

HUMAN FACTORS ENGINEERING BRANCH
DETAILED CONTROL ROOM DESIGN REVIEW
INPUT TO
THE SAFETY EVALUATION REPORT
FOR THE
PERRY NUCLEAR POWER PLANT

BACKGROUND

Cleveland Electric Illuminating Company (CEI) submitted program plan information for the Perry Nuclear Power Plant (PNPP) Detailed Control Room Design Review (DCRDR) in letters dated June 7, 1982; April 15, 1983; and June 21, 1983. NRC staff comments on the program plan information were forwarded to CEI on December 23, 1983. Based on the staff's review of information in the June 7, 1982 submittal, an in-progress audit report was forwarded to the NRC's Division of Licensing for transmittal to CEI on November 2, 1982.

CEI submitted the PNPP DCRDR Summary Report on January 10, 1985. Based on review of the Summary Report and on the results of previous activities, the NRC staff planned a preimplementation audit of the PNPP DCRDR. That audit was conducted from April 8-12, 1985.

DISCUSSION

CEI is committed to prelicensing completion of the DCRDR (including review of the remote shutdown panel) and to prelicensing correction of a large number of HEDs. Staff evaluation of the PNPP DCRDR is provided below. The

evaluation is based on all information available to date and is arranged in order of the DCRDR elements identified in Supplement 1 to NUREG-0737. The staff was assisted in its evaluation by Lawrence Livermore National Laboratory (LLNL). The LLNL technical evaluation report (TER), which provides a detailed evaluation of the PNPP DCRDR, is attached. The staff concurs with the evaluations and conclusions in the TER. A synopsis of the staff's position on the PNPP DCRDR is provided below.

Establishment of a qualified multidisciplinary review team. A qualified multidisciplinary review team has been established for the PNPP DCRDR. CEI should assure continued participation of personnel from appropriate disciplines, including human factors and operations, during the remainder of the DCRDR in order to complete this element.

Function and task analyses to identify control room tasks and information and control requirements during emergency operations. CEI will use Perry Emergency Instructions (PEIs - equivalent to emergency operating procedures at other plants) as the basis for the function and task analysis. The PEIs have been developed using the Boiling Water Reactor Owners' Group (BWROG) Emergency Procedure Guidelines (EPGs). CEI's approach can have acceptable results, but success depends upon the development of complete and technically adequate PEIs. The staff understands that final revision of the PEIs to be implemented prior to fuel load is under way. The staff further understands that CEI will update the task analysis based upon that revision of the PEIs. The update should identify new and modified tasks, the information and

control capabilities needed to perform those tasks, and the displays and controls (including appropriate characteristics) required to satisfy those needs. This element of the DCRDR will be complete upon update of the task analysis. CEI should indicate the revision of the BWROG EPGs upon which the finalized PEIs are based.

Comparison of display and control requirements with a control room inventory.

The organization, process, and current results of this DCRDR element are acceptable. This element of the DCRDR will be complete upon comparison of the control room with the results of the task analysis update discussed in the previous section.

A control room survey to identify deviations from accepted human factors principles. The organization, process, and current results of the control room survey are acceptable. This element of the DCRDR will be complete upon survey of communications equipment and environmental conditions in the finished control room and remote shutdown panel.

Assessment of human engineering discrepancies (HEDs) to determine which are significant and should be corrected. CEI's DCRDR for PNPP used an "Integrated Assessment Methodology" that combined HED assessment and selection of design improvements. The method was not consistent with NRC guidelines in that an independent determination of whether a HED should be corrected (based on error potential and error consequence) was not made. The CEI method did, however, review all HEDs which, following initial assessment, were to remain

uncorrected or partially corrected. The follow-up review was in terms of plant safety and operability. If there was a significant consequence to leaving a HED uncorrected or partially corrected, that HED was iteratively subjected to selection of design improvements and assessment until the problem was resolved. CEI's Integrated Assessment Methodology produced acceptable results with respect to the HED assessment element of the DCRDR. The element will be complete when HEDs identified by comparison of the control room with results of the updated task analysis and HEDs identified by the remaining control room survey activities have been assessed.

Selection of design improvements. The selection of design improvements process, which was part of the Integrated Assessment Methodology, is acceptable. This element of the DCRDR will be complete when design improvements have been selected for safety significant HEDs identified by the comparison of the control room with the results of the updated task analysis and by remaining control room survey activities.

Verification that selected improvements will provide the necessary correction and verification that improvements will not introduce new HEDs. Verification activities were performed by an independent team which included a human factors specialist, a licensed shift supervisor, and a senior design engineer. That group reviewed revised panel drawings against BWROG panel survey checklists. The staff is concerned that a drawing review, by itself, can not assure that new HEDs will not be introduced because such a review does not permit sufficient evaluation of how all proposed corrections

work together. In the staff's judgment the verification activities should be augmented. Further indication that verification activities should be augmented is provided in Appendix D of the attached TER. That Appendix lists a number of recommendations developed by the preimplementation audit team in its evaluation of DCRDR results.

Most proposed corrections have not yet been implemented. The TER recommends that CEI conduct a follow-up survey in the control room when corrections are complete. A hands-on walk/talk through of finalized PEIs is also recommended. In the staff's judgment, the above recommendations provide appropriate means for augmenting the existing verification processes. CEI should also assess the significance of concerns identified in Appendix D of the TER and select and verify design improvements which resolve those concerns. The major thrust of CEI's verification activities should be to assure a consistent, coherent, and effective control room interface with operators.

Coordination of control room improvements with changes from other programs such as the safety parameter display system (SPDS), operator training, Reg. Guide 1.97 instrumentation, and upgraded emergency operating procedures.

Coordination of control room improvements with changes from other programs is acceptable. CEI should assure that coordination continues through the remainder of the DCRDR in order to complete this element.

Summary Report requirements. CEI provided information on 334 HEDs and their proposed disposition as part of the Summary Report. The staff reviewed the status of each of those HEDs during the pre-implementation audit. The status of HED corrections, based on that audit, is provided in Attachment 2 and is summarized as follows:

A. HEDs which have been corrected and are closed	25
B. HEDs to be corrected by licensing	
1. Open pending implementation of correction	237
2. Open pending additional review, revised response, and implementation of correction	35
C. HEDs for which partial or interim corrections will be implemented by licensing and which will be completely corrected by the end of the first refueling outage	
1. Open pending implementation of partial or interim correction	9
2. Open pending additional review, revised response, and implementation of partial or interim response	5
D. HEDs to be corrected by the end of the first refueling outage	
1. Open pending implementation of correction	4

2. Open pending additional review, revised response, 1
and implementation of correction

E. HEDs for which acceptable justification for not correcting
has been, or is expected to be, provided

1. Closed 13

2. To be closed on revised response 5

The staff found proposed HED corrections, implementation schedules, and justifications to be generally acceptable. However, as indicated above, the staff was concerned about the disposition of some HEDs (those requiring additional review and/or revised response). Each concern was discussed with CEI during the preimplementation audit. Information related to HEDs about which the staff has concerns is provided in Appendix C of Attachment 1.

Another staff concern is the auditability of the resolution process for procedure related HEDs that were sent to the CEI Operations Section. Based on discussion during the preimplementation audit, the staff understands that an auditable record of the disposition of those HEDs will be maintained. CEI should use that record as a tool to assure all safety significant concerns are resolved and that technically adequate PEIs are supported by the control room.

At this time the staff's most serious concern with the PNPP DCRDR is the rate at which HED corrections are being implemented. At the time of the preimplementation audit, less than 15 percent of the HEDs were closed. CEI is required to meet the implementation schedule to which it committed in the Summary Report. That commitment was confirmed during the preimplementation audit and by CEI's July 25, 1985 submittal. Progress on correcting HEDs has been slow. Based on current performance, the staff does not expect commitments for DCRDR completion and HED correction to be met in time for early Fall 1985 licensing. The staff will audit correction of HEDs prior to low and full-power licensing. CEI should provide revised responses as indicated in the attachments. CEI should also provide a schedule for completion of the DCRDR in order to assist the staff in its close-out.

CONCLUSION

Several activities must be completed to close-out the PNPP DCRDR. Those activities are:

1. Function and task analysis - update the task analysis to reflect the final revision of the PEIs to be implemented prior to fuel load.
2. Comparison of display and control requirements with a control room inventory - compare the control room with results of the task analysis update.

3. Control room survey - survey communications equipment and environmental conditions in the completed control room and remote shutdown panel.
4. Assessment - assess HEDs identified by comparison of the control room with results of the updated task analysis and by the remaining control room survey activities.
5. Selection of design improvements - select design improvements for safety significant HEDs identified by comparison of the control room with results of the updated task analysis and by the remaining control room survey activities.
6. Verification - augment the existing verification processes in a way that will assure all proposed corrections work together to provide a consistent, coherent, and effective control room interface with the operator (include assessment of concerns identified in Appendix D of the TER and selection and verification of design improvements which resolve those concerns).
7. Summary Report - supplement the Summary Report to provide revised responses to HEDs identified in Appendix C of Attachment 1 and updated implementation status of HED corrections.

In addition to the above, CEI has not satisfied prelicensing commitments for HED correction. In the NRC staff's judgment, completion of the above items is essential to satisfy CEI's prelicensing commitments and the DCRDR requirements in Supplement 1 to NUREG-0737. Evaluation of the PNPP DCRDR will continue through completion of the above elements.

REFERENCES

1. NUREG-0737, "Clarification of TMI Action Plan Requirements." November 1980; Supplement 1. December 1982.
2. Letter from D. R. Davidson (CEI) to A. Schwencer (NRC). Subject: "Control Room Design Review." June 7, 1982.
3. Memorandum from V. Moore (NRC) to A. Schwencer. Subject: "Human Factors Engineering In-progress Audit Report, Perry Nuclear Power Plant Unit 1." November 2, 1982.
4. Letter from M. R. Edelman (CEI) to B. J. Youngblood. Subject: "Our Response to Generic Letter 82-33, NUREG-0737, Supplement 1." April 15, 1983.
5. Letter from M. R. Edelman to B. J. Youngblood. Subject: "Response to Generic Letter 83-18 NRC Staff Review of the BWR Owners' Group Control Room Survey Program." June 21, 1983.
6. Letter from B. J. Youngblood to M. R. Edelman. Subject: "NRC Staff Comments on the Detailed Control Room Design Review Program Plan for Perry Nuclear Power Plant (Units 1 and 2)." December 23, 1983.
7. Letter from M. R. Edelman to B. J. Youngblood. Subject: "Detailed Control Room Design Review Summary Report." January 10, 1985.
8. Letter from M. R. Edelman to B. J. Youngblood. Subject: "PNPP Control Room Design Review Human Engineering Deficiency (HED) Completion Status Report," July 25, 1985.

HUMAN FACTORS ENGINEERING BRANCH
TASK ACTION PLAN ITEM II.K.3.27, COMMON REFERENCE LEVEL
INPUT TO
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FOR THE
PERRY NUCLEAR POWER PLANT

TMI Task Action Plan Item II.K.3.27 requires that a common reference level be provided for vessel level instrumentation. In the Detailed Control Room Design Review (DCRDR) Summary Report for the Perry Nuclear Power Plant (PNPP), dated January 10, 1985, Cleveland Electric Illuminating (CEI) Company commits to establishment of a common reference level for vessel level instrumentation. CEI's commitment is in response to human engineering discrepancy (HED) No. 79. That HED and CEI's response read as follows:

HED No. 79 - "Different zero references are used for reactor water level instruments. This may complicate comparing readings from multiple indications."

Response - "All the vessel level indications will be referenced to the top of active fuel."

Schedule - "Fuel load."

Establishment of the common reference level prior to PNPP licensing (i.e., by fuel load) will satisfy the requirement of TMI Action Plan Item II.K.3.27.