

SAIC-88/3031

TECHNICAL EVALUATION REPORT  
OF THE  
DETAILED CONTROL ROOM DESIGN REVIEW  
FOR  
PUBLIC SERVICE ELECTRIC AND GAS COMPANY'S  
HOPE CREEK GENERATING STATION

TAC NO. 65228

August 15, 1988

**SAIC**

*Science Applications International Corporation*

Prepared for:

U.S. Nuclear Regulatory Commission  
Washington, D.C. 20555

Contract NRC-03-82-096  
Task Order No. 19

8808230249

## TABLE OF CONTENTS

<u>Section</u>		<u>Page</u>
1.0	INTRODUCTION .....	1
2.0	EVALUATION .....	2
2.1	Establishment of a Qualified Multidisciplinary Review Team .....	2
2.2	System Function and Task Analysis .....	2
2.3	Comparison of Display and Control Requirements With a Control Room Inventory .....	2
2.4	Control Room Survey .....	3
2.5	Assessment of Human Engineering Discrepancies (HEDs) to Determine Which Are Significant and Should Be Corrected .....	3
2.6	Selection of Design Improvements .....	3
2.7	Verification That Selected Design Improvements Will Provide the Necessary Correction .....	5
2.8	Verification That Selected Design Improvements Will Not Introduce New HEDs .....	5
2.9	Coordination of Control Room Improvements With Changes From Other Improvement Programs, Such as the Safety Parameter Display System, Operator Training, Regulatory Guide 1.97 Instrumentation, and Upgraded Emergency Operating Procedures .....	6
3.0	CONCLUSIONS .....	6
4.0	REFERENCES .....	7

TECHNICAL EVALUATION REPORT  
OF THE  
DETAILED CONTROL ROOM DESIGN REVIEW  
FOR  
PUBLIC SERVICE ELECTRIC AND GAS COMPANY'S  
HOPE CREEK GENERATING STATION

1.0 INTRODUCTION

Public Service Electric and Gas Company submitted a Summary Report for the Hope Creek Generating Station to the Nuclear Regulatory Commission (NRC) on August 6, 1984 (Reference 1). The NRC reviewed the Summary Report and a preimplementation audit was conducted from November 13 to 15, 1984. Certain analyses were not completed when the Summary Report was submitted and the licensee committed to documenting the completion of these activities in supplemental reports. In a letter to the NRC dated December 6, 1986 (Reference 2), the licensee also documented commitments made during the preimplementation audit.

The licensee has thus far submitted three DCRDR Supplemental Reports. DCRDR Supplemental Report I, submitted on December 27, 1985 (Reference 3), presented a summary of tasks completed and the status of Hope Creek Generating Station with respect to each commitment. The staff's DCRDR Safety Evaluation Report for Hope Creek Generating Station was forwarded to the licensee in April, 1986 (Reference 4). Results of tasks remaining to be completed after submission of Supplemental Report I were incorporated into Supplemental Report II (Reference 5), dated November 6, 1986.

Following the submittal of the Supplemental Reports I and II, one DCRDR analysis commitment and several follow-up tasks remained to be performed in order to meet the DCRDR requirements of NUREG-0737, Supplement 1 (Reference 6). The commitment, as stated in Supplemental Safety Evaluation Report 1, Appendix I, page 13, (Reference 7) was to resolve "...HED A69 by doing a study of zone markings and reporting the results to the NRC one year after fuel load." On April 23, 1987, the licensee submitted Supplemental Report III (Reference 8) which documented the completion of the zone marking study,

as well as follow-up tasks performed to complete commitments addressed in Supplemental Reports I and II.

Science Applications International Corporation reviewed Supplemental Report III with respect to the nine DCRDR requirements specified in NUREG-0737, Supplement 1, and the criteria in NUREG-0800 (Reference 9). This Technical Evaluation Report reflects the consolidated observations, findings, and conclusions of the review team members.

## 2.0 EVALUATION

The purpose of the evaluation was to determine whether the nine DCRDR requirements in NUREG-0737, Supplement 1 had been satisfied. The evaluation was performed by comparing the information provided by Public Service Electric and Gas Company with the criteria in NUREG-0800, Section 18.1, Revision 0, Appendix A of the Standard Review Plan. The reviewers' evaluation of the DCRDR for the Hope Creek Generating Station is provided below.

### 2.1 Establishment of a Multidisciplinary Review Team

It is the review team's judgment that Public Service Electric and Gas Company has met the NUREG-0737, Supplement 1 requirement for establishment of a qualified multidisciplinary review team.

### 2.2 System Function and Task Analysis

It is the review team's judgment that Public Service Electric and Gas Company meets the NUREG-0737, Supplement 1 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

It is the review team's judgment that Public Service Electric and Gas Company meets the NUREG-0737, Supplement 1 requirement for a comparison of display and control requirements with the control room inventory.

#### 2.4 Control Room Survey

It is the review team's judgment that Public Service Electric and Gas Company meets the NUREG-0737, Supplement 1 requirement for a control room survey to identify deviations from accepted human factors principles.

#### 2.5 Assessment of Human Engineering Discrepancies to Determine Which Are Significant and Should Be Corrected

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

#### 2.6 Selection of Design Improvements

As stated earlier, following the submittal of Supplemental Reports I and II, the licensee had one analysis commitment, regarding zone markings on control room instrumentation, which remained open. In Supplemental Report III the licensee discussed the methodology and results of the zone marking study. The method used to establish appropriate zone marking consisted of the following five tasks:

1. Identification of applicable instrumentation
2. Establishment of conventions and standards
3. Determination of appropriate ranges for zone markings
4. Conduct of a trial implementation and operator evaluation
5. Verification that the final zone marking solutions complied with established human factors principles

As a result of the analysis, zone marking was permanently applied to 257 instruments. No new HEDs were identified, nor were any problems identified by operators in using the zone markings.

In addition to the remaining analysis commitment, the licensee also provided information regarding the additional requirements to complete three

tasks previously reported in Supplemental Reports I and II. The tasks and their results are described below.

1. HED Q7 and HED Q8: These illumination HEDs were omitted from the Supplemental Report II Review Findings. These HEDs were both assessed as Category 4 HEDs and no corrective action is planned. Adequate justification was provided for the lack of corrective action.
2. The review of the implementation of 85 HED corrections resulted in the reassessment of two HEDs. HED A25 identified a concern with discriminating the function of indicator lights and pushbuttons on the turbine panel (D Console). The original disposition stated that this HED would be corrected; however, upon reassessment the revised disposition is that no correction is planned for this HED. The licensee adequately justified the revised disposition by stating that: indicator lights and pushbuttons are clearly labeled, the red and green color conventions of turbine panel status lights are followed throughout the control room, and that because procedures direct the operator in use of this panel, there is low probability for operator error.

HED A4 stated that legend pushbuttons and indicator lights exceed three lines of lettering. The original disposition stated that this HED would be corrected. The revised disposition stated that no correction is planned for this HED. Adequate justification for not correcting this HED was provided by explaining that the specific indicators in question have a larger surface area than most Hope Creek indicators and thus have sufficient area to include more than three lines of lettering, as well as larger lettering. In addition, the licensee stated that if the information appearing on these indicators were to be condensed, the message would no longer be meaningful.

3. The Safety Parameter Display System (SPDS) was removed from the Control Room Integrated Display System (CRIDS) in order to meet the minimum requirements for SPDS. The licensee stated that the SPDS is being revised, and, as part of the new design, a human

factors evaluation using NUREG-0700 guidelines will be conducted. The results of the final review of the SPDS will be submitted to the NRC upon completion of the SPDS.

CRIDS HEDs were reviewed for potential changes to the dispositions as a result of removing the SPDS. Reassessment was conducted for the following four CRIDS HEDs using the method as documented in the Summary Report: M5, M22, M41, and M50. All four were assessed as Category 4 HEDs. Originally, all four were to be corrected. The revised dispositions state that HEDs M5 and M50 will be partially corrected, and that no correction is planned for HEDs M22 and M41. Adequate justification was provided for each of the revised dispositions.

It is the review team's judgment that the Public Service Electric and Gas Company meets the NUREG-0737, Supplement 1 requirement for selection of design improvements.

#### 2.7 Verification that Selected Design Improvements Will Provide the Necessary Correction

It is the review team's judgment that the Public Service Electric and Gas Company meets the NUREG-0737, Supplement 1 requirement 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 the Public Service Electric and Gas Company meets the NUREG-0737, Supplement 1 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, Regulatory Guide 1.97 Instrumentation, and Upgraded Emergency Operating Procedures

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

3.0 CONCLUSIONS

Public Service Electric and Gas Company submitted a Summary Report for the Hope Creek Generating Station to the NRC on August 6, 1984. The NRC reviewed the Summary Report and a preimplementation audit was conducted from November 13 to 15, 1984. Certain analyses were not completed when the Summary Report was submitted and the licensee committed to documenting the completion of these activities in supplemental reports. In addition, the licensee also documented commitments made during the preimplementation audit in a letter to the NRC dated December 6, 1986. On December 27, 1985, and November 6, 1986, the licensee submitted, respectively, Supplemental Reports I and II. The licensee submitted Supplemental Report III on April 23, 1987, which documented the results of the final analysis commitment and additional follow-up tasks performed to complete commitments addressed in Supplemental Reports I and II.

Science Applications International Corporation reviewed Supplemental Report III with respect to the nine DCRDR requirements specified in NUREG-0737, Supplement 1. This Technical Evaluation Report reflects the consolidated observations, findings, and conclusions of the review team members. The review team found that Public Service Electric and Gas Company has met all nine DCRDR requirements.

#### 4.0 REFERENCES

1. "Detailed Control Room Design Review Final Summary Report for Hope Creek Generating Station," Letter from PSE&G to NRC, August 6, 1984.
2. Letter from PSE&G to NRC, December 6, 1986.
3. "DCRDR Supplemental Report I," Letter from PSE&G to NRC, December 27, 1985.
4. NUREG-1048, Supplement No. 5, "Safety Evaluation Report Related to the Operation of Hope Creek Generating Station," U.S. NRC, April, 1986.
5. "DCRDR Supplemental Report II," Letter from PSE&G to NRC, November 6, 1986.
6. NUREG-0737, Supplement 1, "Requirements for Emergency Response Capability" (Generic Letter No. 82-33), December 17, 1982.
7. "Supplemental Safety Evaluation Report 1," Letter from NRC to PSE&G.
8. "DCRDR Supplemental Report III," Letter from PSE&G to NRC, April 23, 1987.
9. NUREG-0800, "Standard Review Plan," Section 18.1, "Control Room," and Appendix A, "Evaluation Criteria for Detailed Control Room Design Reviews (DCRDR)," September 1984.