

SUPPLEMENT 1 TO THE
TECHNICAL EVALUATION REPORT
OF THE
DETAILED CONTROL ROOM DESIGN REVIEW
FOR THE CONSOLIDATED EDISON COMPANY'S
INDIAN POINT STATION, UNIT 2

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FOREWORD

This Technical Evaluation Report (TER) serves as a supplement to the TER which was provided to the Nuclear Regulatory Commission (NRC) on September 29, 1986. The purpose of this report is to summarize the review team's conclusions concerning its evaluation of the Detailed Control Room Design Review (DCRDR) of Consolidated Edison at the Indian Point Station, Unit 2.

Science Applications International Corporation's (SAIC) participation was provided under Contract NRC-03-82-096, Technical Assistance in Support of Reactor Licensing Actions: Program III. This supplement to the TER is based on the outcome of two teleconferences and a review of confirmatory documentation submitted by the licensee. It also updates the findings and conclusions contained in the September 1986 TER. SAIC previously participated in the review of the licensee's Program Plan and in two separate meetings with the licensee to discuss Program Plan comments, the first on June 26, 1984, and the second on November 20, 1984. A third meeting took place on December 4, 1985 to review the progress made on the DCRDR. The licensee submitted its Summary Report for the DCRDR on June 30, 1986. SAIC reviewed the Summary Report and documented its findings in a TER submitted to the NRC on September 29, 1986.

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1.0 INTRODUCTION

The Nuclear Regulatory Commission's (NRC) review of the Consolidated Edison Company Final Summary Report (Reference 1) on the DCRDR conducted for the Indian Point Station, Unit 2 plant revealed that the DCRDR satisfied seven of the nine requirements of Supplement 1 to NUREG-0737 (Reference 2). However, there was a minor question involving the System Function and Task Analysis element of the DCRDR and significant concerns involving the Selection of Design Improvements. Phone conferences were held on January 16, 1987 and June 3, 1987 to resolve these issues. Participants in the teleconference meetings are identified in Appendix A. Subsequently, on August 14, 1987, consolidated Edison Company submitted documentation which provided confirmation of its commitments made during the teleconferences (Reference 3).

2.0 EVALUATION

The purpose of the evaluation was to determine whether the nine DCRDR requirements in Supplement 1 to NUREG-0737 had been satisfied. The evaluation was performed by comparing the information provided by Consolidated Edison Company with the criteria in NUREG-0800, Section 18.1, Rev. 0, Appendix A of the Standard Review Plan (Reference 4). Our reviewers' evaluation of the DCRDR for the Indian Point Plant, and a summary of the criteria from the Standard Review Plan are provided below.

2.1 Establishment of a Qualified Multidisciplinary Review Team

The organization for conduct of a successful DCRDR can vary widely but is expected to conform to some general criteria. Overall administrative leadership should be provided by a utility employee. The DCRDR team should be given sufficient authority to carry out its mission. A core group of

specialists in the fields of human factors engineering and nuclear engineering are expected to participate with assistance as required from personnel in other disciplines. Staffing for each technical task should bring appropriate expertise to bear. Human factors expertise should be included in the staffing for most, if not all, technical tasks. Finally, the DCRDR team should receive an orientation briefing on DCRDR purpose and objectives which contributes to the success of the DCRDR. NUREG-0800, Section 18-1, Appendix A describes criteria for the multidisciplinary review team in more detail.

It is the review team's judgment that Consolidated Edison Company has met the Supplement 1 to NUREG-0737 requirement for establishment of a qualified multidisciplinary review team.

2.2 System Function and Task Analysis

The purpose of the system function and task analysis is to identify the control room operators' tasks during emergency operations and to determine the information and control capabilities the operators need in the control room to perform those tasks. An acceptable process for conducting the function and task analysis is as follows:

1. Analyze the functions performed by systems in responding to transients and accidents in order to identify and describe those tasks operators are expected to perform.
2. For each task identified in Item 1 above, determine the information (e.g., parameter, value, status) which signals the need to perform the task, the control capabilities needed to perform the task, and the feedback information needed to monitor task performance.
3. Analyze the information and control capability needs identified in Item 2 above to determine appropriate characteristics for displays and controls to satisfy those needs.

The system function and task analysis descriptions provided in the Summary Report and supplementary information obtained at a meeting on

November 20, 1984 between the licensee and the NRC staff indicate the licensee has satisfied this requirement of Supplement 1 to NUREG-0737. The IE Information Notice No. 86-64 (Reference 5), dated August 14, 1986 however, indicates that many utilities may have not appropriately developed or implemented upgraded emergency operating procedures (EOPs). The licensee was asked to verify that the problems with EOPs identified in this Information Notice were not applicable to Indian Point, Unit 2.

During the teleconference of January 16, 1987, the licensee indicated that they had reviewed their procedures upgrade program against the concerns identified in IE Information Notice No. 86-64: "Deficiencies in Upgrade Programs for Plant Emergency Operating Procedures," and they found that it had no impact on the DCRDR. The licensee planned to submit their EOP procedures generation package to NRC on February 15, 1987. The licensee further indicated that if they identified concerns relating to IE 86-64, they would address them.

It is the review team's judgment that the Consolidated Edison Company has met the Supplement 1 to NUREG-0737 requirement for a function and task analysis to identify control room operator tasks and information and control requirements during emergency operations.

2.3 Comparison of Display and Control Requirements with a Control Room Inventory

The purpose of comparing display and control requirements to a control room inventory is to determine the availability and suitability of displays and controls required to perform the Emergency Operating Procedures. The success of this element depends on the quality of the function and task analysis and the control room inventory. The control room inventory should be a complete representation of displays and controls currently in the control room. The inventory should include appropriate characteristics of current displays and controls to allow meaningful comparison to the results of the function and task analysis. Unavailable or unsuitable displays and controls should be documented as human engineering discrepancies (HEDs).

It is the review team's judgment that Consolidated Edison Company meets the Supplement 1 to NUREG-0737 requirement for a comparison of display and control requirements with the control room inventory.

2.4 Control Room Survey

The key to a successful control room survey is a systematic comparison of the control room to accepted human engineering guidelines and human factors principles. One accepted set of human engineering guidelines is provided in Section 6 of NUREG-0700 (Reference 6); however, other accepted human factors standards may be chosen. Discrepancies should be documented as HEDs.

It is the review team's judgment that Consolidated Edison Company meets the Supplement 1 to NUREG-0737 requirement for a control room survey to identify deviations from accepted human factors principles.

2.5 Assessment of Human Engineering Discrepancies (HEDs) to Determine Which Are Significant and Should Be Corrected

Based on the guidance of NUREG-0700 and the requirements of Supplement 1 to NUREG-0737, all HEDs should be assessed for significance. The potential for operator error and the consequence of that error in terms of plant safety should be systematically considered in the assessment. Both the individual and aggregate effects of HEDs should be considered. The result of the assessment process is a determination of which HEDs should be corrected because of their potential impact on plant safety. Decisions on whether HEDs are safety-significant should not be compromised by consideration of such issues as the means and potential costs of correcting HEDs.

It is the review team's judgment that Consolidated Edison Company meets the Supplement 1 to NUREG-0737 requirement for an assessment of HEDs to determine which are significant and should be corrected.

2.6 Selection of Design Improvements

The purpose of selecting design improvements is to determine corrections to HEDs identified from the review phase of the DCRDR. Selection of design improvements should include a systematic process for the development and comparison of alternative means of resolving HEDs. Furthermore, according to Supplement 1 to NUREG-0737, the licensee should document all of the proposed control room changes.

Review of the Final Summary Report on the DCRDR for the Indian Point Unit 2 plant generated questions regarding some of the human engineering observations (HEOs) and HEDs. These questions, were discussed during the phone conferences between the Consolidated Edison Company and the NRC January 16, and June 3, 1987. All but nine of the questions were resolved during the teleconference of January 16, 1987. The licensee agreed to review the remaining issues and discuss them during the next teleconference scheduled on June 3, 1987. On August 14, 1987 Consolidated Edison submitted documentation confirming the results of the teleconferences. The concerns and results are listed below:

HEO 6.1.005 deals with reading displays located above 70 inches and possible accidental activation of controls located below 34 inches.

The NRC did not consider the rolling ladder as a satisfactory solution to reading high location instruments or controls located too low.

On June 3, 1987, during the second telephone conference, the licensee indicated that they had reviewed 146 indicators that were located above 70 inches, and they found that there were only four indicators that were required by operators during emergency operations which did not meet the guidelines of NUREG-0700 (Reference 6). These four include:

1. Containment narrow range pressure indicator. The licensee indicated that the value 2 psig is the trigger point for safety injection and was clearly visible from the lower half of the indicator.

2. Reactor water storage tank was 69 inches from the floor. However, the licensee stated that it was easily readable and, moreover, there were two backup annunciators for low level reading.
3. Containment sump level indicator. This is 72 inches from the floor. The licensee indicated that it could be read easily and, moreover, there was a redundant indicator recorder for containment sump level below the 70 inch line and found this to be of no problem.
4. Condensate storage tank level indicator. This is 76 inches center line. However, according to the licensee's review, the operators found that it was easily readable and the plant has an automatic low level auxiliary feedwater cut off protection and annunciator alarm driven by low suction pressure when the condensate storage tank is at low level.

The licensee's justifications concerning these issues were judged adequate when discussed during the teleconference.

HEO 6.3.002 - Alarm Parameter Selection (Multichannel or Shared Alarms): Annunciator alarms with inputs from more than one plant parameter include "Electric Heat Trace," "Isolation Phase Bus Duct Cooling," "Feedwater Heaters 21-24 and 26A, B, and C High/Low Alarm," and "Area Monitor High Rad."

The licensee stated that shared alarms were evaluated and it was found that none of them were safety related. The licensee's justification concerning the HEO was judged to be adequate when discussed during the teleconference.

HEO 6.4.004 - Operators have no experience using controls while dressed in protective clothing.

During the June 3, 1987 teleconference the licensee indicated that all operators were given training using protective equipment. The operators were exposed to new scenarios of toxic gas in the control room and also simulated the plant to cold shutdown, which determined that the

protective clothing caused no adverse communications or control difficulty. The licensee's position concerning the HEO was judged to be adequate when discussed during the teleconference.

HEO 6.1.016 deals with the potential operator error due to inability to quickly and accurately identify instruments. The reviewers required more evidence that labels are, in fact, readily visible.

During the teleconference of January 16, 1987, the licensee stated that the display labels will be relocated above instruments in 1989. This would address the issue of dark labels in the shadow of instruments. A review of the confirmatory documentation found that this commitment has been made.

HEO 6.1.024 - RHR flow indication is required to support task ES-1.3/step 16. This information is not available in the control room.

During the teleconference of January 16, 1987, the licensee stated that the "Scale Project" was underway and problems such as residual heat removal (RHR) flow scale should be corrected during the project. A review of the confirmatory documentation found that this commitment has been made.

HEO 6.5.039, HEO 6.5.041, HEO 6.5.047, HEO 6.5.049 - The reviewers need a color code and all its applications in the control room.

During the teleconference of January 16, 1987, the licensee gave the color code as:

white = supervisory
red = flow/open/run
green = lack of flow/close/stop
amber = other than normal

The licensee's color code was judged to be adequate.

Additionally, during the June 3, 1987 teleconference the licensee indicated that they reevaluated the push-to-test lamp capability on

approximately 70 bulbs that did not have push-to-test capability. Of those 70 lamps evaluated, five were determined to be safety significant and needed to be tested. These five are the containment vent coolers of recirculation flow trouble indicators. The licensee committed to install a lamp-test-capability for these five indicator lights. This commitment was made in the confirmatory documentation.

In summary, all selection of design improvement concerns and justifications for not correcting HEDs were discussed and agreed to during teleconferences in January and June, 1987. The licensee's August 14, 1987 submittal documented the cases where the licensee committed to additional work.

It is the review team's judgment that Consolidated Edison Company meets the Supplement 1 to NUREG-0737 requirement for selection of design improvements.

2.7 Verification that Selected Design Improvements Will Provide the Necessary Correction

A key criterion of DCRDR success is a consistent, coherent, and effective interface between the operator and the control room. One good way to satisfy that criterion is through iteration of the processes of selection of design improvements, verification that selected improvements will provide the necessary correction, and verification that the improvements will not introduce new HEDs. According to NUREG-0800, techniques for the verification process might include partial resurveys of mocked-up panels, applied experiments, engineering analyses, environmental surveys, and operator interviews. The consistency, coherence, and effectiveness of the entire operator-control room interface are important to operator performance. Thus, evaluation of both the changed and unchanged portions of the control room is necessary during the verification process.

It is the review team's judgment that Consolidated Edison Company meets the Supplement 1 to NUREG-0737 requirements for verification that selected improvements will produce the necessary correction.

2.8. Verification that Selected Design Improvements Will Not Introduce New HEDs.

It is the review team's judgment that Consolidated Edison Company meets the Supplement 1 to NUREG-0737 requirement for verification that the selected improvements do not introduce new HEDs.

2.9 Coordination of Control Room Improvements With Changes From Other Programs, such as the Safety Parameter Display System, Operator Training, Reg. Guide 1.97 Instrumentation, and Upgraded Emergency Operating Procedures

Improvement of emergency response capability requires coordination of the DCRDR with other activities. Satisfaction of Reg. Guide 1.97 requirements and the addition of the Safety Parameter Display System (SPDS) necessitate modifications and additions to the control room. The modifications and additions should be specifically addressed by the DCRDR. Exactly how the modifications are addressed depends on a number of factors including the relative timing of the various emergency response capability upgrades. Regardless of the means of coordination, the result should be integration of Reg. Guide 1.97 instrumentation and SPDS equipment into a consistent, coherent, and effective control room interface with the operators.

It is the review team's judgment that Consolidated Edison Company meets the Supplement 1 to NUREG-0737 requirement for coordination of the DCRDR with other Supplement 1 improvement programs such as SPDS, operator training, Reg. Guide 1.97 instrumentation and upgraded EOPs.

3.0 CONCLUSIONS

Based on a review of Consolidated Edison Company's Indian Point Unit 2, DCRDR Final Summary Report and the January 16, 1987 and June 3, 1987 phone conferences, and August 14, 1987 DCRDR submittal, it is the review team's judgment that the licensee meets the nine Supplement 1 to NUREG-0737 DCRDR

requirements. The review team's conclusions are listed below in terms of the Supplement 1 to NUREG-0737 requirements.

1. It is the review team's judgment that the licensee meets the Supplement 1 to NUREG-0737 requirement for the establishment of a qualified multidisciplinary review team.
2. It is the review team's judgment that the licensee meets the Supplement 1 to NUREG-0737 requirement for a function and task analysis to identify control room operator tasks and information and control requirements during emergency operations.
3. It is the review team's judgment that the licensee meets the Supplement 1 to NUREG-0737 requirement for a comparison of display and control requirements with the control room inventory.
4. It is the review team's judgment that the licensee meets the Supplement 1 to NUREG-0737 requirement for a control room survey to identify deviations from accepted human factors principles.
5. It is the review team's judgment that the licensee meets the Supplement 1 to NUREG-0737 requirement for assessment of HEDs to determine which are significant and should be corrected.
6. It is the review team's judgment that the licensee meets the Supplement 1 to NUREG-0737 requirement for selection of design improvements.
7. It is the review team's judgment that the licensee meets the Supplement 1 to NUREG-0737 requirement for verification that selected improvements will provide the necessary correction.
8. It is the review team's judgment that the licensee meets the Supplement 1 to NUREG-0737 requirement for verification that the selected improvements will not introduce new HEDs.

9. It is the review team's judgment that the licensee meets the Supplement 1 to NUREG-0737 for coordination of control room improvements with changes from other programs such as Safety Parameter Display System (SPDS), operator training, Reg. Guide 1.97 instrumentation and upgraded Emergency Operating Procedures.

REFERENCES

1. Final Summary Report for the Detailed Control Room Design Review of Indian Point Unit 2, Consolidated Edison Company of New York, Inc., June 30, 1986. Attachment to letter from John P. O'Toole, Consolidated Edison Company of New York to Hugh L. Thompson, Director, Division of PWR Licensing-A, Office of Nuclear Reactor Regulation, USNRC.
2. NUREG-0737, Supplement 1, "Requirements for Emergency Response Capability," U.S. NRC, Washington, D.C., December 1982, transmitted to reactor licensees via Generic Letter 82-33, December 17, 1982.
3. "Documentation of the Detailed Control Room Design Review (DCRDR), attachment to Letter from M. Selman, Consolidated Edison Company, to Document Control Desk, USNRC, dated August 14, 1987.
4. NUREG-0800, "Standard Review Plan," Section 18.1, "Control Room," and Appendix A, "Evaluation Criteria for Detailed Control Room Design Reviews (DCRDR)," September 1984.
5. IE Information Notice No. 86-64, "Deficiencies in Upgrade Programs for Plant Engineering Operating Procedures," August 14, 1986.
6. NUREG-0700, Guidelines for Control Room Design Reviews, U.S. NRC, 1981.

APPENDIX A

**PARTICIPANTS OF TELEPHONE CONFERENCES HELD ON
JANUARY 16, 1987 AND JUNE 3, 1987**

<u>Name</u>	<u>Organization</u>
Joel Kramer	NRC
Marylee Slosson	NRC
Joseph DeBor	SAIC
Kiran Chadda	SAIC
Mr. Karp	Indian Pt. 2
Mr. Adorno	Indian Pt. 2
Mr. Potter	Torrey Pines/Indian Pt. 2