to the above constraints, there is no other available location on this panel which would allow these meters to be lowered.

NRC Finding 6.18

Top row of chart recorders on HVAC Board (over 1T47 and 1M50) and two meters are too high to be read easily. Poor readability is compounded by glare. (3) (7.1, 7.6)

LILCO Response

These recorders and meters are associated with system controls located on panel VC2 and, due to operational and separation requirements, must remain in their present location.

LILCO will verify that there is minimum glare on meter faces and chart recorder glass after the light diffusing ceiling material is installed. Based on the results of the survey, corrections will be made prior to fuel load.

NRC Finding 6.19

The annunciators for NSSS A/B Isolation and NSSS C/D Isolation read logically from left to right although they are on different annunciator panels. The associated Manual Isolation control buttons are arranged in left to right sequence CDAB. (2)

LILCO Response

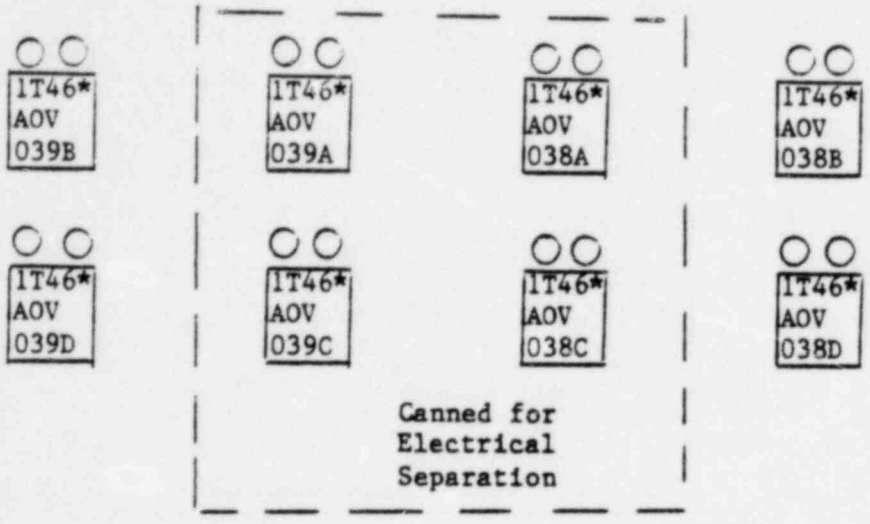
The annunciators and/or switches will be relocated to have the same sequence on both. This will be accomplished by fuel load.

NRC Finding 6.20

Containment Purge Control Valves 38 C and D are reversed with respect to their depiction on the mimic above. (2)

LILCO Response

The mimic shows the actual position of the valves in the flow paths. The switches are located for electrical separation. See below:

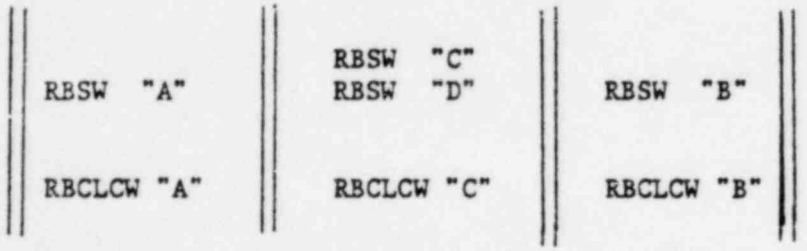


NRC Finding 6.21

Reactor Building Closed Loop Cooling Water Pump ABC and Service Water Pump ABCD control sequences are not in standard sequential order. (2)

LILCO Response

Shoreham is a two train plant, but because of safety system power requirements three safety buses with diesel back-up were provided. Therefore, the Division III (orange) train is not a complete separate entity. It is integrated with Division I and II for ease of operation and separation. Board layout for the three trains is Div. I, Div. III, and Div. II. See below:



Reactor Building Service Water Pumps A and C are in the same mechanical flow loop, and pumps B and D are in the other mechanical flow loop. RBCLCW Pump "C" can be mechanically lined-up with either the A or B pumps. LILCO will demarcate to show division I, II and III separation prior to fuel load.

6. PANEL LAYOUT (Cont'd)

NRC Finding 6.22

On the Reactor Recirculation System mimic on Panel 602, the mimic flow paths for Recirculation Loop A and Recirculation Loop B are not the same. On A the flow path line passes through the flow control, on B it passes through it's % speed and % speed demand meter displays. (1)

LILCO Response

LILCO agrees that the mimic flow path for the recirculation Loop A and B are not the same. The discrepancy arises in the passage of the mimic line through the speed control unit which consists of a controller and feedback meters. To remove this discrepancy LILCO will pad the A and B Loop Speed Control Units such that the mimic line passes through a "Black Box", consisting of the controller and feedback meters. This will be accomplished prior to fuel load.

NRC Finding 6.23

Two strings of six meters each are grouped on the HVAC Board for Air Conditioning System 1X41. There should be no more than five in one string. (3) (7.5)

LILCO Response

Meter groupings of greater than five meters will be visually separated into smaller groupings using demarcation lines or hierarchical labeling. This will be accomplished prior to fuel load.

NRC Finding 6.24

The Primary Containment Atmosphere Control (ACH) Panel layout is poor. Arrangement is mirror image with some controls on the panel not mirror imaged. Units are in BA order from left to right. Switches 1E11*MOVØ57A and 1E11*MOVØ57B are interchanged and therefore located incorrectly on the mimic. Temporary labels are used on the switches. (2)

LILCO Response

Panel 1T48*PNL-ACH has been revised to incorporate the addition of an inerting system for the primary containment. Attempts were made in the course of this revision to relocate controls and instruments (i.e. recorders) to improve panel layout. Physical space and separation requirements constrain our ability to revise this panel. The panel is in the order Division II/Division I, from left to right, due to physical space constraints and separation requirements in the cable spreading area of the Relay Room located underneath the panel. The location of all control switches will be verified and corrected, if necessary, prior to fuel load. All temporary labels will be replaced with permanent nameplates prior to fuel load.

NRC Finding 6.25

On the Reactor Control Benchboard (Panel 603) the IRM range switches are mirror imaged on either side of the rod control. The left to right order is ACEG - rod controls - HFDB. (3)

LILCO Response

Duplicate item. See LILCO Response to NRC Finding 4.3.

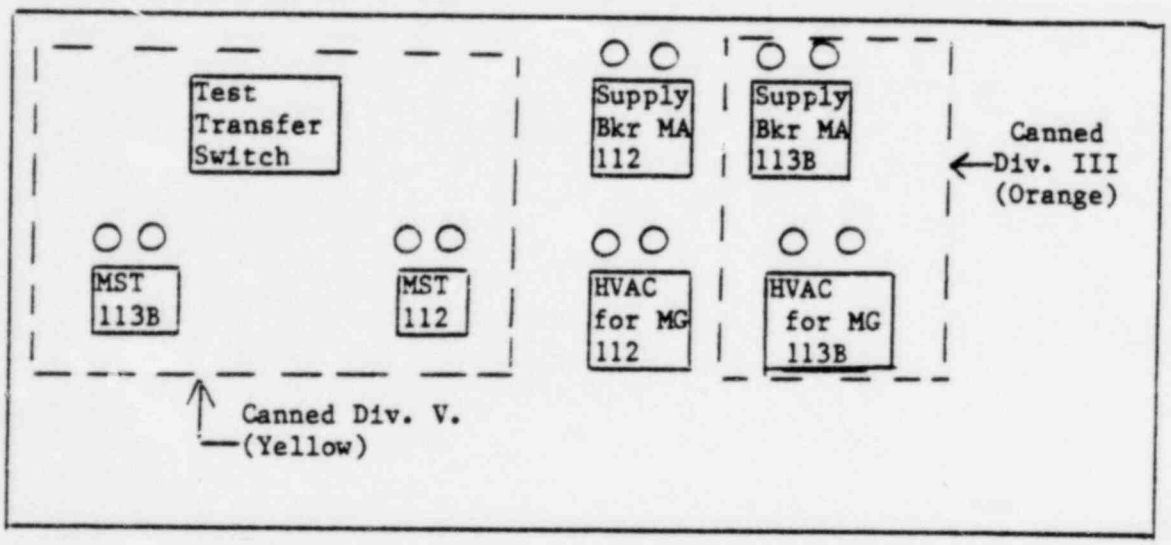
NRC Finding 6.26

Transfer switch MST 113B and related switch MG 113B are separated by switch 112 and a breaker. Similar arrangements are found for switch 111 and switches 113A. (2)

LILCO Response

The layout was designed for electrical separation. See diagram below:

Div. II Section of H11-P601



LILCO will review switches MST 112 and 113B and provide color pad enhancement for the entire switch cluster diagramed above. A similar change will be accomplished for Division I switches on panel 601. This will be accomplished prior to fuel load.

NRC Finding 6.27

On the Main Control Board (MCB) mirror imaging is used inconsistently outside of the Reactor Feedwater System mimic. Within the mimic the mirror imagery is consistent. (3)

LILCO Response

On site system, field, and procedural training have prepared operations personnel to efficiently operate the reactor feedpump turbine controls. The present arrangement in no way impairs or restricts operator action. LILCO will further evaluate the use of mirror imaging in the feedwater mimic as part of the long term review.

NRC Finding 6.28

Inconsistent use of mirror image layout and parallel side by side layouts are used in the mimic of the Reactor Recirculation System on Panel 602. The Recirculation Pump Suction Valves and Generator Drive Motors are arranged in a mirror image layout. The Recirculation Flow controllers and displays, and M/G Generator, Recirculation Pump Discharge, Pump Differential Pressure, and Jet Pump Flow displays are in parallel side-by-side arrangement. (3)

LILCO Response

The present arrangement of instrumentation and controls associated with the reactor recirculation system is parameter oriented. LILCO will reevaluate the arrangement to assess proper control display enhancement techniques. This reevaluation will be conducted as part of the long-term review.

NRC Finding 6.29

The Reactor Water Level display located on Panel 602 near the RCIC system has a 0 - 400 inches range. If the water level falls below the zero reference level on this display, as it could during a loss of feedwater, the operator must go to the Wide Range Water Level meter on Panel 603 to determine the water level in the reactor. (2)

LILCO Response

The subject level display on panel 602 has a range of 0 to 400 inches corresponding to a zero value at reactor vessel instrument zero. This instrument is calibrated for cold reactor conditions and is used as an indication when flooding the reactor vessel and reactor cavity for refueling operations. This level instrument is not used during normal reactor power operations. The control display interrelationship between the Reactor Core Isolation Cooling, Safety Relief Valve (ADS), and High Pressure Cooling Injection Systems, and the Reactor Vessel Water Level indication will be enhanced. A meter indicating reactor

6. PANEL LAYOUT (Cont'd)

vessel wide-range water level (that is +60 inches/0/-150 inches), referenced to reactor vessel instrument zero and calibrated for normal operating reactor pressure and temperature, will be placed on panel 602 in the general vicinity of the isolation mimic panel insert. This will be accomplished prior to fuel load.

LILCO RESPONSE TO NRC AUDIT FINDINGS
SHOREHAM NUCLEAR POWER STATION - UNIT 1

7. CONTROL/DISPLAY INTEGRATION

NRC Finding 7.1

On Panel 6Ø3 the SRM A, B, C, and D displays are located too far from the Rod Pull controls for easy readability. (2)

LILCO Response

The SRM counts per seconds and period meters are located just to the left of the rod pull controls on Panel 6Ø3. The placement of these SRM indications is quite typical of the BWR front panel arrangement; that is, the SRM indications do not share a prominent location relative to the reactor pull controls since these indications are used only during those operations associated with bringing the reactor critical from a full shutdown condition. During this rod pulling operation to critical, the operator is trained to shift his position such that he is directing his awareness to the count level and reactor period as he approaches reactor criticality. Once criticality is achieved, there is a rapid shifting to the intermediate range monitoring system and then power range monitoring system which hold a prominent position adjacent to the reactor pull controls. Since reactor operator simulator training is based on a panel arrangement similar to Shoreham, that is the SRM meter indications being off to the side of the reactor pull controls, LILCO feels that the SRM indications are adequate in their present position. Also, during the pull to reactor criticality, there are flux channel measurements within the intermediate range and power range neutron monitoring system which provide back up scram functions to immediately shut down the reactor should an out of specified flux level be achieved.

NRC Finding 7.2

The computer printer outputs are too far from the computer console to be read easily. (3)

LILCO Response

Considering the size of the Shoreham Control Room, it is impossible for an operator to stand or sit in any one particular location and have the ability to read every meter and indicator from that position. Annunciator systems are arranged such that the operator must go to the area in which the annunciator and feedback controls are located and read the annunciator, assess the feedback instrumentation, and take appropriate action. The same holds true for the computer printouts. Once the operator selects a particular function out of the computer he must walk over to the computer typers, trend recorders or digital

7. CONTROLS/DISPLAY INTEGRATION (Cont'd)

display units to assess the information being transferred from the computer to the readout devices. These typers, trend recorders and digital display units have been located to allow for maximum interface with associated control panel indications and displays. LILCO feels that this general philosophy is appropriate to the Shoreham operation.

NRC Finding 7.3

On Panels 6Ø1 and 6Ø2, the Rosemont SRV pressure indicators are too far from the SRV auto-depressurization controls to be read. (3)

LILCO Response

The operator does not need to read the pressure indicators only to see the trip lights on the front of each module. The operator can tell from the lights how many valves are open or if a valve is open when not required.

NRC Finding 7.4

On Panel 6Ø3 the "Withdraw" or "Continuous Withdraw" push-buttons are located too far from the SRM counts/second and period meters and SRM recorders. (2)

LILCO Response

Duplicate item. See LILCO Response to NRC Finding 7.1.

NRC Finding 7.5

Controls related to annunciators on annunciator panel "E" on Panel MCB are located remotely on Panel MXP. (2) (5.4)

LILCO Response

LILCO has generally complied with the criteria to functionally group annunciators with their corresponding systems. LILCO agrees with the finding. However, final disposition is deferred to the long term review, pending final definition of annunciator system review criteria.

NRC Finding 7.6

The Safety Valve Temperature Indicator/Recorder, which provides positive indications of open safety relief valves, is on a back-panel behind Panel 6Ø1. (3)

7. CONTROLS/DISPLAY INTEGRATION (Cont'd)

LILCO Response

The TMI incident has brought serious questions in both the NRC and Nuclear Community as to the ability of a tail pipe temperature indicator to provide a positive indication of an open safety relief valve. Consequently, NRC position papers, ACRS findings, and general Industry evaluations have concluded that a more positive Safety Relief Valve position indication system was required. LILCO responded to NRC requirements to install a positive position indication system in our response to NUREG Ø578. In that response, LILCO indicated that a tail pipe differential pressure system would be installed on each Safety Relief Valve to provide a positive indication of relief valve position. This LILCO position is similar to the system installed at other BWR's. Within our response, LILCO indicated that the tail pipe temperature indication system would be retained as a back up system to be used by the operator to confirm the tail pipe differential pressure indications. Thus, the temperature recorder for the SRV tail pipes will remain on the back panel, and only the common annunciator will be retained on the front panel

NRC Finding 7.7

The safety relief valves located on Panel 6Ø2 have corresponding annunciator tiles located remotely on annunciator panel G on Panel MCB. (2) (5.4)

LILCO Response

Duplicate item. See LILCO Response to NRC Finding 7.5.

NRC Finding 7.8

The controls located under Panel MCB annunciator panel 2Ø9-H relate to annunciators located remotely on annunciator panels 2Ø9-C and 2Ø9-D. (2) (5.4)

LILCO Response

This finding is more accurately written as: "The controls located under Panel MCB annunciator panels 2Ø9C and D relate to annunciators located remotely on annunciator panel H."

The finding relates to condensate system controls and annunciators. LILCO has generally complied with the criteria to functionally group annunciators with their corresponsing systems. LILCO agrees with the finding. However, the final disposition is deferred to the long term review, pending final definition of annunciator system review criteria.

NRC Finding 7.9

The Seal Water Pump controls on Panel MCB relate to annunciators located remotely

7. CONTROLS/DISPLAY INTEGRATION (Cont'd)

on annunciator panels 209-A and 209-B. (2) (5.4)

LILCO Response

The annunciator in question is displaced on annunciator panel 209-E, while the seal water pump controls and system annunciators are located under annunciator panels A and B.

LILCO genarally complied with the criteria to functionally group annunciators with their corresponsing systems. LILCO agrees with the finding. However, the final disposition is deferred to the long term review, pending final definition of annunciator system review criteria.

NRC Finding 7.10

The controls for by-pass valves on Panel MCB under annunciator panel 209-B relate to remotely located valve position indicators under annunciator panel 209-F. Separate indicator lights for the by-pass valve controls are needed either above the EHC panel or below the feedwater and condensate mimic. (2)

LILCO Response

Duplicate item. See LILCO Response to NRC Finding 6.11.

NRC Finding 7.11

Some annunciators are separated too far from reactor system controls associated with the annunciator and are not readable from the control location. (2) (5.4)

Examples: Condensate controls,
Automatic depressurization system safety relief valve controls.

LILCO Response

LILCO has generally complied with the criteria to functionally group annunciators with their corresponding systems. LILCO agrees with the finding. However, the final disposition is deferred to the long term review, pending final definition of annunciator system review criteria.

NRC Finding 7.12

Some annunciators are separated too far from their annunciator response controls and are difficult to read from the annunciator control location. (2) (5.4)

LILCO Response

LILCO has generally complied with the criteria to functionally group annunciators

with their corresponding systems. LILCO agrees with NRC finding numbers 7.5, 7.7, 7.8, 7.9 and 7.11. However, the final disposition is deferred to the long term review pending final definition of annunciator system review criteria.

NRC Finding 7.13

On Panel 6Ø3 the arrangement of selector controls and recorder displays for the IRM/RBM/APRM 2 pen recorders is confusing and does not show which rod block monitor is selected. (3)

LILCO Response

Instrumentation and controls associated with IRM's, APRM's, and RBM's on panel 6Ø3 are state of the art equipment. In addition to color coding of switches and recorders, operator training, both at the simulator and on site, have reenforced this arrangement. LILCO believs that this present arrangement is efficient.

NRC Finding 7.14

The Feedwater Turbine Test group on Panel MCB contains control shapes and colors which are inconsistent with corresponding indicators. (3)

LILCO Response

See LILCO Response to NRC Finding 6.27.

NRC Finding 7.15

On Panel 6Ø2 there is an inconsistent relationship among the valve switches and the corresponding indicator lights in both position and orientation. (1) (9.1)

LILCO Response

The NRC finding is concerned with the relationship of the switches associated with the ADS and Safety Relief Valves and the corresponding indicator lights. LILCO has identified this problem in their preliminary assessment report as item 9.1. The ADS system will be enhanced through color padding to improve the switch/indication relationship (see enclosure 2). This will be accomplished prior to fuel load.

NRC Finding 7.16

On Panel 654, the relationships between switches and indicators is confusing. The left switch corresponds to the bottom light and the right switch corresponds to the top light. (3)

7. CONTROLS/DISPLAY INTEGRATION (Cont'd)

LILCO Response

Switches S2B, S2F, S2K, and S2P are three-position, keylocked, CR2940's used to test cycle valves E32-FØØ1B, F, K, and P, and E32-FØØ2B, F, K, and P respectively. (i.e. switch S2B left position tests E32-FØØ1B, the right position test E32-FØØ2B). The position indicating lights for E32-FØØ1B are mounted directly above switch S2B. The position indicating lights for E32-FØØ2B are canned and mounted directly above lights for FØØ1B for electrical separation. This arrangement provides the best electrical separation possible within the constraints of panel space.

NRC Finding 7.17

On Panel 6Ø3, the IRM bypass switch handles (G, A, C, & E), the APRM switch handles (A, C, E) and the flow unit switch handles (A, C) are not easily correlated with the displays selected. (3)

LILCO Response

LILCO sees no problem with the arrangement of the IRM, APRM or flow unit bypass switches. Each switch has a distinct position for the instrument channel to be bypassed. Once the operator has made the decision to perform the bypass operation, it is merely a matter of placing the switch towards the channel designation to be bypassed. This bypass arrangement is installed on other operating Boiling Water Reactors and meets applicable regulatory requirements.

NRC FInding 7.18

Reactor Building Supply Fans which are given a vertical portrayal on the mimic (A above B) are associated with controls (IT41-FNØØ2A and IT41-FNØØ2B) arranged horizontally reading in BA order from left to right. (3)

LILCO Response

The control switches will be reversed for a "A" - "B" order left to right. This will be accomplished prior to fuel load.

NRC Finding 7.19

On Panel 6Ø4, the relationship between the reset selector positions and the upscale and downscale trip indicators is not clear. (2)

LILCO Response

On panel 6Ø4 for the Off Gas Vent Pipe Radiation Monitors A&B and the Reactor Building Standby Ventilation Radiation Monitor, a label will be added to indicate that the upscale/downscale push button must be depressed to reset the trip

7. CONTROLS/DISPLAY INTEGRATION (Cont'd)

indications. This will be accomplished prior to fuel load. For the remaining monitors on panel 6Ø4, the reset switch is of the type such that when the reset switch is rotated either to the left or to the right, the trip indications are reset.

HUMAN FACTORS ENGINEERING
CONTROL ROOM DESIGN REVIEW

LILCO RESPONSE TO NRC AUDIT FINDINGS
SHOREHAM NUCLEAR POWER STATION - UNIT 1

8. LABELS & LOCATION AIDS

NRC Finding 8.1

Some labels are located below the controls they identify. (1)
Example: Panel ACH - Primary Containment Gas Analyzer Control.

LILCO Response

Labels located below controls & recorders will be reevaluated for adequacy prior to fuel load. Changes necessitated as a result of the reevaluation will be effected prior to fuel load.

NRC Finding 8.2

Throughout the Control Room, display labels are not consistently located either above or below the displays they identify. (1)

LILCO Response

Duplicate item. See LILCO Response to NRC Finding 8.1.

NRC Finding 8.3

Labels on panel below recorders that protrude from the panel are hidden from view of standing operators.
Example: MXP Panel and Panel 603 (1)

LILCO Response

Duplicate item. See LILCO Response to NRC Finding 8.1.

NRC Finding 8.4

Label on reactor water cleanup return J - switch that states TO REACTOR VESSEL is misleading since the return flow path is through HPCI, RCIC, and feedwater lines to reach the reactor vessel. (1)

8. LABELS & LOCATION AIDS (Cont'd)

LILCO Response

The return flow path of the reactor water cleanup system (RWCU) to the vessel is through the feedwater system. The HPCI and RCIC flow paths also return to the vessel via the feedwater system. The RWCU System does not flow through the HPCI and RCIC systems to return to the vessel. Operator classroom and field training enforces understanding of the entire RWCU flow path. LILCO believes that a change in the labeling, as requested, would be misleading and detract from the primary indication of return flow to the vessel.

NRC Finding 8.5

Temporary labels are used presently at various locations in the Control Room. (1)

LILCO Response

Temporary labeling in the Control Room is utilized as an effective means of identification during this transition and testing phase of the project. Appropriate permanent labeling will be effected prior to fuel load and, subsequently, as equipment and system data become fixed.

NRC Finding 8.6

Some labels are detached or not mounted securely. (1)

LILCO Response

Permanent Control Room labels which are detached or not mounted securely will be corrected prior to fuel load.

NRC Finding 8.7

The labels on the Gai-Tronics alarm control at the operators desk identify the type of sound associated with each switch but they do not show what emergency conditions are associated with each switch. (1) (3.4)

LILCO Response

Duplicate item. See LILCO Response to NRC Finding 3.16.

8. LABELS & LOCATION AIDS (Cont'd)

NRC Finding 8.8

There are no instruction labels for operation of the control transfer switches on the remote shutdown panel. (2)

LILCO Response

Appropriate procedures will be located at the remote shutdown panel. Therefore, no instruction labels at the control transfer switches are required.

NRC Finding 8.9

Labels are inconsistent in the formats of component identifiers and there is no distinction between the letter "O" and the numeral zero when they are used in alpha-numeric identifiers. (1)

LILCO Response

Operations personnel are trained, familiar with and are accustomed to working with the present identifiers. LILCO does not believe there is a need for distinction between the letter "O" and the number zero. LILCO will evaluate and change existing labels to clarify alfa/numeric characters prior to F.L.

NRC Finding 8.10

Different abbreviations are used for the same word. The Control Room abbreviation list shows two and three different abbreviations for each of approximately 16 words. (1)

LILCO Response

The 16 word abbreviations will be evaluated and changed if they are determined to adversely effect operating activities. The evaluation and changes will be completed prior to fuel load.

NRC Finding 8.11

The label on a display that has two indicators identifies the indicators as sensors at locations 1 and 2 but does not identify the actual locations of the sensors being read.
Example: Panel VC2 - Containment and Drywell Moisture Recorder. (1)

LILCO Response

Panel VC2 will be reviewed and appropriate changes will be effected by fuel load.

8. LABELS & LOCATION AIDS (Cont'd)

NRC Finding 8.12

Switch positions are not clearly labeled on some switches. (1)

LILCO Response

Switch position labels will be reviewed and appropriate changes will be effected by fuel load.

NRC Finding 8.13

Control positions of rotary switches are not adequately labeled to identify the function associated with each switch position. (1) (10.2)

LILCO Response

Directional arrows do not appear on the OVERRIDE rotary switches in the Service Water section of the MCB or on the HVAC panel RBSVS SYS A RESET, RBSVS SYS A INITIATE, RBSVS SYS B RESET AND RBSVS SYS BE INITIATE switches. A label change will be made to show the position to which the switch must be placed to accomplish the override/reset function. This will be done prior to Fuel Load.

NRC Finding 8.14

Some labels do not adequately identify the function of the associated control or display. (1)
Examples: Panel ACH - Amber light labeled COMMON ALARM
Panels A2A and A2B - Pushbuttons labeled TEST

LILCO Response

The labels will be revised before fuel load to ensure that they adequately identify the function of the associated control or display.

NRC Finding 8.15

Some annunciator labels are misleading.
Example: Tile 0403 - 125 VDC BUS A1 BRKR OC TRIP on Annunciator Panel 210A. (1)

LILCO Response

Annunciator tiles will be reviewed and changes will be completed prior to fuel load.

NRC Finding 8.16

Lettering has been rubbed off of some labels. (1)

LILCO Response

Permanent Control Room labels will be reviewed and corrected prior to fuel load.

NRC Finding 8.17

Use of white lettering on black background for labels is less desirable than use of black lettering on white background for the lighting conditions present in the Control Room. (1) (10.1)

LILCO Response

The subject labels will be changed to black letters on white background prior to fuel load.

NRC Finding 8.18

There is no sign on the outside of the room housing the Remote Shutdown Panel that identifies it. (1)

LILCO Response

The remote shutdown room will not be labeled. Operators are familiar with the location of the remote S/D Room.

NRC Finding 8.19

There are unlabeled rotary switches at several locations. (1)

LILCO Response

The rotary switches will be properly labeled prior to fuel load.

NRC Finding 8.20

The flow transmitter FT-002 scale is incorrectly marked. It reads 0-12 CFM but actually denotes 0-1200 CFM. (1)

8. LABELS & LOCATION AIDS (Cont'd)

LILCO Response

A X100 multiplier designation will be added to the label associated with the Control Room emergency ventilation flow indicator on the VC2 panel. This will be accomplished by fuel load.

NRC Finding 8.21

Scales on Feedwater Level Control (LIC 10) are not labeled. (1)

LILCO Response

The label on the feedwater level controller (LIC-10) on the MCB will be changed to indicate the units for the tape scale associated with the controller. This will be accomplished prior to fuel load.

NRC Finding 8.22

Labels of displays do not clearly identify the variables displayed, the units displayed, and the scaling parameters of the displays. (1)

LILCO Response

Labels will be evaluated and corrected prior to fuel load.

NRC Finding 8.23

On Panel 603, lines of demarcation do not separate the related sets of selector switches and recorders. (1)

LILCO Response

Panel 603 will be reviewed and appropriate demarcation will be provided. This will be accomplished prior to fuel load.

NRC Finding 8.24

The CRT display control push-buttons on the Panel 603 Reactor Operator's Console are not demarcated from other controls or labeled by function. (1)

LILCO Response

Duplicate item. See LILCO Response to NRC Finding 8.23.

NRC Finding 8.25

On Reactor Building Vent and Off-gas displays on Panel 604, there is an inconsistent relationship between color coding of push-buttons and meter scales. (3)

LILCO Response

Without power to the radiation monitoring units, it would appear that there is no correlation between the range selector push-buttons and the meter scales. However, the push-button range selector switch is back lit with green and blue lights which change to correspond to the meter scale's colors when a particular scale is chosen. LILCO feels that this provides adequate correspondance between range selection and actual meter scale readings.

NRC Finding 8.26

Color coding of controls, position indicators, meter displays, recorder displays, CRT displays, mimics, and demarcation lines are not consistent throughout the Control Room. (3)

LILCO Response

Duplicate item. See LILCO Response to NRC Finding 8.23.

NRC Finding 8.27

The color code labeling scheme of meter ranges and selector switch positions of the Off-Gas Radiation Monitor on Panel 604 is confusing and use of X1 and X.316 scale multipliers make interpretation difficult. (3)

LILCO Response

The Off-Gas Radiation Monitor is essentially an IRM channel with its own range switch. As this switch is changed from red to black positions (labeled 10^{-9} to 1) the meter would be read using either the red or black scales (0-40 red scale, 0-125 black scale). The correlation of the scales is based on an overlap of scales to provide accurate readings in the 0-40 range of a larger 0-125 span similar to an "expand" switch. The electronics establishes the $10 / 10 = 0.316$ relationship. Since this monitor does not provide a safety function and since its operation and base design is similar to the IRM neutron monitors, LILCO feels that the present design is acceptable.

NRC Finding 8.28

The use of red/black color coding to denote the alternate ranges for each pen of the 2 pen IRM/RBM/APRM recorders and to correlate the color of each recorder pen trace with its associated range selector control is confusing. (2)

LILCO Response

Duplicate item. See LILCO Response to NRC Finding 7.13.

NRC Finding 8.29

On Panel 603, the color coding of Rod Drift, Rod Motion Override, RODS Status, RIPS Status, Rod Motion Blocks, and Rod Insert and Withdraw Push-buttons are not correlated with other controls and displays. (2)

LILCO Response

Relative to the NRC finding regarding color coding within the Rod Select Module on Panel 603 the following is offered:

a) The two white lights dealing with the selection of the Stabilizer Valves Set A or Set B are controlled by the black push-button labeled Valve Selector. The use of a black push-button to select the Stabilizer Valves for operation is consistant with selector push-buttons used at other points on the control board. The use of white indicators to show which set of stabilizer valves has been put into operation is also consistant with other status indications, since this is not an off normal or alarm function.

b) The following yellow push-buttons will be changed to black push-buttons prior to fuel load.

1. Accumulator Trouble Acknowledge
2. Continuous Insert
3. Continuous Withdraw
4. Insert
5. Withdraw
6. Rod Drift Test
7. Rod Drift Reset

The use of black push-buttons for acknowledge and reset as well as test operations is consistent with the colors utilized for similar functions at control stations at other points in the Control Room. The rod motion controls dealing with continuous insert and withdrawal and normal insert

and withdrawal will be changed to black push-buttons to be consistent with similar control switches utilized at other locations on the control panels. In addition, the normal insert push-button is backed up by a white insert light when an insert motion is made, the normal withdraw push-button is backed up by a white withdraw light during withdrawal operations and, finally, the continuous withdrawal push-button has a corresponding white continuous withdrawal light during this operation.

c) The Rod Select Block amber light will be left amber to coincide with the amber Rod Select Block light on the Rod Worth Minimizer.

d) The Rod Bypassed, Activity Controls Disagree, and Data Fault amber lights will be left as amber since these lights indicate "Warning" alarm status as opposed to trip indications. The rod motion block lights (insert block and withdraw block) will be changed to red indicator lights to correspond to the insert and withdrawal block lights within the Rod Worth Minimizer and Rod Sequence Control Systems.

f) The individual Control Rod select push-buttons will be left white to correspond with the white select indicator light within the core display just above the rod select module.

g) The white settle light is part of the rod motion status indication. This light is illuminated towards the end of the rod-in or rod-out movement cycle.

NRC Finding 8.30

Some panels, controls, displays, and components of mimics are not labeled. (1)

LILCO Response

LILCO will review the mimics to insure that the mimic components are adequately labeled. In those instances where the shape of the component does not adequately identify the component, a label will be added. This will be accomplished prior to fuel load.

NRC Finding 8.31

Use of different shades of the same color on mimics is confusing. (2)
Example: Remote shutdown panel and Panel 601.

LILCO Response

LILCO has reviewed the Remote Shutdown Panel and Panel 601 and agrees that there are instances where different shades of the same color are used within the mimics on these panels. These differences resulted from repairs and corrections made on a temporary basis. The mimics will be corrected such that the same color is used

8. LABELS & LOCATION AIDS (Cont'd)

throughout the mimic. This action will be taken prior to fuel load.

NRC Finding 8.31(a)

Mimic labels and labels for corresponding controls or displays do not use the same identification nomenclature. (1)
Example: Panels VC1 and VC2.

LILCO Response

The mimic labels and labels for corresponding controls on the VC1 and VC2 panels will be reviewed and discrepancies between the two labels will be corrected prior to fuel load.

NRC Finding 8.32

Mimics do not have arrows indicating direction of flow. (1) (10.3)

LILCO Response

LILCO will install directional arrows on the mimics on panels H11-601, 602, 603 and MCB-01 and the H_2 Recombiner back panel prior to fuel load.

NRC Finding 8.33

Convoluted flow path of Reactor Water Cleanup System mimic detracts from its usefulness. (3)

LILCO Response

LILCO has mimiced the Reactor Water Cleanup System in an effort to enhance the operation of the controls within this area of the control panel. As a result of space restraints on the panel and to meet applicable regulatory requirements, it is possible that some convolution of the flow mimic was necessary. LILCO does not feel that this detracts from the usefullness of the mimic. LILCO feels that the Reactor Water Cleanup System mimic is straightforward, easy to follow, and suitably colored to distinguish major from minor flow paths. However, LILCO will include the use of directional arrows for flow indication prior to fuel load.

NRC Finding 8.34

On Panel 602, the flow mimic showing pump suction valves B-31-F023A, MOV031A and MOV031B is inconsistent and confusing. (1)

LILCO Response

Duplicate item. See LILCO Response to NRC Finding 6.22.

9. COMPUTERS AND CRT DISPLAY

NRC Finding 9.1

Addresses of analog data points are indexed by system only. A cross reference index by point name and point alpha-numeric address code is needed. (1)

LILCO Response

Will we comply with this finding. Three (3) reference indices of computer points will be available to the operator prior to fuel load as follows:

A. System Index which alphabetically lists the systems and the computer input and outputs associated with each system.

B. Computer Point I.D. Alphabetical Index which lists the computer inputs and outputs in alphabetical order of the Computer Point I.D.

C. A Character Description Alphabetical Index which lists the computer inputs and outputs in alphabetical order of the 24 Character Description for each computer point.

NRC Finding 9.2

Excessive referencing of printed documentation located at the computer control console is needed to interpret CRT displays. Information needed to interpret each CRT display should be an intergral part of the display. (2)

LILCO Response

It is felt that sufficient information presently exists on each graphic display for the operator to interpret the variable data (analog, digital, and calculated values) and the background portion of each display. Additionally, operation personnel have reviewed each graphic display and their commments were then incorporated into the final design. Prior to fuel load, Operator Training will be conducted for each graphic display in the areas of purpose, use, content of data and data interpretation.

NRC Finding 9.3

There is excessive reflected glare from ceiling lights on the CRT video displays

on Panel 6Ø3. (3) (11.1)

LILCO Response

After installation of the permanent Control Room lighting diffusers, the glare associated with the CRT's on the H11-6Ø3 panel will be assessed. If necessary, corrective measures (hoods or non-reflective coatings) will be taken prior to fuel load.

NRC Finding 9.4

The video display brightness contrast between the signal and background is not sufficient on the Alarm CRT. (2) (11.2)

LILCO Response

The Alarm CRT on panel H11-6Ø3 will be adjusted to correct the signal to background contrast prior to fuel load.

NRC Finding 9.5

It is difficult to read CRT video displays on Panel 6Ø3 from the operator's desk and the computer control console which are located more than 12 feet away from the displays. (3)

LILCO Response

The general philosophy expressed in the LILCO position associated with item 7.2 applies to this NRC finding. Also, the CRT display can be controlled from the control station located on the 6Ø3 panel.

NRC Finding 9.6

The reactor operator has no control to selectively limit the amount of information being displayed on CRT displays. This lack of information control options can result in possible information overload for the operator. (3)

LILCO Response

Interactive CRT's are not within the scope of the 4Ø1Ø Video Display Subsystem installed at Shoreham. The operator, therefore, cannot selectively limit the amount of information presented on the CRT displays. Operations personnel have reviewed the graphic displays and in many cases requested the data presented. Their comments were subsequently incorporated into the final design. Operator training will be conducted for each graphic display in the areas of purpose, use, data presented and data interpretation.

9. COMPUTERS AND CRT DISPLAY (Cont'd)

NRC Finding 9.7

Panel 6Ø3 CRTs are mounted with the bottom of the screen 69 inches above floor level making it difficult to read the upper portion of the displays. The location and orientation of the CRT displays on Panel 6Ø3 combined with the curvature of the CRT screens make it impossible to read the upper edge. Recommended maximum mounting height is 61 inches. (3)

LILCO Response

Readability of the CRT displays on panel 6Ø3 is within the 11Ø° vertical visual field coupled with the 5th to 95th percentile eye height data.

NRC Finding 9.8

Combined with NRC Finding 9.7.

NRC Finding 9.9

The wording used to identify alarms displayed by the computer and the wording used on annunciator tiles differ for the same alarm conditions. (1)

Example: Annunciator - CRD HYDRAULICS TEMP HI
Computer - CONTROL ROD DRIVE TEMP ALARM

LILCO Response

The wording differences between alarms displayed by the computer and the annunciator windows will be corrected to the extent practicable based on computer capability prior to fuel load.

NRC Finding 9.1Ø

There is inconsistent use of color conventions between the CRT displays and conventional control board and annunciator displays. (3)

LILCO Response

Computer graphic display color schemes are limited by hardware restraints within the 4Ø1Ø Video Display Subsystem. Where possible, every effort was made to match the color conventions to the control board schematics. In those cases where duplicate colors were not available, consistent substitutions were employed.

NRC Finding 9.11

Unconventional symbols are used on the CRT displays. (2)

LILCO Response

Video hardware limitations (available symbols, CRT resolution) does not always allow the generation of conventional symbols. A review will be made of all displays as part of a long-term Control Room review and modifications (symbol revision, additional labels) will be made where appropriate.

NRC Finding 9.12

There is inconsistent use of color coding between different computer generated CRT displays. (2)

LILCO Response

Color coding of variable data (analog, digital, and calculated values) is consistent for all displays. Inconsistent color coding in the background portion of the more detailed displays has been made for clarity as requested by operations personnel.

NRC Finding 9.13

It is difficult to read printer printouts of decimal data because decimal points ar not aligned on the printouts. (1)

LILCO Response

The software will be modified prior to fuel load to allow for the alignment of the analog alarm message decimal points.

NRC Finding 9.14

Some annunciator alarams for auxiliary systems are not shown by the computer alarm display. (3)

LILCO Repsonse

The process computer system on Shoreham has limited number of inputs, therefore, it was decided that only alarms for major systems and multi-point alarms would be taken to the computer individually.

NRC Finding 9.15

The alarm printer print speed, (30 characters per second) is too slow to provide timely printouts when a large number of alarms occur simultaneously or in rapid succession. The recommended minimum printer speed is 300 lines per minute, (200 characters per second at 40 characters per line. (2)

LILCO Response

Printers will be upgraded to a rating of 200 characters per second for all alarm messages, as soon as feasible, consistent with vendor availability.

NRC Finding 9.16

Use of flashing yellow 99.9 to indicate that data should be ignored is confusing. (2)

LILCO Response

The use of flashing yellow "- 99.9" to indicate an unknown analog value has been reviewed and approved by operations personnel. This convention is also consistent with G.E. software. Multiple unknown analog values on most displays during the audit was due to the fact that a large number of analog points are currently awaiting check out by startup personnel. During plant operation the occurence of unknown values will be infrequent.

NRC Finding 9.17

The computer generated CRT display system does not have prompting or structuring features to assist the operator request additional or corrected information. (3)

LILCO Response

Interactive CRT's are not possible with the 4010 Video Display Sub-system. Therefore, the 4010 cannot assist the operator to request additional information. Operator training will be conducted prior to fuel load so the operator is aware of other graphic displays and demanable computer functions which will provide him with necessary additional information.

NRC Finding 9.18

The computer generated digital displays and trend recorder displays on Panel 6Ø2 do not have any identification of the variables being displayed. (3)

LILCO Response

Digital and trend recorder displays are selected by the Control Room Operator for purpose of trending of selected parameters. Parameter ID's are typed on computer output printers. Reaffirmation of the parameter designation, if required can be achieved by request of the operator through the use of the process computer operator console.

10. DATA RECORDING AND RETRIEVAL

NRC Finding 10.1

Combined use of red and black to distinguish between the high and low range scales and to identify the two pen traces of the IRM, APRM, and RBM recorders is confusing. (3)

LILCO Response

Duplicate item. See LILCO Response to NRC Finding 7.13.

NRC Finding 10.2

The 12 channels of data displayed on the turbine vibration multipoint recorders on Panel MCB are difficult to read because: (3)

a) The sensor identification numbers are too small,

b) The color coding of the printed data points is not distinct,

c) The chart is arranged in a three column format without delineation between the parallel columns, and

d) The sensor channels displayed in each column are not consistently grouped in numerical order.

LILCO Response

Shoreham recorder usage follows standard industry convention where each channel is individually indicated, either in the Control Room or locally, and the multipoint recorder is used as a data logger and trend indicator. The operator always has the ability to select individual channels as necessary.

NRC Finding 10.3

Strip chart recorders are loaded with chart paper having scales that do not match the recorder scales. (1) (7.18)

10. DATA RECORDING AND RETRIEVAL (Cont'd)

LILCO Response

The strip chart recorders will be equipped with the proper chart paper prior to fuel load.

NRC Finding 10.4

Multipoint recorders have an excessive number of sensor channels displayed on a single chart (up to 12 channels per chart). (3)

LILCO Response

Duplicate item. See LILCO Response to NRC Finding 10.2.

NRC Finding 10.5

It is difficult to distinguish between the blue and green traces of some recorders. (1)

LILCO Response

Shoreham uses the colors Red, Blue, and Green for the three-pen recorders. The colors are distinguishable except where two channels have the same value and the pens are tracing over each other (this will happen no matter what colors are used). For this reason the recorders are provided with scales and indicators for each pen.

NRC Finding 10.6

Full scale deflections of the IRM and APRM 0-125 and 0-40 ranges do not match. The difference between the full scale deflections is nearly 1/4 inch. The recorder chart paper is printed with the two scales alternating every 1.5 inches. A single 0-100 scale for all ranges would be satisfactory for operator use since absolute values of the neutron production rate or power rate are not used by the operators. (3)

LILCO Response

It is true that the two scales on the IRM/APRM/RBM recorders do not match. The reason for this mismatch relates to the IRM function of the recorder. During IRM operations, the range switching associated with the IRM step through as power increases and alternates the IRM scale between the 0-40 red scale and the 0-125 black scale. As the IRM range switch is changed from red to black positions, the recorder is read using the appropriate red or black scale. The correlation of the scales is based on an overlap of scales to provide accurate readings in the

0-40 range of the larger 0-125 span, similar to an "expand" switch. The electronics within the IRM chassis establishes the 10/10 = 0.316 relationship. The 0-40 scale, or expanded scale, is necessary for accurate operator readings when ascending in power. This particular IRM arrangement is a standard BWR design and is a proven safe configuration.

NRC Finding 10.7

Units associated with recorder scales are not identified. (1)

LILCO Response

The units associated with the recorder scales in the Control Room will be indicated either on the recorder or on the recorder label. This will be accomplished prior to fuel load.

NRC Finding 10.8

Setpoints and normal operating values or ranges are not shown on recorder scales. (1) (7.8)

LILCO Response

Duplicate item. See LILCO Response to NRC Finding 5.17.

NRC Finding 10.9

Most chart recorders are not operational and could not be evaluated completely. (1)

LILCO Response

Chart recorders associated with plant operation will be fully operational by fuel load.

NRC Finding 10.10

Data recording and retrieval could not be evaluated because the procedures are not fully operational. (1)

LILCO Response

Procedures associated with data recording and retrieval will be implemented prior to fuel load.

ENCLOSURE)

SHOREHAM - SEQUENCE OF EVENTS LOG DESCRIPTION

A. OBJECTIVE

The objective of this program is to provide a log that lists the sequence in which changes of state occur among specified groups of digital inputs. The Sequence of Events Log program is turned on by the Event Record Driver when that program detects a change of state among the contacts in any of the seven digital groups monitored by the Sequence of Events function. The points in these groups are selected to represent significant plant-trip-associated parameters, so that the Sequence of Events log will serve as a useful post-trip analysis tool.

B. METHOD

1. Log Description

The Sequence of Events log will contain at least 80 NSS and 40 BOP points listed in chronological order of change of state to a resolution of 2 milliseconds (i.e., for changes of state occurring within less than 2 milliseconds, the correct sequence cannot be guaranteed). Points are typed on the log in the following format:

TIME	CYCLE	POINT ID	NAME	STATUS
XXXXXX	XX	XXXX	30 characters	XXXX

The TIME field gives the time at which the contact changes state in hours, minutes, and seconds. The CYCLE field further subdivides the time to the nearest 1/60 of a second. The POINT I.D. and NAME contain the identification and coded description of the point, and the STATUS field gives the contact status of the point following the change of state.

The table in which the Event Record Driver stores sequential change-of-state data has a capacity of 80 NSS and 40 BOP points. Once this table has been filled, further sequential processing of changes of state is discontinued until the Sequence of Events Log program has finished typing the points in the table. For this reason, only 80 NSS and 40 BOP points are guaranteed for sequence. However, up to the point at which it is filled, the table is essentially a circular list, from which points are being removed by the Sequence of Events as they are typed on the log concurrent with the adding of points to the table by the Event Record Driver as changes of state occur among the monitored contacts. As long as the rate at which changes of state occur does not exceed the rate at which points can be processed for the log, sequential processing can continue indefinitely. Moreover, unless the first 80 NSS and 40 BOP changes of state occur in extremely rapid succession, it is quite possible that the log will contain more than 80 NSS and 40 BOP points in sequence.

After the table has been filled, sequential processing discontinued, and the sequential printout of the points in the table completed, an additional printout will appear listing all points among the monitored contacts that changed state after the table was filled and while the sequential edit was in progress. These points are not listed in sequence, however, and appear on the log as if they all changed state simultaneously.

2. Operating Sequence

a. Event Record Driver

The Event Record Driver is turned on by an uninhibitable interrupt generated by a change of state among any of the 92 NSS and 69 BOP contact inputs monitored by the Sequence of Events function. These contacts are contained within seven digital groups. Event Record Driver initiation may occur from either of four separate interrupts, each of which is generated by a change of state among the contacts in two different groups.

Upon occurrence of any of the four interrupts, the Event Record Driver is turned on, and it immediately imposes a master inhibit to prevent additional interrupts during the time (which is extremely short) that the first interrupt is being processed. Next the Driver tests to determine if the maximum number of events (80 NSS or 40 BOP) have been stored - that is, if the respective table is full. If so, the two interrupts specifically associated with the (NSS or BOP) Sequence of Events function are disabled, and will remain so until the 80 NSS or 40 BOP stored points have been processed for the log. The program then exits after removing the master inhibit which disabled all interrupts. If the maximum number of events have not been stored, the Driver reads and stores the status of every contact in the two digital groups associated with the initiating interrupt, and also stores the time of the interrupt to the nearest cycle. Next the Driver turns on the Sequence of Events Log program, then exits after removing the master inhibit and permitting interrupts to again be accepted and processed.

b. Sequence of Events Log Program

When turned on by the Event Record Driver, the Sequence of Events Log program first tests to determine if there is any processing to do. If not, the program exits to ECP. If there is processing to do, the program next tests to see if non-sequence alarming is in progress - that is, if the program is presently processing points non-sequentially that changed state during the time a sequential log edit was in progress. If so, the program skips the next several steps and goes to the test for changes in groups checked described below. If non-sequence alarming is not in effect, the program tests to see if there have been any changes of state among the contacts in any of the "interrupt group", which consists of the two digital groups associated with one of the interrupts that may

turn on the Event Record Driver. If there have been any changes of state in any "interrupt group" the program builds an alarm message identifying the point that changed state and goes to the output routine described below.

If there are no changes of state among any of the monitored contacts, the program tests to see if the maximum number of sequentially-processed groups has already been done. If not, a further test is made to see if the last sequentially-processed group available has been done, even though the total number done is less than the maximum. If the last group has been processed, the program returns to its initial entry point to test for any non-sequential processing to do. If the last sequentially-processed group has not been done, the program loops back to the start of the processing routine to process the next group. When the maximum number of groups has been done, the program reads in and stores the identification and status of all non-sequence groups (i.e., those groups in which there have been changes of state while sequential processing was in progress). A test is then made to see if there have been any changes of state in the first group to be checked. If there have, the program builds an appropriate message for printout on the log and goes to the output routine described below. If there are no changes in the first group checked, the program tests to determine if it were the last group to be checked, and if not, loops back to check the next one. When the last group has been checked, the program returns to its initial entry point.

When the program determines in its processing routine that there has been a change of state among the contacts in the group being checked, it builds an alarm message and then enters the output routine. Here the program alarms the contact change, updates the point status, and then tests for processing to do for the second unit, a test which is meaningful only at dual-unit plants. Following the "yes" path from this test, the program delays available for one second, then returns to its initial entry point. The Sequence of Events Log is printed on the alarm terminet with the on-demand terminet as backup.

3. Program-to-System Interface

a. Associated Software

The Sequence of Events Log program and the Event Record Driver are mutually interfacing, but are essentially independent of other functional programs. The Driver program performs the scanning and storing functions required for the Sequence of Events function, while the Log program organizes the data gathered by the Driver and prints it out for use by the operator. The Sequence of Events Log program uses the following system subroutines:

Alarm Message Request (ALM3)

Program Delay (DELC01)

Turn Program Off (OFFC02)

b. Program Operating Status

The Sequence of Events Log program has an assigned priority level of 35.

NSS SEQUENCE OF EVENTS POINTS

MAR 12, 1980

SNPS IOLIST - REV 15
DIGITAL POINTS BY DIGITAL ADDRESS

FIELD TERMINATION CABINET NO.	POINT ID	POINT DESCRIPTION	NID NO.	SYSTEM	NORM STAT PRT	ALRM STAT PRT	NORM CONT STAT	ALRM CONT STAT	SIGNAL TYPE	BT RY DP
1-2010-00	D500	SCRAM DISCH VOL LLV CH-A	C1501	1C71	RSET	TRIP	OPEN	CLSD	CSA	D2
1-2010-01	D507	MAIN STEAM LINE CHNL A	C1509	1C71	NORM	TRIP	OPEN	CLSD	CSA	D2
1-2010-02	D511	CONTMT HIGH PRESS CH A	C1513	1C71	NORM	TRIP	OPEN	CLSD	CSA	D2
1-2010-03	D515	REACTOR HI PRESS CHNL A	C1517	1C71	NORM	TRIP	OPEN	CLSD	CSA	D2
1-2010-04	D501	SCRAM DISCH VOL LLV CH-B	C1502	1C71	RSET	TRIP	OPEN	CLSD	CSA	D2
1-2010-05	D508	MAIN STEAM LINE CHNL B	C1510	1C71	NORM	TRIP	OPEN	CLSD	CSA	D2
1-2010-06	D512	CONTMT HIGH PRESS CH B	C1514	1C71	NORM	TRIP	OPEN	CLSD	CSA	D2
1-2010-07	D516	REACTOR HI PRESS CHNL B	C1518	1C71	NORM	TRIP	OPEN	CLSD	CSA	D2
1-2010-08	D502	SCRAM DISCH VOL LVL CH-C	C1503	1C71	RSET	TRIP	OPEN	CLSD	CSA	D2
1-2010-09	D509	MAIN STEAM LINE CHNL C	C1511	1C71	NORM	TRIP	OPEN	CLSD	CSA	D2
1-2010-10	D513	CONTMT HIGH PRESS CH C	C1515	1C71	NORM	TRIP	OPEN	CLSD	CSA	D2
1-2010-11	D517	REACTOR HI PRESS CHNL C	C1519	1C71	NORM	TRIP	OPEN	CLSD	CSA	D2
1-2010-12	D503	SCRAM DISCH VOL LVL CH-D	C1504	1C71	RSET	TRIP	OPEN	CLSD	CSA	D2
1-2010-13	D510	MAIN STEAM LINE CHNL D	C1512	1C71	NORM	TRIP	OPEN	CLSD	CSA	D2
1-2010-14	D514	CONTMT HIGH PRESS CH D	C1516	1C71	NORM	TRIP	OPEN	CLSD	CSA	D2
1-2010-15	D518	REACTOR HI PRESS CHNL D	C1520	1C71	NORM	TRIP	OPEN	CLSD	CSA	D2
1-2010-16	D519	REACTOR LO WTR LVL CH A	C1521	1C71	NORM	TRIP	OPEN	CLSD	CSA	D2
1-2010-17	D520	REACTOR LO WTR LVL CH B	C1522	1C71	NORM	TRIP	OPEN	CLSD	CSA	D2
1-2010-18	D521	REACTOR LO WTR LVL CH C	C1523	1C71	NORM	TRIP	OPEN	CLSD	CSA	D2
1-2010-19	D523	MSL A HIGH RADIATION	C1525	1C71	RSET	TRIP	OPEN	CLSD	CSA	D2
1-2010-20	D542	TCV FAST CLOSURE CHNL A	C1557	1C71	RSET	TRIP	OPEN	CLSD	CSA	D2
1-2010-21	D527	NEUT MON SYSTEM CHNL A1	C1529	1C71	RSET	TRIP	OPEN	CLSD	CSA	D2
1-2010-22	D538	TSV FAST CLOSURE CHNL A	C1553	1C71	RSET	TRIP	OPEN	CLSD	CSA	D2
1-2012-00	D524	MSL B HIGH RADIATION	C1526	1C71	RSET	TRIP	OPEN	CLSD	CSA	D2
1-2012-01	D543	TCV FAST CLOSURE CHNL B	C1558	1C71	RSET	TRIP	OPEN	CLSD	CSA	D2
1-2012-02	D539	TSV FAST CLOSURE CHNL B	C1554	1C71	RSET	TRIP	OPEN	CLSD	CSA	D2
1-2012-03	D528	NEUT MON SYSTEM CHNL B1	C1530	1C71	RSET	TRIP	OPEN	CLSD	CSA	D2
1-2012-04	D525	MSL C HIGH RADIATION	C1527	1C71	RSET	TRIP	OPEN	CLSD	CSA	D2
1-2012-05	D529	NEUT MON SYSTEM CHNL A2	C1531	1C71	RSET	TRIP	OPEN	CLSD	CSA	D2
1-2012-06	D540	TSV FAST CLOSURE CHNL C	C1555	1C71	RSET	TRIP	OPEN	CLSD	CSA	D2
1-2012-07	D544	TCV FAST CLOSURE CHNL C	C1559	1C71	RSET	TRIP	OPEN	CLSD	CSA	D2
1-2012-08	D526	MSL D HIGH RADIATION	C1528	1C71	RSET	TRIP	OPEN	CLSD	CSA	D2
1-2012-09	D545	TCV FAST CLOSURE CHNL D	C1560	1C71	RSET	TRIP	OPEN	CLSD	CSA	D2
1-2012-10	D541	TSV FAST CLOSURE CHNL D	C1556	1C71	RSET	TRIP	OPEN	CLSD	CSA	D2
1-2012-11	D530	NEUT MON SYSTEM CHNL B2	C1532	1C71	RSET	TRIP	OPEN	CLSD	CSA	D2
1-2012-12	D533	MANUAL SCRAM CHANNEL A	C1537	1C71	RSET	TRIP	OPEN	CLSD	CSA	D2
1-2012-13	D534	MANUAL SCRAM CHANNEL B	C1538	1C71	RSET	TRIP	OPEN	CLSD	CSA	D2
1-2012-14	D535	REACTOR AUTO SCRAM CH A	C1539	1C71	RSET	TRIP	OPEN	CLSD	CSA	D2
1-2012-15	D536	REACTOR AUTO SCRAM CH B	C1540	1C71	RSET	TRIP	OPEN	CLSD	CSA	D2
1-2012-16	D522	REACTOR LO WTR LVL CH D	C1524	1C71	NORM	TRIP	OPEN	CLSD	CSA	D2
1-2012-17	D626	APRM THERMAL LEVEL TRIPA	C1756	1C51	NORM	TRIP	CLSD	OPEN	CSA	D2
1-2012-18	D627	APRM THERMAL LEVEL TRIPB	C1757	1C51	NORM	TRIP	CLSD	OPEN	CSA	D2
1-2012-19	D628	APRM THERMAL LEVEL TRIPC	C1758	1C51	NORM	TRIP	CLSD	OPEN	CSA	D2
1-2012-20	D629	APRM THERMAL LEVEL TRIPD	C1759	1C51	NORM	TRIP	CLSD	OPEN	CSA	D2
1-2012-21	D630	APRM THERMAL LEVEL TRIPE	C1760	1C51	NORM	TRIP	CLSD	OPEN	CSA	D2
1-2012-22	D631	APRM THERMAL LEVEL TRIPF	C1761	1C51	NORM	TRIP	CLSD	OPEN	CSA	D2

NSS SEQUENCE OF EVENTS POINTS

MAR 12, 1980

SNPS IOLIST - REV 15
DIGITAL POINTS BY . .GITAL ADDRESS

FIELD TERMINATION CABINET NO.	POINT ID	POINT DESCRIPTION	NID NO.	SYSTEM	NORM STAT PRT	ALRM STAT PRT	NORM CONT STAT	ALRM CONT STAT	SIGNAL TYPE	BT RY DP
1-2014-00	D552	NSS SPARE SEQUENCE ANNUN	C1567						CSA	D2
1-2014-01	D553	NSS SPARE SEQUENCE ANNUN	C1568						CSA	D2
1-2014-02	D555	IRM CHNL B UPSCALE LVL	C1570	1C51	RSET	TRIP	OPEN	CLSD	CSA	D2
1-2014-03	D559	IRM CHNL F UPSCALE LVL	C1574	1C51	RSET	TRIP	OPEN	CLSD	CSA	D2
1-2014-04	D556	IRM CHNL C UPSCALE LVL	C1571	1C51	RSET	TRIP	OPEN	CLSD	CSA	D2
1-2014-05	D560	IRM CHNL G UPSCALE LVL	C1575	1C51	RSET	TRIP	OPEN	CLSD	CSA	D2
1-2014-06	D537	NSS SPARE SEQUENCE ANNUN	C1552						CSA	D2
1-2014-07	D546	APRM CHNL A UPSCALE LVL	C1561	1C51	RSET	TRIP	OPEN	CLSD	CSA	D2
1-2014-08	D547	APRM CHNL B UPSCALE LVL	C1562	1C51	RSET	TRIP	OPEN	CLSD	CSA	D2
1-2014-09	D548	APRM CHNL C UPSCALE LVL	C1563	1C51	RSET	TRIP	OPEN	CLSD	CSA	D2
1-2014-10	D549	APRM CHNL D UPSCALE LVL	C1564	1C51	RSET	TRIP	OPEN	CLSD	CSA	D2
1-2014-11	D550	APRM CHNL E UPSCALE LVL	C1565	1C51	RSET	TRIP	OPEN	CLSD	CSA	D2
1-2014-12	D551	APRM CHNL F UPSCALE LVL	C1566	1C51	RSET	TRIP	OPEN	CLSD	CSA	D2
1-2014-13	D554	IRM CHNL A UPSCALE LVL	C1569	1C51	RSET	TRIP	OPEN	CLSD	CSA	D2
1-2014-14	D558	IRM CHNL E UPSCALE LVL	C1573	1C51	RSET	TRIP	OPEN	CLSD	CSA	D2
1-2014-15	D557	IRM CHNL D UPSCALE LVL	C1572	1C51	RSET	TRIP	OPEN	CLSD	CSA	D2
1-2014-16	D561	IRM CHNL H UPSCALE LVL	C1576	1C51	RSET	TRIP	OPEN	CLSD	CSA	D2
1-2014-17	D562	NSS SPARE SEQUENCE ANNUN	C1579						CSA	D2
1-2014-18	D563	NSS SPARE SEQUENCE ANNUN	C1584						CSA	D2
1-2014-19	D564	NSS SPARE SEQUENCE ANNUN	C1591						CSA	D2
1-2014-20	D565	NSS SPARE SEQUENCE ANNUN	C1592						CSA	D2
1-2014-21	D566	NSS SPARE SEQUENCE ANNUN	C1593						CSA	D2
1-2014-22	D567	NSS SPARE SEQUENCE ANNUN	C1594						CSA	D2
1-2016-00	D568	NSS SPARE SEQUENCE ANNUN	C1595						CSA	D2
1-2016-01	D615	NSS SPARE SEQUENCE ANNUN	C1745						CSA	D2
1-2016-02	D616	NSS SPARE SEQUENCE ANNUN	C1746						CSA	D2
1-2016-03	D617	NSS SPARE SEQUENCE ANNUN	C1747						CSA	D2
1-2016-04	D618	NSS SPARE SEQUENCE ANNUN	C1748						CSA	D2
1-2016-05	D619	NSS SPARE SEQUENCE ANNUN	C1749						CSA	D2
1-2016-06	D620	NSS SPARE SEQUENCE ANNUN	C1750						CSA	D2
1-2016-07	D621	NSS SPARE SEQUENCE ANNUN	C1751						CSA	D2
1-2016-08	D622	NSS SPARE SEQUENCE ANNUN	C1752						CSA	D2
1-2016-09	D623	NSS SPARE SEQUENCE ANNUN	C1753						CSA	D2
1-2016-10	D624	NSS SPARE SEQUENCE ANNUN	C1754						CSA	D2
1-2016-11	D625	NSS SPARE SEQUENCE ANNUN	C1755						CSA	D2
1-2016-12	D504	NSS SPARE SEQUENCE ANNUN	C1505	1C71					CSA	D2
1-2016-13	D505	NSS SPARE SEQUENCE ANNUN	C1506	1C71					CSA	D2
1-2016-14	D506	NSS SPARE SEQUENCE ANNUN	C1507	1C71					CSA	D2
1-2016-15	D531	MANUAL SCRAM CHANNEL C	C1535	1C71	RSET	TRIP	OPEN	CLSD	CSA	D2
1-2016-16	D532	MANUAL SCRAM CHANNEL D	C1536	1C71	RSET	TRIP	OPEN	CLSD	CSA	D2
1-2016-17	D632	NSS SPARE SEQUENCE ANNUN	C1762						CSA	D2
1-2016-18	D633	NSS SPARE SEQUENCE ANNUN	C1763						CSA	D2
1-2016-19	D634	NSS SPARE SEQUENCE ANNUN	C1764						CSA	D2
1-2016-20	D635	NSS SPARE SEQUENCE ANNUN	C1765						CSA	D2
1-2016-21	D636	NSS SPARE SEQUENCE ANNUN	C1766						CSA	D2
1-2016-22	D637	NSS SPARE SEQUENCE ANNUN	C1767						CSA	D2

BOP SEQUENCE OF EVENTS POINTS

MAR 12, 1980

SNPS IOLIST - REV 15
DIGITAL POINTS BY DIGITAL ADDRESS

FIELD TERMINATION CABINET NO.	POINT ID	POINT DESCRIPTION	NID NO.	SYSTEM	NORM STAT FRT	ALRM STAT PRT	NORM CONT STAT	ALRM CONT STAT	SIGNAL TYPE	BT RY DP
1-2024-00	D107	NSS XFMR DIFF PRI PROT	C7827	1R62	NORM	TRIP	OPEN	CLSD	CSA	D2
1-2024-01	D108	NSS BKR 1350/1360 FAIL	C7828	1R62	NORM	TRIP	OPEN	CLSD	CSA	D2
1-2024-02	D109	RSS XFMR DIFF PRI PROT	C7829	1R62	NORM	TRIP	OPEN	CLSD	CSA	D2
1-2024-03	D110	RSS B/U OC PROT	C7830	1R62	NORM	TRIP	OPEN	CLSD	CSA	D2
1-2024-04	D111	RSS B/U GRD OC X WDG	C7831	1R62	NORM	TRIP	OPEN	CLSD	CSA	D2
1-2024-05	D112	RSS B/U GRD OC Y WDG	C7832	1R62	NORM	TRIP	OPEN	CLSD	CSA	D2
1-2024-06	D113	RSS XFMR AUX FAULT PROT	C7833	1R62	NORM	TRIP	OPEN	CLSD	CSA	D2
1-2024-07	D114	RSS XFMR 69KV BKR B/U	C7834	1R62	NORM	TRIP	OPEN	CLSD	CSA	D2
1-2024-08	D115	RSS XFMR 69KV BUS DIFF	C7835	1R62	NORM	TRIP	OPEN	CLSD	CSA	D2
1-2024-09	D116	13KV GAS TURB BKR FAIL	C7836	1R62	NORM	TRIP	OPEN	CLSD	CSA	D2
1-2024-10	D133	NSS BKR 1310 B/U PROT	C7837	1R62	NORM	TRIP	OPEN	CLSD	CSA	D2
1-2024-11	D134	NSS BKR 1330 B/U PROT	C7838	1R62	NORM	TRIP	OPEN	CLSD	CSA	D2
1-2024-12	D158	NSS GEN LEADS CC PROT	C7841	1R62	NORM	TRIP	OPEN	CLSD	CSA	D2
1-2024-13	D159	BOP SPARE SEQUENCE ANNUN	C3832	1N32					CSA	D2
1-2024-14	D160	BOP SPARE SEQUENCE ANNUN	C3833	1N32					CSA	D2
1-2024-15	D161	BOP SPARE SEQUENCE ANNUN	C3834	1N32					CSA	D2
1-2024-16	D163	BOP SPARE SEQUENCE ANNUN	C7761	1R61					CSA	D2
1-2024-17	D164	BOP SPARE SEQUENCE ANNUN	C7762	1R61					CSA	D2
1-2024-18	D165	BOP SPARE SEQUENCE ANNUN	C7763	1R61					CSA	D2
1-2024-19	D166	BOP SPARE SEQUENCE ANNUN	C7821	1R62					CSA	D2
1-2024-20	D167	BOP SPARE SEQUENCE ANNUN	C7822	1R62					CSA	D2
1-2024-21	D168	BOP SPARE SEQUENCE ANNUN	C7842	1R62					CSA	D2
1-2024-22	D169	BOP SPARE SEQUENCE ANNUN	C7843	1R62					CSA	D2

BOP SEQUENCE OF EVENTS POINTS

MAR 12, 1980

SNPS IOLIST - REV 15
DIGITAL POINTS BY DIGITAL ADDRESS

FIELD TERMINATION CABINET NO.	POINT ID	POINT DESCRIPTION	NID NO.	SYSTEM	NORM STAT FRT	ALRM STAT FRT	NORM CONT STAT	ALRM CONT STAT	SIGNAL TYPE	BT RY DP
1-2020-00	D140	HI EXH HOOD T	C3801	1N32	NORM	TRIP	OPEN	CLSD	CSA	D2
1-2020-01	D141	LOSS OF STATOR COOLANT	C3802	1N32	NORM	TRIP	OPEN	CLSD	CSA	D2
1-2020-02	D149	LOSS OF 24VDC PWR	C3810	1N32	NORM	TRIP	OPEN	CLSD	CSA	D2
1-2020-03	D152	TURBINE BACKUP OVERSPEED	C3813	1N32	NORM	TRIP	OPEN	CLSD	CSA	D2
1-2020-04	D151	TURBINE	C3812	1N32	NORM	TRIP	OPEN	CLSD	CSA	D2
1-2020-05	D155	LOSS OF EMERG TRIP FLUID	C3816	1N32	NORM	TRIP	OPEN	CLSD	CSA	D2
1-2020-06	D142	SHAFT PP DIS LOW P	C3803	1N32	NORM	TRIP	OPEN	CLSD	CSA	D2
1-2020-07	D147	HIGH TURB VIBRATION	C3808	1N32	NORM	TRIP	OPEN	CLSD	CSA	D2
1-2020-08	D148	CONDENSER HIGH VACUUM	C3809	1N32	NORM	TRIP	OPEN	CLSD	CSA	D2
1-2020-09	D150	MANUAL TURBINE	C3811	1N32	NORM	TRIP	OPEN	CLSD	CSA	D2
1-2020-10	D143	THR BRG WEAR-L.O. LOW P	C3804	1N32	NORM	TRIP	OPEN	CLSD	CSA	D2
1-2020-11	D144	LOSS OF 125VDC EHC PWR	C3805	1N32	NORM	TRIP	OPEN	CLSD	CSA	D2
1-2020-12	D145	LOW HYDRAULIC P	C3806	1N32	NORM	TRIP	OPEN	CLSD	CSA	D2
1-2020-13	D146	PRI & B/U SPEED SIG LOST	C3807	1N32	NORM	TRIP	OPEN	CLSD	CSA	D2
1-2020-14	D153	MOIST SEPARTR DRN HI LVL	C3814	1N32	NORM	TRIP	OPEN	CLSD	CSA	D2
1-2020-15	D154	BOP SPARE SEQUENCE ANNUN	C3831	1N32					CSA	D2
1-2020-16	D101	VOLTS/HZ GT 110P/C PROT	C7720	1R61	NORM	TRIP	OPEN	CLSD	CSA	D2
1-2020-17	D102	VOLTS/HZ GT 118P/C PROT	C7721	1R61	NORM	TRIP	OPEN	CLSD	CSA	D2
1-2020-18	D117	UNIT DIFF PRI PROT	C7722	1R61	NORM	TRIP	OPEN	CLSD	CSA	D2
1-2020-19	D118	GEN NEUT GRD PRI PROT	C7723	1R61	NORM	TRIP	OPEN	CLSD	CSA	D2
1-2020-20	D119	MAX EXC LIM UNIT PR PROT	C7724	1R61	NORM	TRIP	OPEN	CLSD	CSA	D2
1-2020-21	D120	MN XFMR 1A SUDDEN P	C7725	1R61	NORM	TRIP	OPEN	CLSD	CSA	D2
1-2020-22	D156	LOSS OF CIRC WATER	C5417	1N71	NORM	TRIP	OPEN	CLSD	CSA	D2
1-2022-00	D121	MN XFMR 1B SUDDEN P	C7726	1R61	NORM	TRIP	OPEN	CLSD	CSA	D2
1-2022-01	D122	MN GEN LINE DIFF PROT	C7727	1R61	NORM	TRIP	OPEN	CLSD	CSA	D2
1-2022-02	D123	UNIT BKR 1350/1360 FAIL	C7728	1R61	NORM	TRIP	OPEN	CLSD	CSA	D2
1-2022-03	D124	UNIT ANTIMOTORING PROT	C7729	1R61	NORM	TRIP	OPEN	CLSD	CSA	D2
1-2022-04	D125	MN XFMR 1A DIFF B/U PROT	C7730	1R61	NORM	TRIP	OPEN	CLSD	CSA	D2
1-2022-05	D126	MN XFMR 1B DIFF B/U PROT	C7731	1R61	NORM	TRIP	OPEN	CLSD	CSA	D2
1-2022-06	D127	MN GEN DIFF B/U PROT	C7732	1R61	NORM	TRIP	OPEN	CLSD	CSA	D2
1-2022-07	D128	EXC-ALT DIFF B/U PROT	C7733	1R61	NORM	TRIP	OPEN	CLSD	CSA	D2
1-2022-08	D129	GEN NEUT GRD B/U PROT	C7734	1R61	NORM	TRIP	OPEN	CLSD	CSA	D2
1-2022-09	D130	GEN GRD BUS B/U PROT	C7735	1R61	NORM	TRIP	OPEN	CLSD	CSA	D2
1-2022-10	D131	LOSS OF EXC B/U PROT	C7736	1R61	NORM	TRIP	OPEN	CLSD	CSA	D2
1-2022-11	D162	BOP SPARE SEQUENCE ANNUN	C7760	1R61					CSA	D2
1-2022-12	D132	GEN REV PWR B/U PROT	C7737	1R61	NORM	TRIP	OPEN	CLSD	CSA	D2
1-2022-13	D135	MN XFMR 1A GRD B/U PROT	C7738	1R61	NORM	TRIP	OPEN	CLSD	CSA	D2
1-2022-14	D136	MN XFMR 1B GRD B/U PROT	C7739	1R61	NORM	TRIP	OPEN	CLSD	CSA	D2
1-2022-15	D137	NEG PHASE SEQ B/U PROT	C7740	1R61	NORM	TRIP	OPEN	CLSD	CSA	D2
1-2022-16	D138	OFFSET MHO RLY B/U PROT	C7741	1R61	NORM	TRIP	OPEN	CLSD	CSA	D2
1-2022-17	D139	GEN FLD GRD PRI PROT	C7742	1R61	NORM	TRIP	OPEN	CLSD	CSA	D2
1-2022-18	D157	UNIT GEN LEADS OC PROT	C7743	1R61	NORM	TRIP	OPEN	CLSD	CSA	D2
1-2022-19	D103	NSS B/U OC PROT	C7823	1R62	NORM	TRIP	OPEN	CLSD	CSA	D2
1-2022-20	D104	NSS B/U GRD OC X WDG	C7824	1R62	NORM	TRIP	OPEN	CLSD	CSA	D2
1-2022-21	D105	NSS B/U GRD OC Y WDG	C7825	1R62	NORM	TRIP	OPEN	CLSD	CSA	D2
1-2022-22	D106	NSS XFMR AUX FAULT PROT	C7826	1R62	NORM	TRIP	OPEN	CLSD	CSA	D2

ENCLOSURE 2

SHOREHAM ADS SYSTEM COLOR PADDING