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March 29, 1984

W3P84-0845
3-A1.01.04
3-H1

Director of Nuclear Reactor Regulation
Attention: Mr. G.W. Knighton, Chief
Licensing Branch No. 3
Division of Licensing
U.S. Nuclear Regulatory Commission
Washington, D.C. 20555

SUBJECT: Waterford SES Unit 3
Docket No. 50-382
Control Room Design Review
Anthropometric Review

REFERENCE: W3T82-0491, dated December 22, 1982

Dear Sir:

The referenced letter summarized the Human Engineering Deficiencies (HEDs) and corrective actions identified during the Waterford 3 Control Room Design Review. Four HEDs (B1-14, B1-15, B1-16 and B7-3: Attachment 1) addressed possible concerns with control board readability and/or accessibility.

In HED B1-15 we agreed to identify and evaluate significant readability or control problems during startup testing and emergency operating procedure (EOP) validation. As you know, the EOP Verification and Validation Program is in its final stage; we are now in a position to address the anthropometric concerns raised by the Control Room Design Review.

During the EOP V&V process a wide range of operators (including the shortest at 5'4") were involved in the control room walkthrough of the procedures. The operators were asked to provide comments on meter readability and control accessibility which were duly noted by the personnel conducting the program. Upon evaluation of the comments no significant problems were identified in the areas of readability and control.

However, as the operator crew does not include a 5th percentile female, an additional study was performed to evaluate the extent of readability and control problems for this extreme case. Figure 1 was developed utilizing the criteria of NUREG 0700 Sections 6.1.2.2b(1), 6.1.2.2e(1)(a) and (b), and Exhibit 6.1-5. As noted on the figure, the top of the highest meter on the main control boards is at 80.75 inches, well below the NUREG 0700 allowable display height of 85.5 inches for the 5th percentile female.

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Page 2
W3P84-0845
3-A1.01.04
3-H1

Control accessibility, as shown, is limited to just below the vertical benchboard section, encompassing the large majority of controls. There are several controls, as noted in HED B1-14, located on the vertical benchboard sections of the main control boards which are outside the NUREG 0700 allowable height. Because there exist no control accessibility problems for the present Waterford operating crew, LP&L does not intend to reposition controls to accommodate a 5th percentile female. Besides the time and expense involved compared to a questionable benefit to be gained, the need for operators to refamiliarize themselves with control locations this close to plant licensing argues against such an approach. Should a 5th percentile female be employed as a reactor operator we will ensure that other operators will be available on shift who are capable of reaching controls on the vertical benchboard sections. Where manual operation of these controls can be carried out in a deliberate and unhurried manner, the 5th percentile female will be provided with a portable footstool to allow direct control manipulation.

HED B1-16 also raised the issue of parallax for the upper row of meters. LP&L employs International Instruments Series 1151/1251 "anti-parallax" meters. The design incorporates bi-level scales allowing the meter pointer to be placed in the same plane as the scale. We have confirmed that parallax error is negligible and generally below the accuracy level of the instrument.

With this letter LP&L has completed all actions required for HEDs B1-14, B1-15, B1-16 and B7-3. Should you have any questions or comments in this matter please contact Mike Meisner at (504) 363-8938.

Yours very truly,



K. W. Cook
Nuclear Support & Licensing Manager

KWC/MJM/ch
Attachments

cc: W.M. Stevenson, E.L. Blake, J.T. Collins, D.M. Crutchfield, J. Wilson,
G.L. Constable, A. Ramey-Smith

1. B-1 Finding 14, Priority 3

"The dimensions of the control board (console) are such that reachability and access for the shorter potential operators is not accommodated. Based on a review of civilian population anthropometric data, it is estimated that the 5th percentile female will have a functional reach approximately 5 inches above the start of the vertical plane of the control boards. Result: Some important controls may be out of reach, e.g., Turbine Trip; Lockout relay trip on CP-1; Safety Actuation on CP-8. Upper ends of many vertical meter scales may be very difficult to read."

Original Response*

Refer to B-1, Finding 15 below.

2. B1, Finding 15, Priority 3

"The Main Control Board layout in general is not designed to accommodate the 5th percentile female. Many displays even exceed the recommended viewing envelope for the 50th percentile male."

Original Response

Photograph 2.15-2 shows that the shortest operator (5'-2" male) can in fact reach the highest controls on CP-1. Manual operation of these controls is infrequent, deliberate and generally unhurried.

Likewise, the most significant displays are felt to be readable especially within all but the most extreme upper ranges. Often recorders showing the same parameter are located below the meters and the plant computer displays can and will be used during normal operation.

During startup testing and emergency procedure validation any significant readability or control problems will be identified. Anthropometric problems will be evaluated based on the increased potential for operator error, and the criticality of the resulting error. A report will be submitted to NRC 60 days prior to Licensing. As necessary, studies to determine feasible corrective action will be made. Possible fixes might include physical relocation, allocation to the plant computer, a change to larger meter scales with increased letter size to enhance visibility for very high (70") meters, etc.

* Original findings and responses contained in W3T82-0491, dated December 22, 1982.

3. B-7, Finding 3, Priority 1

"CRT Displaying CEA positions - scaled tapes are applied to the face of the CRT, at borders. Scales delineated the order of CEA sub-groups labeling for part length groups, and the individual CEA numbers.

1. Tape scales do not correspond with the sub-group order, labeling for part length groups, or CEA number sequence used on the CEDMCS Module.
2. The upper scale is about 78" above the floor, on the convex surface of the CRT face and about 32" viewing distance (excessive) for the 95th percentile operator height. Viewing angle and distance are excessive for readability/use.
3. Registration (lateral alignment) of the 91 CEA vertical (rod) bars with the tape scales will vary with the viewing angle, and registration reliability of the CRT."

Original Response

The scaled tapes will be removed since the display software now provides coordinates for the CRT. Incorporating coordinates in the CRT display will help the readability. The high density of this display is acceptable considering the intended function (i.e., gross display of group positions). Indicating modules above the selector switch are being revised to be consistent with selector switch positions.

The need to have the same CEA order used on CRT and the CEDMCS module has been reviewed and evaluated to be of very little consequence to trained operator. Refer to Section 2.15.5, B-1, Findings 14 and 15 for a generic discussion of anthropometric/readability issues.

4. B-1, Finding 16, Priority 2

1. "The panel meters that are located on the upper portion of the panel are placed too high. They are located beyond the optimum visual distance for good human engineering practices."
2. "Parallax in discrimination of the major/minor scales of the meter may result from the present location of many of the meters. Lighting reflections may increase the reading problem, especially for shorter operators."

Original Response

The control boards do not accommodate the 5th percentile female. However, the control boards are designed so that all the major controls and indicators are generally accessible and readable. If during startup testing and procedure validation a readability problem is discovered, then the individual component will be evaluated and modified if necessary prior to Licensing. Lighting changes will reduce reflective glare and ameliorate reading difficulties for the shorter operators. Also refer to Section 2.15.5, Findings 14 and 15.

FIGURE 1

WATERFORD 3
MAIN CONTROL BOARD
5TH PERCENTILE FEMALE

