

John D. O'Toole
Vice President

Consolidated Edison Company of New York, Inc.
4 Irving Place, New York, NY 10003
Telephone (212) 460-2533

February 11, 1982

Re: Indian Point Unit No. 2
Docket No. 50-247

Director of Nuclear Reactor Regulation
U.S. Nuclear Regulatory Commission
Washington, D.C. 20555

ATTN: Mr. Steven A. Varga, Chief
Operating Reactors Branch
No. 1 Division of Licensing



Dear Mr. Varga:

A Confirmatory Order was issued in February 1980 by the NRC which, among other things, directed Con Edison to conduct a Human Engineering assessment of the Indian Point No. 2 Central Control Room (CCR). The purpose of this letter is to inform the NRC of the results of the assessment to date. As part of the assessment, Con Edison contracted with Essex Corp. to conduct a human factors review of the Indian Point Unit No. 2 CCR. In November 1980 we received the Essex Corp. report "Human Factors Engineering Assessment of Indian Point Nuclear Steam Electrical Station Control Rooms".

The report identified Human Engineering Discrepancies (HEDs) without regard to mitigating features or seriousness of their impact. The study utilized:

- o Site Visits
- o Central Control Room Surveys
- o Interviews with Operators
- o Simulator Run-Throughs of Procedures
- o Video Taping of Selected Emergency Procedures
- o Review & Rewrite of Emergency Procedures

Prior to the Essex study, Con Edison had committed to replace the PRODAC plant computer with the PROTEUS computer system which has human engineered CRT displays. Since the Essex study, the NRC has issued additional guidelines regarding Human Factors Engineering of the Central Control Room. A coordinated engineering and human factors overview was required to integrate these added guidelines as well as to re-evaluate the NRC-TMI short-term Central Control Room modifications which had already been implemented.

8202220255 820211
PDR ADOCK 05000247
P PDR

*AOO1
Sip*

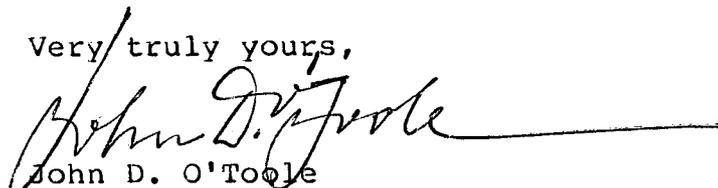
In June 1981 Gibbs & Hill, Inc. was retained by Con Edison to perform an independent review and assessment of the human factors engineering concerns identified by Essex and to integrate the additional guidelines into the overall program to improve the Central Control Room. Their scope of work also included an analysis of changes made to the Central Control Room (unrelated to Human Factors Engineering) after the Essex study was completed. A Gibbs & Hill team, which was experienced in nuclear plant control room design, evaluated human engineering discrepancies and recommended appropriate changes to address these discrepancies. Gibbs & Hill was assisted in this effort by Dr. Thomas B. Sheridan, of the human factors engineering consultants, Sheridan Associates. Dr. Sheridan is currently Professor of Engineering and Applied Psychology at MIT. He is past-chairman of IEEE Systems, Man & Cybernetic Society.

The Gibbs & Hill review of the Essex report is completed, and they are now reviewing the capabilities of the proposed computer terminal additions to the CCR to determine if any of the identified HEDs are remedied by these systems which will be installed during the 1982 refueling outage. The Gibbs & Hill recommendations received to date have been evaluated by Con Edison to determine the best method of improving the Central Control Room.

The attachment to this letter reflects the results of Con Edison's overall review of human factors engineering in the Indian Point Unit No. 2 CCR including our review to date of the Essex and Gibbs & Hill reports. Each of the human factors improvements in the CCR will be implemented by the completion of the Cycle 6/7 refueling outage. The attachment provides a detailed discussion of the various modifications to be accomplished. Should any changes to this plan be necessitated by future human factor reviews or requirements we will inform you of such changes.

Should you or your staff have any further questions, please contact us.

Very truly yours,


John D. O'Toole
Vice President

HUMAN FACTORS ENGINEERING ASSESSMENT

SUMMARY OF PROPOSED MODIFICATIONS

The results of the human factors engineering review of the Indian Point No. 2 Central Control Room are summarized below:

- (1) Modifications to sixty-five supervisory points will be implemented. This will locate the annunciator point closer to its control/display position.
- (2) Modifications to accomplish audible alarm localization, increase annunciator flash rates and improve horn silence circuitry will be implemented.
- (3) Further modifications will be made to eliminate green tiles (normally lit points) to achieve "dark board" normal operation.
- (4) Annunciators and panel device nameplates will be relabeled as required for clarity and consistency.
- (5) Alarms on some alarm panels will be regrouped to facilitate Operator recognition.
- (6) Control/Display Separation discrepancies will be corrected.
- (7) A guard rail will be installed on the Flight Panel to prevent inadvertent operation of the "J" handle control switches.
- (8) Lamp Test capability will be provided for safety-related indicating lamps having no alternate display.
- (9) Miscellaneous enhancement improvements as well as hardware modifications will be implemented to correct human engineering deficiencies identified by Gibbs & Hill on equipment installed after the completion of the Essex review.

These items are described in more detail in the following pages (under the corresponding number).

1. ANNUNCIATOR POINT RELOCATIONS & CONSOLIDATIONS

<u>Annunciator</u>	<u>Existing Panel</u>	<u>Proposed Correction</u>
1. Hotwell High	SJ	Relocate to SC
2. Hotwell Low	SJ	Relocate to SC
3. Hotwell Low-Low	SJ	Relocate to SC and relabel to read "Hotwell low-low level" to be consistent with other level alarms.
4. RWST Level High	SJ	Relocate to FCF
5. RWST Level Low	SJ	Relocate to FCF
6. RCP Thermal Barrier LO P	SF	Relocate to SA
7. Steam Generator Control Deviation	SB-1	Relocate to FBF
8. Low Steam Pressure	SB-1	Relocate to FBF
9. - 27. BFP Annunciators (19)	SC	Relocate to FBF and Delete Two Alarms
28. Saturation Temperature Margin Approached	SK	Relocate to FCF
29. Pressurizer Heater Group Tripped	SF	Relocate to FCF
30. RCS Low Level	SG	Relocate to FCF
31. Tavg-Tref Deviation	SC	Relocate to FCF
32. PCV 455C Lo Nitrogen Supply	SK	Combine into Common Alarm PCV-455C Nitrogen Supply Trouble
33. PCV 455C Nitrogen Supply Regulator Failure Lo	SK	Combine into Common Alarm PCV-455C Nitrogen Supply Trouble
34. PCV 455C Nitrogen Supply Regulator Failure Hi	SK	Combine into Common Alarm PCV-455C Nitrogen Supply Trouble

35.	PCV 456 Lo Nitrogen Supply	SK	Combine into Common Alarm PCV 456 Nitrogen Supply Trouble
36.	PCV 456 Nitrogen Supply Regulator Failure - LO	SK	Combine into Common Alarm PCV 456 Nitrogen Supply Trouble
37.	PCV 456 Nitrogen Supply Regulator Failure Hi	SK	Combine into Common Alarm PCV 456 Nitrogen Supply Trouble
38.	345kV Direct Trip Trouble	SK	Relocate to FCF
39.	Redundant Overspeed Turbine Trip Failure/Test	SE	Relocate to FBF
40.	ISO Phase Bus Cooling Water Low Flow or Low Air Flow	SE	Combine into one Alarm (40-41-42)
41.	ISO Phase Bus Heat Exchanger Leak	SE	Combine into one Alarm (40-41-42)
42.	ISO Phase Bus Return Air High Temp.	SE	Combine into one Alarm (40-41-42)
43 - 50.	Main Transformer Alarms (8)	SE	Relocate to FBF
51 - 56.	Generator Alarms (6)	SE	Relocate to FBF
57 - 60.	Exciter Alarms (4)	SE	Relocate to FBF
61.	345kV Primary Pilot Wire Trouble	SE	Relocate to FCF
62.	345kV Back-Up Pilot Wire Trouble	SE	Relocate to FCF
63.	345kV Breaker Trip	SE	Relocate to FBF
64.	345kV Breaker Pressure Low	SE	Relocate to FBF
65.	345kV Breaker Not Closed	SE	Relocate to FBF

2. AUDIBLE ALARM LOCALIZATION, FLASH RATE FREQUENCY & HORN SILENCE CONTROL

2.1 Audible Alarm Localization

Con Edison plans to install three audible devices to provide for localized alarm audibles.

These audible devices will be directional-type horns, arranged such that the operator's attention is directed to the area from which the sound is emanating. This will improve response time by minimizing search time.

2.2 Flash Rate Frequency

Con Edison plans to replace the flasher module relay to increase the flash rate to 2 flashes per second.

2.3 Horn Silence Control

The first out annunciator will be interlocked with the audible silence controls. Only when the "first out" is actuated (indicating that a severe disturbance is in progress) will the audible silence pushbutton be able to silence all supervisory audibles for a pre-set time duration. It should be noted that the alarm windows will continue to flash. After this time delay the audible would re-sound reminding the operator of those alarms which were actuated earlier. Under other operating conditions, the alarm must be silenced and acknowledged from the specific set of pushbuttons designated for that alarm panel.

3. ANNUNCIATOR PRIORITIZATION

- 3.1 During the last refueling outage, modifications were made to green and green/white annunciator points in an attempt to achieve "dark board" normal operation. Since the unit returned to service, it has been determined that additional modifications should be made to five of these points to reduce the time they are lit during normal operation. These modifications will be implemented and all green and green/white tiles will be replaced with white tiles.

4. ANNUNCIATOR TILE LABELING

Con Edison plans a relabeling program for both annunciators and control board devices, using consistent nomenclature, abbreviations and colors.

5. REGROUPING OF ALARMS

Each of the annunciator sections was reviewed to determine where alarms related to a particular system are scattered within a panel section.

The annunciator tiles will be rearranged to obtain a better grouping of the alarms. Also included are additional alarms deletions or combinations with other alarms.

- Panel SA -- Group "Pressurizer Low Pressure Channel Trip" with other related pressurizer alarms

- Panel SB-1 -- Group nuclear instrumentation system alarms together on left side of annunciator.

- Panel SC -- Boiler Feed Pump alarms are scattered. Rearrange to group them together. Also group condensate-related alarms together.

- Panel SE -- Remove "LFC ON AUTO" alarm and associated control equipment on Flight Panel, since they are no longer used.

- Panel SJ -- Combine "Service Water HDR (24, 25, 26) High Low Press" with other Service Water Header alarm since alarm responses are the same.
 - Remove "INST AIR REF DRYER BYPASS VALVE OPEN" since this action would also actuate the "INST AIR LOW PRESS" alarm
 - Combine "INSTR AIR COOLING WATER LOW PRESSURE" with "INST AIR CLOSED COOLING SYSTEM CIRC. PP FAILED", since the alarm responses are similar.

- Panel SL -- Combine "Heater Drain Tank Hi Level" alarm with similar alarm on Panel SC.

6. CONTROL/DISPLAY ALIGNMENT

Con Edison plans to minimize control/display separation at three locations:

6.1 RCP Controls (SA)/RCP Seal Injection Flows (SG)

6.2 Charging Controls (FBF)/Charging Displays (SG)

Three new controllers will be installed on Panel SFF below the letdown orifice valve controls. A selector switch will be added to FBF to permit operation of the controllers either from FBF or SFF.

6.3 Indicating lights for 345kV MO DISC SW 7A-7B and 345kV MO DISC SW 9B. To correct the separation of indicating lights with its associated controls, the following is planned:

- Move mimic section for M.O. DISC. SW 9B to location adjacent to its control switch.
- Add dashed lines from the single control switch 7A-7B to its associated sets of disconnect switch status lights.

7. PREVENTION OF INADVERTENT ACTUATIONS

7.1 The Essex report indicated that the "J" handles on the bench portion of Flight Panel FAF might be susceptible to inadvertent actuation. Prior to the end of the last refueling outage, selected "J" handled control switches were replaced. After some operating experience was obtained, it was determined that the replacement handles were difficult to operate. The "J" handles were therefore restored. To address the potential for inadvertent actuation, Con Edison will install a guard rail along the Flight Panel.

8. LAMP TEST CAPABILITY

8.1 Red/Amber monitor lights with lamp test capability (push to test) are provided on Supervisory Panels S31, S32 and SW for all safeguard valves.

The Gibbs & Hill report stated that there may be insufficient contrast between the red and amber lights to facilitate rapid identification. Con Edison will experiment with lenses on site and modify, as appropriate, the existing lights to ensure that sufficient contrast is displayed.

8.2 All of the remaining lamps on each panel have been reviewed to identify whether they are significant to safety and whether there are alternate displays available to verify lamp status in lieu of lamp testing. Con Edison will install lamp test-capability for safety-related indicators having no alternate display.

9. POST-ESSEX CCR MODIFICATIONS

A Human Engineering review has been performed on display, alarms and other equipment that have been added to the CCR subsequent to the Essex Study. For twelve items corrective action will be taken.

9.1 The undervoltage relays (4), auxiliary relays (4) and associated lights were added to Panel 3M for the 480 volt buses 5A, 2A, 3A & 6A. The following changes are planned:

1. Each of the indicating lights is not identified. Labels will be provided for each light indicating its significance (proper voltage).
2. According to the alarm response procedures, these lights are normally illuminated and will not be lit for an undervoltage condition. Circuits for these lights will be changed to illuminate on undervoltage and bulb test capability will be provided.

9.2 The Assessment Panels are used to provide additional monitoring and verification of plant conditions during the mitigation of an accident. The Assessment Panels contain the following instrumentation:

- Panalarm Solidstate Annunciator
- Radiation Monitoring
- Multipoint Chart Recorders
- TV Monitors
- Level Indicators

Con Edison plans to delete the existing "NARROW WIDE" legend on the RCS VESSEL LEVEL indicator labels and install them directly below the appropriate display. Also, bands will be provided to indicate where the narrow range ends and wide range begins.

The Assessment Panels are located between sections of the Indian Point No. 1 Flight Panels. Since most of the instrumentation on the Indian Point No. 1 Flight Panels is no longer used, it is planned that this instrumentation will be removed or relocated. This will improve operator response by minimizing the presentation of non-applicable displays.

9.3 In association with the addition of Train A and Train B reset status lights for Safety Injection (SB-2) and Containment Spray (SB-1), it is planned that "Train A" and "Train B" labels be provided for the pushbuttons, similar to those provided for the Containment Isolation equipment on Panel 3N.

On SB-1, the reset status lights were installed below the reset pushbutton because of space limitations. To prevent confusion with the Containment Spray Phase "B" isolation pushbuttons, it is planned that a thin black demarcation line be used and the reset light be relocated.

- 9.4 For the key-operated Containment isolation valve interlock bypass switches on Panel SN, labeling will be provided to specifically identify the positions that the keys can be turned to.
- 9.5 The reactor head vent system control switches and indicators on Panel SA will be relocated to the Assessment Panel and a "Reactor Vent Valve Not Closed" alarm will be provided.
- 9.6 The LI-1128A added to Panel SC is the second channel of condensate storage tank level indicator. Con Edison will install new labels for the two level displays indicating their channels.
- 9.7 The internal equipment labels of flow indicators 924A and 926A on Panel SB-2 are identical to FI-924 and FI-926. Con Edison will provide external labels with the instrument number and word "Hot Leg" for FI-924A and 926A, to distinguish them from other SI flow loop displays on same panel. The labels for FI-924 and FI-926 will be revised to include the words "Cold Leg".
- 9.8 The following instrumentation and alarms are provided for the Reactor Cavity Sump:

Reactor Cavity Level Indicator - SBI
HI Water Reactor Cavity Sump Alarm - SA
HI-HI Water Reactor Cavity Sump Alarm - FCF

The above two alarms will be relocated to two spare alarm points on SBI. This will bring the alarms in alignment with its associated display.

- 9.9 The following instrumentation and alarms are provided for the Recirculation Sump:

Recirc. Sump HI or Recirc. Sump HI-HI Alarm - FCF
Recirc. Sump Pump Suction Level Indicating Lights - SBI
Recirc. Sump Level Indicating Lights - SBI

Con Edison plans to relocate the alarm to the SC Panel to correct the misalignment.

- 9.10 The following instrumentation and alarms are provided for the Containment Sump System:

Control and indication of the two containment sump pumps (#29 & #210) and Discharge Flow Displays - Panel SF.

Containment Sump Level Indicators - SBI
HI-HI Containment sump Level Alarm (Elev. 44'-11") - SBI
HI Containment Sump Level Alarm (Elev. 44'-3") - SC
HI-HI Water Containment Sump Alarm (Elev. 41'-6") - FCF
High Water RHR Suction Containment Sump (Elev. 41'-9.5") - FCF
Sump Pump 29 Tripped Alarm - FCF

Con Edison plans the following modifications to the instrumentation located in the Central Control Room for the Containment Sump system.

1. Relocate the two Containment Sump Pump controls and flow displays from Panel SF to Panel SC.
2. Delete "Hi Containment Sump" alarm (Elev. 44'-3") on Panel SC.
3. Relocate "Sump Pump 29 Tripped" alarm to Panel SC and relabel to "Sump Pump 29 Unavailable".
4. Relabel "Hi-Hi Water Containment Sump" alarm on FCF to "High Containment Sump Level" and relocate the "High Water RHR Suction Containment Sump" alarm to Panel SC.

9.11 A spare control switch on Panel SA has been indicated with a blank label. Con Edison will remove all spare equipment on the Supervisory panels.

9.12 The fan cooler weir level indicator is installed on Panel SO. This display is associated with an alarm on SM and related valve controls on SO. There is no label on the weir level indicator. Con Edison plans the installation of a label "Containment Fan Cooler Drain Collection" on the face of the level indicator on Panel SO.