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January 6, 1984

Mr. Harold R. Denton, Director
Office of Nuclear Reactor Regulation
U.S. Nuclear Regulatory Commission
Washington, DC 20555

Subject: Byron Station Units 1 and 2
Braidwood Station Units 1 and 2
Control Room PDA
NRC Docket Nos. 50-454/455 and 50-456/457

References (a): T. R. Tramm letter to H. R. Denton dated November 12, 1981

(b): E. D. Swartz letter to H. R. Denton dated May 9, 1983

(c): E. D. Swartz letter to H. R. Denton dated September 30, 1983

Dear Mr. Denton:

References (a) and (b) provided the Byron and Braidwood Station Control Room Preliminary Design Assessment (PDA) along with Supplements I and II in response to NUREG 0660 Task Action Plan Item I.D.1 and Section 18 of the Byron Station SER. The purpose of this letter is to provide revisions to certain Human Engineering Deficiencies (HEDs) contained in Reference (b) that should allow for closure of Outstanding Item No. 17 in the Byron Station SSER No. 3.

Specifically, the Enclosures to this letter contain revisions to HED numbers 1.2, 1.4, 1.5, 1.11, 1.13, 3.6, 4.12, 4.13, 4.22, 4.26, 5.9 5.17, 5.18, 5.37, 6.9, 7.2, 8.4, 9.3 and 9.12. These changes result from Commonwealth Edison Company employee and consultant discussions with the NRC Human Factors Engineering Branch.

Additionally, the purpose of this letter is to discuss the applicability of the Byron Station PDA to our Braidwood Station. References (a) and (b) contained only our Byron Station Docket Numbers. The Control Room PDA is applicable to both Byron and Braidwood Stations. However, to the large extent that the Byron and Braidwood Station Control Rooms are identical, we will be making modifications to the duplicate aspects of the Braidwood Control Room based upon the Reference (a) and (b) PDA. Future Braidwood Control Room PDA work covering the remaining site unique aspects of the Control Room will be addressed as discussed in Reference (c).

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Please address any questions concerning this matter to this office.

One (1) signed original and fifteen (15) copies of this letter with Enclosures are provided for your use.

Very truly yours,

E. Douglas Swartz
Nuclear Licensing Administrator

Enclosures

cc: J. A. Stevens - LB1

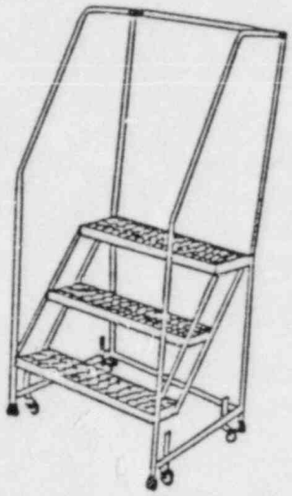
7931N

1.2 Some of the controls on the stand-up console are located out of reach of the 5% height operator. The highest control is located 65" from the floor (recommended maximum = 60").

CE Response: Several controls on 1PM04J (Feedwater Panel) are located 65" from the floor. These controls are separated into four groups with three controls (Steam Flow, Feed Flow, and Steam Generator Level) included in each group. The purpose of these controls is to select the controlling channel for the Steam Flow, Feed Flow, and Steam Generator Level parameters. The controls are used with an estimated frequency of two times a year (in addition to four times per year for calibration). These controls are not used during an accident scenario and are therefore not time-critical. They are only used to change to an operable channel <u>after</u> the system has been stabalized.

A step ladder will be available, as a temporary solution, to aid the fifth percentile female in reaching the switches. This will also be equipped with handrails, as shown below, to prevent falls and to prevent inadvertent actuation of controls. These controls will be reviewed along with other board changes based on the conduct of a DCRDR.

Implementation: Complete



1.4 Some controls on the common vertical panels are mounted above and below the recommended 34"-70" height range. The lowest controls are 12" from the floor. The highest controls are 12" from the floor. The highest controls are 87" from the floor. (4.1.3)

CE Response: The incore thermocouple indicator switch box (controls) located 12" from the floor is periodically used by the Tech Staff. Those thermocouples that are to be used by the operators are being made available for display on the 1PM05J control board, as part of Reg. Guide 1.97 instrumentation. Since this is redundant information used by the Tech Staff, it is not critical to the safe operation of the plant that the controls on the vertical panel are mounted in the recommended 34"-70" envelope.

Two annunciator acknowledge stations have been relocated to the acceptable height envelope on 0PM03J. Two others, on 0PM02J, have not been moved due to space constraints. They are only discrepant by 1" from the standard and are the only controls which are located more than 70" from the floor. The probability of creating control-display relationship errors would be significantly increased if these controls were relocated due to the limited space on this panel.

The controls located below the suggested height of 34" are:

4 Motor Operated Discconnects SAT (26")

4 SX Clg Twr M/U Vlvs (31")

4 SX Clg Twr Hotwater Byp Vlvs (31")

2 CW Blowdn Spray Vlvs (28")
2 CW ISOL Vlvs (31")
3 CW M/U Pp trip Pushbuttons (29")
4 SX Clg Twr OA Substation Vent Fans (32.5")
8 Cnmt Chlr Sx Vlv Control (29")
2 MEER Vent Fan (32.5", 26")
2 CSR Vent Fan (32.5", 26")
2 RSH Vent Fan (25")
4 Rx Cav Vent Fan (32.5")
4 Cnmt Char Bstr Fans (32.5")
4 Aux Stm Vlvs (26")
2 Cnmt Post Loca Exh Fans (32.5")
2 MCR Purge Control (32")
2 MCR M/U Air Control
2 MCR Recirc Fltr Damper Control (29")
2 Fuel Handling Bldg Fltr Select (29")
2 Fuel Handling Bldg Char Bstr Fan (28.5")

None of these controls are time critical to the safety of the reactor.

1.5 Some displays on the common vertical panels are mounted above and below the recommended 41"-70" height range. The lowest display is located 23" from the floor. The highest display is located 92" from the floor. The top rows of the annunciators are located 90" from the floor.

CE Response: Seventeen displays are located out of the suggested 41"-70" height range. These displays are:

- o 2 CW Blow Down Spray Valve Position
- o 2 PWST Levels
- o 1 PW Pump Press
- o 1 WS Pump Press
- o 1 CW Intake Bay Level
- o 2 SX Basin Level
- o 1 Fire Pump Discharge Press
- o 1 IA Press
- o 2 SA Press
- o 2 CST Levels
- o 2 CNDS M/U Pump Press

These displays (80.5" from the floor) can be read without difficulty and are not time critical.

Also, on 0PM03J, 25 Transmission Line Indicators (the highest is located 91" from the floor) can be read without difficulty and do not impact reactor operations.

All indicators will be green banded and/or tied to alarms.

The requirements for viewing distance for annunciators is that the operator subtend a visual angle of 15 minutes of arc. This requirement is met by the current letter height of .25 inches and viewing distance of over 5 feet. In addition, annunciators meet the requirements of 6.1.2.2 in that they are within the horizontal line of sight.

Implementation: Prior to fuel load.

1.11 The annunciators on the vertical panels are oriented at less than the recommended minimum 45 degree angle on the line of sight from the position of the associated response controls.

CE Response: Guideline 1.2.2e indicates all displays and annunciators be mounted so that the angle from the line of sight to the face plane is 45 degrees or greater. The upper limit is based on an eye height of 56 inches. The lower limit is based on an eye height of 70 inches. Under the present configuration all annunciators are located within the minimum 45 degree angle of the line of sight when monitored from the normal work station.

In addition, during a thorough review of the annunciator system, many modifications were made to insure ease of readability. Not only were messages changed for consistency, abbreviations were changed and ambiguity reduced. Also, the stroke width of the letters was increased.

Implementation: None required.

1.13 No plans have been made to provide protective clothing for control room operators, except for full hood/face masks with air lines.

CE Response: As noted in Byron/Braidwood FSAR 9.4.1.3, the following information regarding environmental protection describes the adequacy of relying solely on the full hood/face mask to protect control room personnel:

a. The control room HVAC system is designed to ensure control of space environment conditions within specified maximum and minimum limits which are conducive to personnel habitability and prolonged service life of Safety Category I components under all normal and abnormal station operating conditions. Redundant equipment is provided where needed to ensure system function. Power for the redundant equipment is supplied from separate ESF buses which are energized during all normal and abnormal conditions. All of the HVAC equipment and surrounding structures are seismically designed except heating and humidification equipment which is only seismically supported. Although all control equipment in the control room is rated for continuous operation at 86°F maximum temperature, the control room ambient temperature is maintained at 75°F.

b. Flood protection for this system is not applicable.

c. A local fire in the control room should not cause the abandonment of the control room because early detection, filtration and purging capabilities are provided in addition to local fire fighting apparatus.

d. Air distribution in the control room is designed to supply air into the occupied area and exhaust approximately half the supply quantity through the main control boards. In the event of smoke or products of combustion in the control panels, the ionization detection system automatically directs the mixed air (return and makeup) delivered to the conditioned spaces through a normally bypassed charcoal absorber, for smoke and odor removal. A manual override is provided for this function as well as the ability to introduce 100% outside air to purge the spaces served by the system.

e. Two radiation monitors are provided in each control room HVAC system makeup air intake to detect high radiation. These monitors alarm in the control room. The intake monitors are described in detail in Subsection 12.3.4, of the FSAR. The high radiation actuation signal causes: 1) automatic closure of the normal outside makeup air source to the system; 2) the opening of the turbine building makeup air intake; 3) as well as startup of the makeup air filter train to clean up the makeup air.

f. The makeup filter trains and control room shielding are designed to limit the control room operator dose below levels of 5 rem as required by Criterion 19 of 10 CPR 50, Appendix A.

g. A minimum quantity of makeup air is provided to the Control Room HVAC System to maintain the Control Room and other spaces serviced by the Control Room HVAC System at a positive pressure with respect to surroundings.

h. There are no high energy lines in close proximity to or within the control room envelope which will affect the habitability of the control room.

i. Chlorine monitors in the outside air intakes for the control room HVAC system have been deleted because as stated in paragraph 9.4.1 of the Byron FSAR there are no transportation or storage facilities in the vicinity of the site which could cause a chlorine hazard to the control room operators. (Byron only)

3.6 A manually initiated annunciator block is available for Feedwater, Condensate and Turbine Control panels. Two red alternating flashing lights indicate when the block is in use. The annunciator silence buttons silence only a single audible alarm, wheras the guidelines state that it should be possible to silence an auditory alert signal from any set of annunciator response controls in the primary operating area. (2.3.3.2-4)

CE Response: Any of the annunciator response controls in the primary operating area will silence all of the horns in the area.

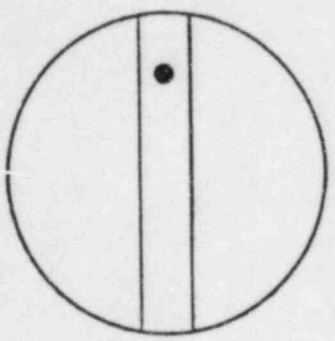
A manually initiated timed audio block is available for the Condensate and Turbine panels. The audio block must be manually initiated by the operator when permitted by the condition that one of four throttle valves on the main turbine is closed. A time delay relay (which has a range of 0 to 30 minutes) is energized, which de-energizes a green light marked RESET and energizes a red light marked BLOCK and inhibits the turbine associated audible alarms from (2) 1UL-AN025 and (2) 1UL-AN026 on panels (2) 1PM02J and (2) 1PM03J respectively. The time delay relay has initially been set for 10 minutes. A manual reset function (on the same switch) is provided to permit the operator to reset the audio block any time after its actuation and before it has timed out to automatically reset.

When reset occurs by the time delay relay having timed out or by operator action, the red light indicating BLOCK is de-energized and the green light which indicates RESET is energized and the annunciator block is removed.

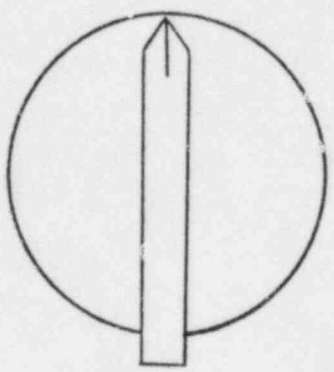
Implementation: Prior to fuel load.

4.12 On 1PM06J, the same type of control handles are used for valves with different functions. An operator cannot differentiate among throttle, open/close and throttle open-seal close valves. (4.4.19) (2.3.3.1-9)

CE Response: Throttle valves will be supplied with a non-lever type handle. All other valves will have lever type handles. There are no throttle open-seal close valves. The lever and non-lever type handles are shown below.



Non-Lever Type Handle



Lever Type Handle

Implementation: Prior to fuel load.

4.13 The REACTOR TRIP and REACTOR RESET functions are on the same switch (2.3.3.2-1).

CE Response: The REACTOR TRIP and REACTOR RESET functions have been separated. Each has a separate control switch. This change is shown on drawing Nos. 6/20E-1-4030 RD06 Revision J dated 8-25-83 and 6/20E-1-4030 RD07 Revision J dated 9-23-83.

4.22 On the reactor end of the 1PM05J, Reactor Chemical and Volume Control Panel, and on 1PM06J, Engineered Safeguards Panel, one switch in each string maintains trip contact position while all the rest are spring return.

CE Response: The maintained contact on the actuation switch for the Main Steam Isolation Valves closes the valves by energizing a close solenoid and must be maintained for the valves to close completely. Whereas, the Reactor trip control switch RT2 (another switch in the same string) is operated to momentarily energize a shunt trip coil and therefore returns to NORMAL by spring return action.

Implementation: None required.

4.26 On 1PM08J, In-Core Instrumentation panel, the DETECTOR E knob pointer mark does not intend to the position indication mark because of the knob's black skirt.

CE Response: The indicator marks for all the detector knobs on the In-Core Instrumentation panel (1PM08J) will be extended to coincide with the knob pointer marks.

Implementation: Prior to fuel load.

5.9 The recorders are not all designed to permit monitoring of data without open door operation.

CE Response: The recorders have been modified and a photograph of the modified recorders has been provided to the Human Factors Engineering Branch.

Implementation: Complete

5.17 The Westinghouse J-handle switches have incorporated indicator flags that originally indicated the status of the control. These flags have been made obsolete by the installation of a new system of NORMAL/ABNORMAL indicator lights. The colored flags are still visible and may present confusing information to the operator.

CE Response: Westinghouse J-handle switches (type W-2) are spring return to center. After placing the switch to "CLOSE", it will spring return to center. This position is known as "AFTER CLOSE" and makes up a unique contact configuration for this position. After placing the switch to "TRIP", it will again spring return to center. This position is known as "AFTER TRIP" and will make up a contact configuration unique to this position. Therefore, while the switch physically appears to be in the same position following the two operations described above, the contact configurations are very different. The colored flag indicator tells the operator which position the switch is in. A green flag indicates "AFTER TRIP" while a red flag indicates "AFTER CLOSE". It is important for the operator to know which position the switch is in.

For example, if the centrifugal charging pump auto-starts and subsequently trips, a trip alarm is only generated if the control switch is in "AFTER CLOSE". However, because the pump was originally not running, the control switch is in "AFTER TRIP". Therefore, the trip alarm will not

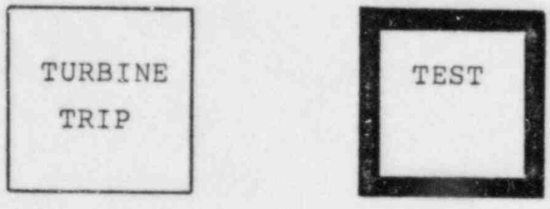
be generated. Normally, the operator would place the control switch to "AFTER CLOSE" following the auto-start. This would then allow a trip to be annunciated. If the operator wishes to verify at a later date that the switch is indeed in the "AFTER CLOSE" position he can simply look at the colored flag. Without the flag, he must physically place the switch to "CLOSE" whenever he wishes to verify that the switch is in "AFTER CLOSE". This example applies to many components, including all ECCS pumps, Station Air Compressors and Electrical Bus Breakers.

While indicating lights provide indication of breaker position, the colored flag indicates switch position and will be retained.

Implementation: None required.

5.18 Illuminated legend pushbuttons are not readily distinguishable from illuminated legend indicators.

CE Response: Illuminated pushbuttons will be fitted with a 1/16" demarcation line around the button as shown below. This line will be the same color as all other demarcation lines in the control ro...



Indicator Light Pushbutton

Implementation: Prior to fuel load.

5.37 On 1PM04J there is inconsistent use of color for indicator lights and some lights are not labeled.

CE Response: All indicator lights are currently consistent in the use of color. All square lights on the control boards are labeled. The small amber and white round indicator lights are unlabeled due to space constraints. A Job Performance Aid will be used to ensure that the operators would know the meaning of each light.

Implementation: Prior to fuel load.

6.9 Some control board labels use inconsistent color coding schemes (2.1.4-2).

CE Response: Color is not used on any labels in the control room. The labels have been modified so that they are all currently on a white background. The legends on all control room labels and annunciators are in black print.

Implementation: Complete

7.2 On 1CX05J, unnecessary Computer Operator console functions are now available to the control room staff. Unnecessary keys are also available to the control room operators.

CE Response: The unused keys will be covered with a rigid guard shield that will physically prevent the operators from manipulating unnecessary keys.

Implementation: By the first refueling outage.

8.4 To avoid leaving the Reactor panel unattended during startup, operators require another person to change the range and volume of the SOURCE RANGE nuclear instrument. (2.3.3.2-5)

CE Response: The range and volume controls of the SOURCE RANGE nuclear instrument will be moved from the nuclear instrumentation cabinet 2PM07J to the main control board 2PM05J on Unit 2 prior to its pre-operational test. If test results prove that there are no technical problems caused by this design change, the change will be made on Unit 1 prior to the completion of its first refueling outage.

Implementation: Contingent upon test results.

9.3 Displays should read off-scale (not zero) when not selected, especially if zero is a possible parameter to be displayed. The Power Distribution panel displays do not reflect this requirement. (4.9.2)

CE Response: Most of the meter displays on the Power Distribution panel will not normally be reading zero. The operator uses this meter display information in conjunction with the live mimic display information to quickly determine the plant electrical systems status.

The generators, trsnsformers, circuit breakers and electrical buses making up the various plant electrical systems are portrayed to the operator in the form of a simplified, live, mimic on the auxiliary electrical control boards. The main generator, all transformers, and all electrical buses are normally energized at the proper voltage. An energized light on each bus shown on the mimic, tells the operator, at a glance, that his electrical buses are alive. Each of the higher voltage buses can be energized from two or more different sources. An energized light on the mimic representation of each of these sources will tell the operator whether all sources are available for use. Normally each bus is supplied (energized) from only one of its possible sources. As part of the live mimic, the "CLOSED" light energized on Control Switch connecting a source to the bus tells the operator that the meter displays above that Control Switch, that are associated with that bus, should be energized.

Similarly it tells him the meter displays above the Control Switches connecting the bus to other sources, which indicate "OPEN" should not be energized (read zero).

Implementation: None required.

9.12 On 1PM03J, there is a reversed control-display relationsip:

	LEFT	RIGHT
Meters	GSC	CNDS-CB
Controls	CNDS Booster	GSC

CE Response: At first glance, there appears to be a reversed control-display relationship. Upon further investigation, however, it is apparent that this system can be arranged in several ways. At this point, however, it is difficult to ascertain the correct critical path. If the meters are swapped, the retrofit may create additional HEDs due to other cross-overs. For example the flow and pressure indicators are currently functionally grouped and this grouping would be destroyed if the Gland Steam Condenser and Condensate Condensate Booster displays were exchanged.

Implementation: None required.