ENCLOSURE 2

SAIC-85/3056

TECHNICAL EVALUATION REPORT

OF THE

DETAILED CONTROL ROOM DESIGN REVIEW

FOR

PILGRIM NUCLEAR STATION

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Prepared by:

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FOREWORD

This Technical Evaluation Report (TER) was prepared by Science Applications International Corporation (SAIC) under Contract NRC-03-82-096, Technical Assistance in Support of NRC Licensing Actions: Program III. The evaluation was performed in support of the Division of Human Factors Safety, Human Factors Engineering Branch (HFEB). The NRC previously evaluated Boston Edison Company's (BECo) Program Plan (Reference 1) for conducting a Detailed Control Room Design Review (DCRDR) at Pilgrim Nuclear Power Station. BECo's Program Plan letter of transmittal invited the staff to visit Pilgrim Station to discuss the program concept and engage in a general information exchange. This meeting took place on November 15-16, 1983. NRC staff comments on BECo's Program Plan along with additional information provided to the staff during the November, 1983 meeting were forwarded to the licensee on March 6, 1984 (Reference 2). The NRC review of the Program Plan led to a favorable conclusion; the plan was found to comply with the requirements stated in Supplement 1 to NUREG-0737 (Reference 3). However, some areas of the plan required further detail to ensure that the processes used would lead to a thorough and successful review. Based upon the November meeting, BECo proposed to develop a Program Plan revision, which was transmitted to the NRC on August 14, 1984 (Reference 4).

A preliminary review of the Detailed Control Room Design Review Executive Summary Report (Reference 5) submitted to BECo, on September 24, 1984, was conducted by the NRC staff and SAIC. Based upon this review, the NRC decided to conduct an on-site, pre-implementation audit of the Pilgrim DCRDR. This audit was conducted on November 26-30, 1984. This TER is based upon both the Summary Report submitted by BECo and the information provided by the licensee during the November, 1984 pre-implementation audit.

TABLE OF CONTENTS

TECHNICAL EVALUATION OF THE DETAILED CONTROL ROOM DESIGN REVIEW FOR PILGRIM NUCLEAR STATION

This Technical Evaluation Report (TER) documents Science Applications International Corporation's (SAIC) evaluation of the Detailed Control Room Design Review (DCRDR) Summary Report submitted to the Nuclear Regulatory Commission (NRC) by the Boston Edison Company (BECo) for Pilgrim Nuclear Station (Reference 5) and the results of a pre-implementation audit conducted at Pilgrim. BECo's review was conducted in accordance with the Program Plan (Reference 1) submitted to the NRC on October 14, 1983. The NRC staff accepted BECo's invitation to meet (November 15-16, 1983) to discuss the Program Plan and engage in an information exchange. The NRC staff's evaluation of the Program Plan coupled with the additional information obtained at the November, 1983 meeting were forwarded to the licensee on March 6, 1984 (Reference 2). The NRC review of the Program Plan in conjunction with the November, 1983 meeting information led to the favorable conclusion that the plan was found to be generally complete, but in need of some further detail. Based on the results of the Program Plan review and the November, 1983 meeting, BECo formally transmitted a Program Plan revision to the NRC on August 14, 1984 (Reference 4). Even though the Program Plan was judged acceptable, the NRC staff and SAIC evaluation team determined in the course of reviewing the Summary Report (Reference 5) that further information would be needed in order to ensure a valid assessment of the DCRDR process. A pre-implementation audit was therefore conducted on November 26-30, 1984, to gather further information as to the adequacy of the DCRDR.

The audit team consisted of the NRC team leader, two consultants from SAIC and SAIC's consultant from Comex Corporation. The disciplines of human factors engineering, mechanical engineering, and nuclear operations were represented on the team. Attachment 3 provides complete lists of the attendees at the entrance and exit briefings.

This report (TER) is an evaluation of both the licensee's Summary Report and the findings from the NRC pre-implementation audit. It was compiled and integrated by SAIC with input from Comex Corporation and the NRC. As such, it represents the consolidated observations, conclusions, and recommendations of the audit team.

BACKGROUND

Licensees and applicants for operating licenses are required to conduct a Detailed Control Room Design Review (DCRDR). The objective is to "...improve the ability of nuclear power plant control room operators to prevent accidents or cope with accidents if they occur by improving the information provided to them" (NUREG-0660, Item I.D). The need to conduct a DCRDR was confirmed in NUREG-0737 and in Supplement 1 to NUREG-0737. DCRDR requirements in Supplement 1 to NUREG-0737 replaced those in earlier documents. Supplement 1 to NUREG-0737 requires each applicant or licensee to conduct its DCRDR on a schedule negotiated with the NRC. Guidelines for conducting a DCRDR are provided in NUREG-0700 while criteria for NRC's evaluation of a DCRDR are contained in Appendix A to SRP Section 18.1 of NUREG-0800. (NUREG documents 0660, 0700, 0737, and 0800 cited are listed as References 6-9.)

A DCRDR is to be conducted according to the licensee's own Program Plan (which must be submitted to the NRC). According to NUREG-0700, it should include four phases: (1) planning, (2) review, (3) assessment, and (4) reporting. The product of the last phase is a Summary Report which must include an outline of proposed control room changes, their proposed schedules for implementation, and summary justification for human engineering discrepancies with safety significance to be left uncorrected or partially corrected. Upon receipt of the licensee's Summary Report and prior to implementation of proposed changes, NRC must prepare a Safety Evaluation Report (SER) indicating the acceptability of the DCRDR (not just the Summary Report). The NRC's evaluation encompasses documentation as well as briefings, discussions, and audits, if any were conducted.

The purpose of this Technical Evaluation Report is to assist the NRC in the technical evaluation process by providing an evaluation of all BECo DCRDR documentation and the results of an on-site, pre-implementation audit.

The DCRDR requirements as stated in Supplement 1 to NUREG-0737 can be summarized in terms of nine specific issues, a list of which provides a convenient outline of the areas covered in this technical evaluation. The nine issues are:

1. Establishment of a qualified multidisciplinary review team.

2. Use of function and task analyses to identify control room operator tasks and information and control requirements during emergency operations.

3. A comparison of display and control requirements with a control room inventory.

4. A control room survey to identify deviations from accepted human factors principles.

5. Assessment of human engineering discrepancies (HEDs) to determine which HEDs are significant and should be corrected.

6. Selection of design improvements that will correct those discrepancies.

7. Verification that selected design improvements will provide the necessary correction.

8. Verification that improvements can be introduced in the control room without creating any unacceptable human engineering discrepancies.

9. Coordination of control room improvements with changes resulting from other improvement programs such as SPDS, operator training, new instrumentation, Reg. Guide 1.97 (Rev. 2), and upgraded emergency operating procedures.

PLANNING PHASE

1. Preparation and Submission of a Program Plan

The DCRDR Program Plan for Pilgrim Station was submitted in October, 1983. The NRC review of the licensee's Program Plan included questions regarding review team structure and qualifications, and dealing with the process used for: (1) function and task analysis; (2) control room

inventory; (3) control room survey; (4) HED assessment; (5) selection of design improvements; (6) verification of improvements, including the assessment that no new HEDs are introduced; and (7) the coordination of DCRDR activities with other programs. Even though the NRC concluded that the scope of the plan addressed all major points of concern stated in NUREG-0737, Supplement 1, some areas of the plan required further information to allow a conclusive evaluation to be made of BECo's DCRDR.

2. Establishment of a Qualified Multidisciplinary Review Team

The Boston Edison Company's DCRDR administrative organization was found to be as described in the Summary Report. The personnel involved in the DCRDR effort were organized into various team segments including: the Executive Team, the Management Review Team, and the Design Review Team. BECo and Torrey Pines Technology (TPT), a consultant to BECo, are providing personnel to do the work for the DCRDR. The Design Review Team members have a suitable mix of expertise and meet the qualifications of a multidisciplinary review team. As noted in the Program Plan review, resumes and discussions indicated that all skill categories needed for a multidisciplinary review team were present. Therefore, for the work conducted to date, the multidisciplinary review team meets the requirements of Supplement 1 to NUREG-0737. However, BECo's DCRDR organization lacks coordination between those assigned to develop the new symptom based EOPs and the personnel involved in the DCRDR. The Systems Function and Task Analysis section as well as the Coordination of Control Room Improvements with Changes Resulting from Other Improvement Programs section addresses this issue more thoroughly.

Activities that will require further effort on the part of Pilgrim's DCRDR team have been identified in both the Executive Summary Report, Section 4.2.2, "Work Remaining To Be Completed" and the discussions held during the audit. The work remaining to be completed represents an extensive effort. BECo has identified Pilgrim's eighth refueling outage as the date for completing all DCRDR activities. At the NRC exit briefing, the staff indicated that to accomplish the needed work BECo should increase the amount of support provided to the DCRDR in terms of quantity and expertise of personnel. Additional staff are particularly needed in the disciplines of nuclear systems, operations, and instruments and controls.

The licensee has assembled a well-qualified Design Review Team and placed them under the supervision of the Executive Team and the Management Review Team. It is also strongly recommended that BECo increase the coordination between the development of the new EOPs and the activities of the DCRDR team. Furthermore, to accomplish the work remaining on the DCRDR within the time schedule identified, BECo may have to increase consultant support.

REVIEW PHASE

The methodology used and some of the results which were obtained for each of the separate tasks of the DCRDR are described in Section 2.2 of the Boston Edison Executive Summary Report (Reference 5). The methods and results include:

1. Criteria Development
2. Data Base Management System
3. Operating Experience Review Report
4. Control Room Survey
5. Control Room Inventory
6. System Function and Task Analysis
7. Verification of Operator Task Performance Capabilities
8. Validation of Operator Function Execution
9. HED Assessment.

The above activities are those recommended by NUREG-0700 (Reference 7) guidelines as contributing to the accomplishment of review phase objectives. Activities 4, 5, 6 and 9 contribute to the accomplishment of specific DCRDR requirements contained in Supplement 1 to NUREG-0737. Activity 9 will be more appropriately covered in the Assessment and Implementation Phase of this report. Additionally, methodologies and results for five other activities which are not required by the NRC are included in the scope of BECo's DCRDR (activities 1, 2, 3, 7 and 8). Of these last five activities, the Operating Experience Review (OER) will be specifically covered by this evaluation. Also, activities 7 and 8 are reviewed as they may impact or augment requirements of NUREG-0737, Supplement 1.

SAIC's evaluation of the above activities is presented in the following order:

1. System Function and Task Analysis
2. Control Room Inventory
3. Control Room Survey
4. Review of Operating Experience

BECo indicated that Pilgrim's remote shutdown capability was not included within the scope of their DCRDR because remote shutdown is not a requirement of Supplement 1 to NUREG-0737.

1. Systems Function and Task Analysis (SFTA)

The SFTA conducted by BECo was based on Revision 2 of the General Electric Company's Emergency Procedure Guidelines (EPGs). BECo operations personnel developed plant-specific EPGs, but were not part of the DCRDR team. These personnel were aided by an outside contractor to produce a writer's guide as a part of the Procedures Generation Package (PGP) requirement of Supplement 1 to NUREG-0737. They also wrote plant-specific Emergency Operating Procedures (EOPs). At this juncture, the DCRDR team obtained the EOPs from the procedure writers and developed a set of four accident and one normal operating procedure scenarios. These four accident scenarios were based on eight EOPs. BECo stated that it believed the scenarios utilized all the plant safety systems and exercised every operator task step of the EOPs. These steps were arranged on pre-fill sheets for use in the videotaped EOP walk-through process utilizing a control room photo-mosaic mockup. Prior to this process, and outside of the control room, some operators were subjected to questioning to determine information and action needs for an undisclosed number of operator tasks. As is discussed later, this questioning process did not produce a complete listing of the characteristics of indicators and controls.

The NRC audit team found that, overall, the SFTA methodology did produce some useful data. However, there are several concerns which BECo should address in completing the work required to satisfy the SFTA requirement. The discussion which follows provides additional NRC guidance on how

the licensee can comply with Supplement 1 to NUREG-0737 and specifically which areas of the BECo SFTA are cause for concern.

On May 14, 1984, the NRC met with the BWR Owner's Group to discuss the task analysis requirements for the DCRDR. As a result of that meeting, Revision 3 of the EPGs was found to provide a satisfactory starting point for the Systems Function and Task Analysis. The conclusions of that meeting are summarized below and documented in Reference 11.

- "...It appears that Revision 3 of the EPGs provides a functional analysis that identifies, on a high level, generic information and control needs. However, these EPGs do not explicitly identify the plant-specific information and control needs which are necessary for preparing emergency operating procedures and determining the adequacy of existing instrumentation and controls.

- "Because detailed plant-specific information and control needs cannot be extracted directly from the EPGs, plant-specific analysis is required.

- "Each licensee and applicant must describe the process used to identify plant-specific parameters and other plant-specific information and control capability needs and must describe how the characteristics of needed instruments and controls will be determined. These processes may be described in either the PGP or the DCRDR Program Plan with appropriate cross-referencing.

- "For each instrument and control used to implement the EOPs, there should be an auditable record that defines the necessary characteristics of the instrument or control and the bases for that determination. The necessary characteristics should be derived from analysis of the information and control needs identified in NRC-approved EPGs and from analysis of plant-specific information."

Of the above four points, BECo has partially complied with the first two points, but has not complied with the second two points. Following are

specific examples of which areas need to be upgraded in order to result in an effective DCRDR.

There are two important new guidelines in Revision 3 of the EPGs (secondary containment control and radioactivity release control) which should be included in the BECo SFTA effort. Recommended scenarios involving the escape of fission products outside of the primary containment (drywell) include unisolatable main steam line break outside containment and an interfacing small break LOCA. Examples of the types of operator information needs that BECo did not evaluate because Revision 3 of the EPGs was not used include:

- Ability to monitor the success of the standby gas treatment system to maintain a negative pressure in secondary containment.

- Ability to monitor area radiation monitors and vent stack process radiation monitors.

In response to the discussion concerning which revision of the GE EPGs should be used for the systems function and task analysis, BECo committed to include the two additional EPGs from Revision 3 in their work to be completed.

There was a lack of integration between what should have been two closely related activities; namely, the development of the plant-specific symptomatic EOPs and the task analysis phase of the DCRDR (see Supplement 1, NUREG-0737, paragraph 5.1.b.ii.). This conclusion was based on discussions during the audit with licensee representatives involved in both efforts. The Boston Edison procedure representative stated that the availability of all indications and controls required by the operators in the control room to carry out the steps of the new EOPs was verified. Verification documentation was not available for review, and the BECo DCRDR team representatives stated that any problems identified in the verification process had not been formally included in the DCRDR SFTA. A review by the NRC audit team disclosed that at least two indications required in the EOPs are not present directly in the control room. These are (1) drywell sump pump flow, and (2) torus pressure above 2 psig. It was concluded that future DCRDR and EOP

revision task analysis efforts should be integrated in accordance with Supplement 1 to NUREG-0737.

There are two basic problems with the BECo SFTA process. First, no systematic "front-end" task analysis was done during the EOP writing or prior to the DCRDR SFTA walk-throughs using the mock-up. A "front-end" task analysis should involve systems engineers, operations and human factors specialists to identify all operator tasks performed during emergency operations and all corresponding operator information and control needs and associated required characteristics of needed displays and controls. As a result of the May, 1984 meeting between NRC and the Emergency Procedures Guidelines and Control Room Design Review Committees of the BWROG, Revision 3 of the EPGs was found to provide a satisfactory starting point for the System Function and Task Analysis. However, further plant-specific analysis is required as described in Generic Letter 83-18. The SFTA process as used by BECo did not systematically pursue the identification of operator information and control needs and the characteristics of these needs. Evidence supporting this conclusion includes the following observations made during the audit:

- No confirmatory or alternate indications and controls possibly needed to confirm the performance of individual SFTA steps were annotated on the SFTA data sheets.

- Only the absolute values of parameters for completing operator steps were annotated on SFTA data sheets. No range, accuracy, trending, or other needed instrument and control characteristics were annotated.

- Audit of the very elaborate set of computer printouts comparing the operator needs with the control room inventory only disclosed two or three cases of needs not matching the as-built control room. Many additional problems were identified by other DCRDR tasks, but a proper SFTA should have also identified these and other problems.

In order to meet the intent of Supplement 1 of NUREG-0737 (Reference 3), BECo must include a front-end analysis in their SFTA effort as well as the two additional Revision 3 EPG guidelines.

The second basic problem with the BECo SFTA process is that the EOP walk-through portion of the SFTA did not include a systematic interview technique to prompt the operators to describe integrated plant operations needs. The walk-through process concentrated on individual components and did not pursue the integrated aspects of accident prevention and mitigation. This conclusion is based on: (1) observations made and questions asked of the NRC audit team during a repeat walk-through of one selected accident sequence using the mock-up, SFTA data sheets, BECo operations personnel and the SFTA consultant; and (2) audit team observation of videotapes of the actual SFTA. Examples of the types of operator information and control needs which were identified by the NRC audit team and not by the initial BECo walk-through process are:

- The specific need to provide mimics for several of the ECCS systems (RHR, CS, HPCI and RCIC).

- The fact that although some new heated reference leg reactor pressure vessel instrumentation has been installed, this instrumentation was not included in the DCRDR and the operators do not understand under what conditions it is accurate.

- Operator desires for protective guards or shrouds on HPCI and RCIC turbine trip buttons.

- A possible need to relocate the offgas process radiation monitor from a back panel to the offgas control panel in the control room.

- Rod worth minimizer panel is too far from rod controls to be easily read when moving control rods.

- Inability to observe all indications of satisfactory start of the standby gas treatment system (many indications and controls on back panels).

- Numerous problems with Leeds and Northrop data point recorders were generically identified in other DCRDR tasks, but came up specifically in numerous steps of the task analysis audit performed by the NRC team.

- Operator confusion over reactor pressure vessel (RPV) level accuracy at elevated drywell temperatures was not identified in the BECo walk-through.

- The 1001-604 recorder on the PAM panel has inaccurate scales for the two RPV level pens. This should have been identified in not only the SFTA walk-through but also in the control room survey.

- Several Yarway meters have poor scale legibility and frosted glass. Again, this should have been identified in the SFTA walk-through and the control room survey.

The NRC audit team notes that the licensee could have identified the above needs in other phases of the DCRDR, for example the survey or the operator questionnaire.

In conclusion, BECo must complete the following work to meet the SFTA requirements: (1) include two additional guidelines from Revision 3 of the EPGs; (2) include a "front-end" task analysis for all the EPGs including those in Revision 3 to establish operator information and control needs and associated characteristics; (3) include interview techniques and questions designed to identify SFTA information and control needs during the "front-end" phase and task analysis HEDs during the walk-through phase; (4) expand the scope of the task analysis to include all operator tasks during all emergency operations including going to hot shutdown.* The description of

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*NOTE: If the system is used during emergency operations, the operator tasks associated with the use of that system during emergency operations should be analyzed. If branching takes place from the EOPs to other procedures that involve the use of emergency equipment or systems, then these procedures should be analyzed as well.

the revised SFTA process and results of this work should be included in BECo's Supplement to the DCRDR Summary Report. At the audit, the NRC audit team provided BECo with examples of front-end and walk-through interview techniques as well as a list of specific questions designed to identify HEDs by task analysis methods.

2. Comparison of Display and Control Requirements with Control Room Inventory

According to the NRC requirement stated in NUREG-0737, Supplement 1, the DCRDR should include: "(iii) A comparison of the display and control requirements with a control room inventory to identify missing displays and controls" (Reference 3).

BECo compiled a control room inventory of each piece of panel-mounted equipment. They stored every line item (i.e., control and display) in a computerized data bank. These line items or devices were then used in the SFTA and in the survey to perform the comparison of display and control requirements. The computer sort used by BECo was an excellent tool to facilitate comparison of the various demands placed on each device in the inventory. It was essentially this computer sort which established some of the instrument requirements such as maximum and minimum scale range and unit. BECo is encouraged to use this same computer sorting process for comparing the results of the remaining task analysis work with the control room inventory. However, as previously noted, the task analysis lacked detailed identification of the required operator information and control characteristics and a complete analysis of alternatives. The potential benefits of the comparison were diluted by this deficiency.

In conclusion, the NRC audit team judged the inventory portion of this two-step task to be satisfactory for meeting the requirements of Supplement 1 to NUREG-0737. However, because the task analysis as performed by BECo did not independently and systematically identify display and control requirements, it is clear that an adequate comparison of these requirements with the inventory was not made. Hence, the licensee must perform the comparison using the requirements identified in the SFTA as the criteria to compare with the inventory. A description of the results of this comparison should be included in the licensee's Supplement to the Summary Report.

3. Control Room Survey

BECo performed a control room survey using checklists developed from human engineering criteria presented in NUREG-0700, checklists developed for the BWROG control room survey, and Nuclear Utility Task Action Committee (NUTAC) control room survey documents. During the audit, BECo described three methods for collecting the data necessary to conduct their survey. The methods included: (1) an operating experience review; (2) a NUREG-0700 checklist survey; and (3) the verification and validation phase of their system function and task analysis. Differences in criteria among NUREG-0700 and the BWROG and NUTAC documents were discussed.

Specific examples of differences between the BECo survey criteria and the NUREG-0700 survey criteria were discussed during the audit. All of the BECo survey criteria were found satisfactory except the following:

- NUREG-0700, 6.1.5.3.g. The NRC audit team did not consider assessment of reflectance by means of subjective questions in the Operating Experience Review (OER) to be an adequate substitute for an objective criterion to measure reflectance in the control room. (Photographs taken by the audit team in the control room exhibited marked differences in illumination as well as excessive reflectance. The photographs show a need for evaluating lighting levels in an objective manner.

- NUREG-0700, 6.1.5.5.e. The NRC audit team did not consider the data produced from the OER questionnaire to be an adequate substitute for objective criteria for reverberation time and sound absorption.

- NUREG-0700, 6.3.1.3. The NRC audit team understands that BECo will consider a capability to provide first out annunciator indication.

Examination of Table 3-1 in the Summary Report (Reference 5) suggested that the control room survey resulted in over 90% of the HEDs whereas none was discovered by the SFTA and only 2% were discovered by the OER. The audit team therefore questioned the effectiveness of the SFTA and the OER in

identifying HEDs. BECo's response was that this table is incomplete and inaccurate. The licensee committed to expanding and correcting Table 3-1 in its Supplement to their Summary Report.

A minisurvey conducted by the NRC audit team, using NUREG-0700 criteria, on one panel from the mock-up disclosed no safety-significant HEDs that were not found by BECo. However, other NRC audit team observations in either the Pilgrim control room or the mock-up resulted in HEDs which apparently were not discovered during the BECo survey:

- The specific recorder problems mentioned in the SFTA section.

- Numerous annunciators have been broken or out of service for years (e.g., traveling screen Delta P). These were not specifically identified in the control room survey.

- Specific Yarway reactor vessel level indicators as well as nearly all 480, 4160 and 13 kv voltage, frequency and amperage meters have frosted faceplates which make them difficult to read. This could not be identified in the mock-up because the photos used for the mock-up were taken with polarized light which made the faceplates appear clear. This points up the possible need to repeat certain portions of the survey in the actual control room where the instruments are seen as the operators see them. The same comment applies to the new Sigma meters.

- The colored dot system used for new construction turnover procedures still exists on some meters. These colored dots should be scraped off as they are confusing to new operators.

- There is extensive use of plastic tape and handwriten labels in the control room. While the problem has been generically identified by the BECo DCRDR team, the situation was not well documented at the time the Summary Report was submitted. The problem should be specifically documented by the licensee, by device, before commencing the design improvement program in this area.

In conclusion, the NRC determined that the BECo survey methodology was satisfactory for meeting the requirements of Supplement 1 to NUREG-0737. However, BECo must resolve the issues associated with the three NUREG-0700 survey criteria noted above. Also, the five items above that were not discovered during the survey should be addressed in the Supplement to the Summary Report.

4. Operating Experience Review

Although not specifically required by NUREG-0737, Supplement 1, an operating experience review (OER) was conducted for the Pilgrim DCRDR. This effort was divided into three activities:

- A review of plant-specific Licensee Event Reports (LERs)
- The use of an operations-oriented questionnaire
- Interviews following up the results of the written questionnaires

The review of LERs covered a five-year period to determine possible human factors involvement. Very little information was obtained from this effort. This may be a result of the way LERs were written. The NRC audit team suggested that Pilgrim may want to consider revising procedures for writing LERs so more information can be recovered in the future. Also suggested by the audit team was the possibility of interviewing the operators involved in the events at Pilgrim along with a review of some of the industry-wide BWR classics such as the Browns Ferry hydraulic problem which prevented complete control rod insertion, i.e., failure to scram.

A questionnaire covering all applicable guideline topics from NUREG-0700 was given to individuals in both operations and management positions. Summaries of the written responses by topic area are included in the Summary Report. Responses that were determined to have the potential to degrade operator performance would be identified as "Human Engineering Observations" (HEOs). An HEO is the terminology used by BECo to denote an observation which will later be assessed either as a valid human engineering discrepancy (HED) or dropped from further assessment (remaining an HEO).

Although some human engineering observations were obtained from this source, a review of selected sections of the operator questionnaires by the

NRC audit team indicates that the following additional HEOs should have been documented and assessed:

- Core spray discharge pressure meter is hard or impossible to read.

- Main turbine steam seal header valves are confusing.

- Many benchboard switches have worn detents making positive determination of switch position difficult.

- More of the feed system controls, such as block valves and heater drains, should be moved to the front control panel with the rest of the feed system. This possible HEO is of particular interest since the BECo DCRDR team chose the feed system to demonstrate their concept for future panel layouts. Since these operator desires were not evaluated, the new layout did not consider the inclusion of additional controls and indications.

- Add reactor and turbine building closed cooling water system heat exchanger backwash capability to the control room. The backwashes are now performed remotely and these heat exchangers have been the source of numerous operational problems. The ultimate decision may be to leave the situation as is, but the original SFTA would not have brought the problem to light for evaluation.

- The torus vacuum breaker and primary containment air supply valve controls are easily confused with each other.

- The source range nuclear instrument period meters are too far from the rod controls.

The OER was useful in that it discovered 49 observations that were of an operational nature. However, of these, only four observations were unique to the OER and were documented as HEOs. The remaining 45 observations were documented as HEOs and credited to other parts of the DCRDR.

ASSESSMENT AND IMPLEMENTATION PHASE

The BECo Design Review Team (DRT) assessed the HEOs to determine which were HEDs and made recommendations for design improvements. The recommended design improvements are to be submitted to the Management Review Team (MRT), which will make the final decision as to the disposition of the HEDs. The methods for correcting HEDs are presented in the Summary Report.

1. Assessment Methodology

Beco's Summary Report presents a description of the assessment process for the DCRDR (pp. 2-30 through 2-34). Identified HEOs were assessed by the DRT to determine which were HEDs using the following criteria:

Category 1 - HEOs associated with documented or high potential errors.

Category 2 - HEOs associated with safety considerations.

Category 3 - HEOs associated with availability or reliability considerations.

Category 4 - HEOs that are minor or nonsignificant.

The MRT reviewed each HED separately using the control room photomosaic mock-up constructed for the DCRDR. The MRT either approved or rejected the assessment made by the DRT. From the licensee's discussion during the audit, it was apparent to the NRC audit team that the MRT attempted to assess each HED independent of the solution recommendations made by the DRT. During the assessment process, the MRT relied heavily on people with operation experience and advisors from the DRT, including a human factors expert. A majority vote of the MRT served as the final ruling, with the rationale being recorded along with any discrepancies between the DRT and MRT assessments. As a result of this effort, some HEDs were returned to the DRT for reevaluation, others were downgraded to HEOs and a few HEOs were upgraded to HEDs. Those HEDs that were recategorized were discussed during the NRC audit. The present disposition of these HEDs/HEOs is presented in this TER under the section on page 22, "Analysis of Proposed Design Changes and

Justification for HEDs With Safety Significance that are to be Left Uncorrected or Partially Corrected."

The NRC audit team found that the HED assessment process meets the requirements of Supplement 1 to NUREG-0737; however, the application of the process has not yet been completed for all HEDs/HEOs. The MRT is encouraged to continue to involve the active participation of the DRT, including human factors specialists, during completion of the assessment phase. BECo should provide additional detail in support of this requirement in its Supplement to the Summary Report.

2. Selection of Design Improvements

Even though the Summary Report (Reference 5) provides little information describing the process used to select design improvements for HEDs, the Revised Program Plan (Reference 4) provides a more thorough description of how HED corrections will be selected. Figure 4-5 (Reference 4) shows the process to be used for the selection of HED corrections and their implementation. The Design Review Team will consider the following methods for HED correction: enhancement, design changes, design improvement studies, and procedure changes. For each HED, the Design Review Team will consider all correction methods, documenting the reasoning for their final selection. Furthermore, the Design Review Team stated that it intends to reevaluate all HEDs selected for a similar corrective method to ensure that individual improvements are still justifiable when considered as a group. However, BECo has not addressed the specific concerns of cumulative or interactive effects of individual improvements.

The Management Review Team will then review each of the recommendations selected by the Design Review Team in order to arrive at a final decision. As is the case with HED assessment, advisors from the Design Review Team will be available to the Management Review Team.

BECo will produce a "Design Manual" in order to help standardize the Pilgrim control room. This manual will address topics including but not limited to color, switches, standardization of meters, and other concerns covered in NUREG-0700, section 6. Discussion during the audit revealed that this manual will be used to ensure consistent and compatible HED solutions

as well as to be used later as part of the continuing, long-term control room upgrade program.

It appears that the methodology described by BECo for the selection of design improvements will result in the successful completion of this requirement of Supplement 1 to NUREG-0737. BECo should describe how cumulative and interactive effects of HED solutions are to be considered in their Supplement to the Summary Report. The Management Review Team is encouraged to continue the active participation of Design Review Team members, including human factors specialists, during the final selection of design improvements. Since the final selection of design improvements has not been completed, the licensee should summarize the results in its Supplement to the Summary Report.

3 and 4. Verification That Improvements Will Provide Necessary Correction and That Control Room Modifications Do Not Introduce New HEDs

In order to perform this phase of the work, the licensee must first have selected all the design improvements. Because BECo has not done this yet, they have not started this part of the DCRDR. Therefore, these requirements of Supplement 1 to NUREG-0737 have not been satisfied. While the process that BECo intends to use involves a mock-up, validated EOPs, and a simulator to evaluate time-dependent operator tasks, BECo needs to describe the actual process to be used to complete the verification activities in greater detail along with the final results in their Supplement to the Summary Report.

5. Coordination of Control Room Improvements With Changes Resulting from Other Supplement 1, NUREG-0737 Improvement Programs.

BECo's Summary Report contains a diagram (Figure 1-1, p. 1.6) showing the relationships between the DCRDR and other Supplement 1 to NUREG-0737 requirements. They are EOP development, SPDS, upgrade of emergency support activities, implementation of Reg. Guide 1.97, and changes in requirements for training and staff.

The licensee's plans to facilitate the integration of the different programs was discussed during the NRC audit. The BECo manager of the DCRDR

has presented and reviewed the contents of the Summary Report with various BECo organizational units and plans to increase interaction among these groups. The importance of involving people from other BECo organizational units in the DCRDR program at an early stage was emphasized by the NRC audit team. The licensee mentioned cooperation, integration, and coordination among several groups such as those for operations, systems, training, maintenance, and spare parts. All control room improvement programs (SPDS, Reg. Guide 1.97, DCRDR) and the acquisition of a plant-specific simulator, are under the same group manager. This management configuration will greatly enhance the potential for successful coordination of activities. The NRC audit team noted, however, that a major area in which improved integration is required is between the DCRDR and the new Emergency Operations Procedures. In particular, the remaining task analysis work should be performed with the participation of personnel involved in the EOP development effort. The licensee should describe this coordination in their Supplement to the Summary Report.

An example of a good coordination effort by the licensee was revealed in the NRC audit team review of BECo plans for integrating the SPDS installation. The SPDS will be in agreement with plant-specific EOPs, set points, and General Electric performance curves. The SPDS contractor will have all of the above information for use in customizing the SPDS displays. BECo should send any future revisions of EOPs to the SPDS contractor as they are developed (i.e., Rev. 3). Furthermore, BECo intends to make a copy of its "Design Manual" available to GE so the SPDS will be consistent with Pilgrim control room standards.

The inventory generated for the DCRDR was used as a data base for the Reg. Guide 1.97 work. The docketed submission of the BECo response to Reg. Guide 1.97 does not list any major exceptions to the required instrumentation. The unresolved Reg. Guide 1.97 issues are nearly all related to instrument qualification and power supplies. The DCRDR Team is aware of the remaining instrument changes which will affect the DCRDR. If any instrument changes do take place as a result of Reg. Guide 1.97 work, these changes should be coordinated with and evaluated in the DCRDR process.

In summary, the NRC audit team found that the licensee understands the coordination requirement of Supplement 1 to NUREG-0737 and has methods and

procedures developed to ensure that this requirement will be satisfied. The DCRDR team, however, needs to enhance its coordination efforts with EOP personnel.

6. Proposed Schedules for Implementing Design Changes

In the cover letter attached to the licensee's Summary Report, BECo has committed to complete all DCRDR modifications by the end of refueling outage eight (RF08). This is approximately three years from the date of the audit. The licensee indicated that SPDS, Reg. Guide 1.97 and operator training are also scheduled for completion by the end of the eighth refueling outage.

In order to meet the RF08 commitment, BECo intends to submit the following documents to the NRC:

- Letter containing firm commitment on the date on which the Supplement to the Summary Report will be submitted.

- Draft of the Supplement to the Summary Report (to be submitted on September 30, 1985). The NRC audit team indicated that it would be willing to meet with BECo at NRC if the licensee wanted to discuss the draft.

- Supplement to the Summary Report (to be submitted tentatively on November 30, 1985).

The licensee should note that the NRC requires a detailed schedule for the implementation of HED corrections. It is not sufficient to state that all HEDs will be corrected by RF08. BECo must identify the approximate date for the correction of every HED by specific HED number. BECo is urged to consider the implementation of the most safety-significant HEDs as soon as possible. In cases where BECo intends to postpone the correction of HEDs with high safety significance, BECo must provide justification.

Because the modifications presently planned for the Pilgrim control room are very extensive and the planned timing of the project is very short,

the NRC audit team finds that BECo will need to devote particular attention to several areas:

- Early notification to procedure writers of control room modifications which will require procedure change, update, or rewrite. The EOPs have high visibility and will probably receive adequate attention automatically, but the individuals responsible for normal, off-normal, and alarm response procedures must be kept apprised of modifications affecting them (e.g., the extensive modifications planned for the annunciator panels will probably require rewrite of all alarm response procedures).

- Lead time on procurement of the numerous new instruments and associated spare parts.

- Addition of adequate I&C, operations, and systems personnel to the project.

- Proper planning of the actual outage period installation work will be critical and must include time for fire protection reviews, QA checks, point-to-point wiring checks, drawing revision, startup testing, and operator retraining.

In conclusion, BECo has committed to implementing the DCRDR modifications by the end of RF08. The results and modifications from the special studies should be included in the licensee's Supplement to the Summary Report. Finally, coordination with the proper organizational units within BECo along with enhanced support to the DCRDR team in several areas will be critical to completing the planned extensive DCRDR effort on schedule.

ANALYSIS OF PROPOSED DESIGN CHANGES AND JUSTIFICATION FOR HEDS WITH SAFETY SIGNIFICANCE THAT ARE TO BE LEFT UNCORRECTED OR PARTIALLY CORRECTED.

Analysis of Proposed Design Changes

The Summary Report lists 153 HEDs which were assigned to three categories for correction. No proposed design changes have been made for 57% of these HEDs. BECo intends to complete seven generic special studies in order

to ensure an integrated correction methodology before finalizing changes. The NRC audit team believes that successful design changes will be difficult to achieve unless several program upgrades are completed or considered. They are:

- Upgrade the existing SFTA work (as previously described).
- Compare results of SFTA with the control room inventory.
- Complete the SFTA for two additional GE EPGs (Rev. 3).
- Ensure that all potential modifications from all DCRDR phases are assembled prior to commencing the detailed selection of new instruments and new panel layouts.
- Consider a final upgrade of the survey in the actual control room (vs. mock-up).
- Consider repeating operator experience interviews and/or questionnaires.
- Consider formally placing all control room modification work (present and future) under the control of the DCRDR team.

With regard to the final point, it should be noted that many control room modifications are being carried out or have been carried out without the cognizance or control of the DCRDR team. Below are examples of such changes which were discovered by the NRC audit team:

- Past removal of maps used to locate main condenser tube leaks into the inter-tube sheet area.
- Recent upgrades of numerous analog meter displays to qualified Sigma instruments which all have scales so small that the operators have great difficulty reading them.
- The recent installation of new control room carpeting, acoustic ceiling tiles, and lighting fixture diffusers.

- The recent disabling of the special scram discharge volume ultrasonic level probe system.

- The recent installation of H_2/O_2 monitoring system valve controls in the RCIC and MSIV sections of the benchboards.

- The recent addition of PASS (Postaccident Sampling System) sample valve controls in the MSIV section of the benchboards.

- The in-progress work of installing a torus temperature recorder on the postaccident monitoring (PAM) panel.

- Other miscellaneous modifications planned for the PAM panel.

- The planned installation of a RCIC turbine trip reset feature in the control room.

- Modification of RPV level instrumentation to provide accurate level indication during reference leg flash situations.

- Planned replacement of selected RPV Yarway instruments.

Other than the above comments, no analysis of the proposed design changes will be made in this TER. Because the licensee has not completed the design changes, assessment and conclusions will be made upon review of the Supplement to the Summary Report. The NRC audit team recommends that BECo include resolutions to all of the above items, as well as information and results of the generic studies.

Justification for HEDs Not to be Corrected

Several of the HEDs originally categorized by the DCRDR Team were both up and downgraded in priority by the Management Review Team evaluation. During the pre-implementation audit, the NRC audit team reviewed those HEDs reduced in priority from the status of HED to human engineering observation (HEO). In reviewing these HEOs, the NRC audit team either agreed that the downgrade was warranted or the Management Team agreed to reevaluate the HED

based upon the discussion with the staff. There were no disagreements with the disposition of downgraded HEDs.

Following are HEOs identified by the BECo DCRDR team. Even though the Design Review Team recommended to the Management Review Team that these HEOs be upgraded to HEDs and resolved, the MRT did not concur with the DRT. During the audit, it was clear that the BECo documentation process for this step was incomplete because justification was not available or specific enough for the audit team to be able to assess. Resolution of those HEOs should be included for formal NRC staff review in the upcoming Supplement to the Summary Report.

HEOs	Audit Team Comments
6.3.021	Annunciator Reset Controls
6.3.026	Annunciator Reset Controls
6.1.012	Annunciator Response Controls on Panels C904 and C-1

These HEOs address problems identified with the annunciator system. The NRC audit team recommends that they be reclassified from Category "D" to "Further Consideration." Additionally, it is recommended that these HEOs be considered during the annunciator special study to be conducted during BECo's DCRDR.

6.5.037	Pointer TIPs
6.5.038	Scale Selection
6.5.039	Contrast

These three HEOs address concerns with the Yarway meters. The NRC audit team felt that these HEOs should be reclassified as Category B HEDs because the meters are to be replaced. Furthermore, BECo should keep track of the progress of their replacement to make sure the work is done and to produce an audit trail.

6.8.001 HPCI Fast Start Up

It is the NRC audit team's understanding that this HEO will be included in the labeling/mimic/nameplate special study. Additionally, this HEO should be reclassified from a "D" to a "B" because it is a safety-related item.

6.8.016 Two sets of controls on reactor cleanup panel (control numbers 1008, 1013 and 992, 997)

The NRC audit team recommends that BECo keep track of the scheduled removal of this equipment. Furthermore, this HEO should be reclassified as a "B" because it is a safety related change in the control room.

6.1.032 Dry Well Cooling Fans Instrumentation

At the audit, BECo agreed to have the individuals responsible for writing the EOPs examine this situation. Additionally, this HEO should have a status change from "D" to "Further Consideration."

6.1.033 Dry Well Sump Flow Indication

The NRC audit team felt that this issue needed to be re-examined since operators interviewed by the audit team favored locating the Dry Well Sump flow instruments in the main control room. Rewriting the EOPs was presented as a possible solution because this information may not have a time constraint associated with it. This HEO should be reclassified as an "A" since it is a safety related item.

The following HEOs were downgraded by the Management Review Team. Justification for the recategorization was acceptable to the NRC Audit Staff.

HEOs	Audit Team Comments
6.1.010A/B 6.1.013 6.1.014	While the explanation for HEOs 6.1.010 A/B, 6.1.013, and 6.1.014 was accepted by the Audit Team, BECo agreed to consider these three HEOs in the control room studies to be conducted.
6.3.020	
6.4.019	
6.8.004	
OER-003	
6.1.025	
6.1.026	
6.1.009	

REPORTING PHASE

As previously noted in the planning phase, BECo submitted a Program Plan for Pilgrim Station on October 14, 1983 (Reference 1). At BECo's invitation a meeting was held in November, 1983 with the NRC staff to discuss the program concept and engage in an information exchange. NRC's review of the Program Plan along with comments from the November meeting were forwarded to the licensee on March 6, 1984 (Reference 2). Based upon the November, 1983 meeting, BECo proposed to develop a Program Plan revision; this was transmitted to the NRC on August 14, 1984 (Reference 4). The BECo Summary Report (Reference 5) was submitted on September 24, 1984. An on-site pre-implementation audit was conducted November 26-30, 1984. BECo has tentatively committed to submit a Supplement to the Summary Report by November 30, 1985.

CONCLUSION

In conclusion, BECo has shown genuine dedication to the DCRDR of the Pilgrim Station. Although numerous and extensive modifications are envisioned, the details have not as yet been developed. The NRC audit team notes that BECo has planned substantial improvements. These should make a significant contribution to operational safety and availability.

The following requirements of the DCRDR, as stated in Supplement 1 to NUREG-0737, have been met by BECo:

1. The establishment of a well-qualified, multidisciplinary review team

2. The generation of a control room inventory. However, the requirement to compare the display and control requirements generated by the SFTA with the inventory has not been met.

3. The control room survey, except for criteria 6.1.5.3.g, 6.1.5.5.e and 6.3.1.3, and the five HEDs discovered by the NRC audit team (see the Survey section of TER).

4. Coordination of the DCRDR with SPDS is satisfactory; however, ample evidence exists that there is little or no coordination with the upgraded EOP effort. Additionally, methods, criteria, and results used to coordinate Reg. Guide 1.97 and the DCRDR should be reported. Finally, coordination with the proper organizational unit (such as procedure writers, procurement department, maintenance, operations and training) needs to be addressed so the proposed design changes will be undertaken in an orderly manner.

The following requirements of a DCRDR, as stated in Supplement 1 to NUREG-0737, have not been satisfactorily met and require additional upgraded effort. These items should be addressed in detail and resolved by BECo in its Supplement to the Summary Report:

1. The use of a function and task analysis (that had been used as the basis for developing emergency operating procedures, technical guidelines, and plant-specific emergency operating procedures). While the BECo methodology was sound in some areas and did produce useful data, there were some procedural deficiencies. BECo should upgrade their SFTA effort to correspond to the NRC May 14, 1984, BWROG meeting minutes on Task Analysis (Reference 11). This includes an enhancement of the front-end and back-end analyses to produce an auditable record of information and control characteristics determinations and the adding of two additional guidelines

from Revision 3 of the GE generic EPGs. Further, BECo needs to include specific interview techniques designed to identify HEDs during EOP walk-through/talk-throughs.

2. The comparison of SFTA display and control requirements with the control room inventory (already generated as noted above). Since BECo's task analysis did not independently identify information and control requirements, a comparison of these requirements with the inventory still needs to be performed. The methodology and results of this comparison should be included in the Supplement to the Summary Report.

3. The assessment of HEDs to determine which are significant and should be corrected has not yet been completed. BECo should describe in detail additional efforts performed to complete this requirement. Additionally, BECo should encourage the active participation of the DRT, particularly the human factors specialist, during this phase of work.

4. The selection of design improvements has not yet been completed. BECo needs to describe in detail additional efforts towards completing this requirement (e.g., the results and solutions from the special studies; how BECo will address cumulative and interactive effects of design solutions; and the continued participation of the DRT in this process).

5. BECo has not started the process of verifying that improvements will provide the necessary corrections and that control room modifications do not introduce new HEDs. BECo needs to describe the actual process to be used to complete this activity along with the results.

OTHER ITEMS DISCUSSED DURING THE AUDIT

Although the following items are not specific DCRDR requirements, as stated in Supplement 1 to NUREG-0737, they were discussed at the pre-implementation audit, and are considered important to the DCRDR process. BECo is urged to resolve these items in accordance with the discussion as noted.

1. The needed increase in coordination between the writing of the EOPs and the activities of the licensee's DCRDR DRT.

2. To complete the DCRDR by RF08, BECo will need to increase the program's support, particularly in the disciplines of nuclear systems, operations, and I&C. Work remaining to be done is identified in the Executive Summary Report, Section 4.2.2, in discussions held during the audit, and as items noted in this TER.

3. Three NUREG-0700 survey criteria need to be addressed and resolved: 6.1.5.3.g, 6.1.5.5.e, and 6.3.1.3.e. Additionally, five NRC audit team observations, listed in this TER, were made in both the control room and mock-up and apparently not discovered in BECo's survey. These five items should be resolved and reported in the Supplement to the Summary Report.

4. During a review of selected sections of the operator questionnaires, seven items were found that should have been documented as HEDs and evaluated since the Assessment and Implementation Phase of the DCRDR is dependent upon the thoroughness of the Review Phase.

5. Schedule of implementing modifications. More detailed information is needed. BECo committed to submit a firm date for transmitting a Supplement to the Summary Report. The tentative date for submission of this Supplement is November 30, 1985. BECo committed to completing the control room physical changes by the end of RF08. Paint-label-and-tape corrections should be done promptly and not necessarily tied to refueling outages.

ANALYSIS OF PROPOSED DESIGN CHANGES AND JUSTIFICATION FOR HEDS WITH SAFETY SIGNIFICANCE THAT ARE TO BE LEFT UNCORRECTED OR PARTIALLY CORRECTED.

1. Awareness and timely resolution to the seven program upgrades prior to the identification of design changes.

2. Incorporation into the DCRDR process of all control room modifications that were not under the control of the DRT.

3. Resolution of those downgraded HEDs discussed during the audit where the NRC audit staff did not find the MRT's justifications for reclassification to be acceptable.

4. Reconsideration of HEOs: 6.1.01A/B, 6.1.013, and 6.1.014.

REFERENCES

1. Letter from W.D. Harrington, Boston Edison Company to D. B. Vassallo, NRC, forwarding "Detailed Control Room Design Review Program Plan," October 14, 1983.

2. "NUREG-0737 Supplement 1, DCRDR Program Plan" Letter from D.B. Vassallo, NRC to W.D. Harrington, BECo, dated March 6, 1984.

3. NUREG-0737, Supplement 1, "Requirements for Emergency Response Capability," USNRC, Washington, D.C., December 1982, transmitted to reactor licensees via Generic Letter 82-33, December 17, 1982.

4. Letter from W.D. Harrington, Boston Edison Company, to D.B. Vassallo, NRC, dated August 14, 1984, submitting revised "Detailed Control Room Design Review Program Plan for Pilgrim Station," June 1984, Rev. 1.

5. Letter from W.D. Harrington, Boston Edison Company, to D.B. Vassallo, NRC, dated September 24, 1984, transmitting "Detailed Control Room Design Review Report" for BECo's Pilgrim Station, Volume 1: "Executive Summary Report," Rev. 1, and Vol. 2: "Appendices A through D," Rev. 1, dated September 1984, and "Attachment A," dated August, 1984.

6. NUREG-0660, Vol. 1, "NRC Action Plan Developed as a Result of the TMI-2 Accident," May 1980; Revision 1, August 1980.

7. NUREG-0700, "Guidelines for Control Room Design Reviews", September 1981.

8. NUREG-0737, "Clarification of TMI Action Plan Requirements," November 1980.

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.

10. "Results of DCRDR pre-implementation audit at Pilgrim Station 26-30 November," Comex Corporation, December 1984.

11. Memorandum for V.A. Moore, NRC, from S.H. Weiss, NRC, on Task Analysis Requirements of Supplement 1 to NUREG-0737 - Meeting with BWROG EPG and CRDR Committees, May 14, 1984.

Additional Materials Reviewed at the Audit

1. Pilgrim Station Plant-Specific EPGs, Rev. 0, September 1982

2. EOPs for Pilgrim Station

3. Writer's Guide for EOPs, October 1983

4. EOP Implementation Plan

5. Survey checklist, developed by Torrey Pines Technology for Pilgrim Station

6. Letters from BECo to GE

   - Re: transmittal of data (DCRDR Summary Report, operator task data) for inclusion on the process computer system to be developed by GE for BECo.

   - RE: proprietary information agreement with CAE Electronics (developer for the simulator for Pilgrim Station).

   - Re: wiring changes, software specifications for the computer system.

ATTACHMENT 1

AUDIT TEAM COMMENTS ON EXECUTIVE SUMMARY

REPORT ITEMS NOT ON THE AGENDA

These items should be addressed in the Supplement to the Summary Report.

Ref. 5 p. 1-5 — The last sentence on this page refers to man/machine interfaces identified during the System Function and Task Analysis that fall outside the scope of the control panels as identified by BECo. An example of such a man/machine interface should be included to help clarify this statement.

Ref. 5 p. 2-7 — The LERs for 1979 and 1980 were reviewed by a DCRDR Team Member. The NRC recognizes that LERs tend to be written in a fashion that does not lend itself to linking plant events directly to incidents of human error or human engineering design deficiencies. Therefore, further explanation regarding the depth of the analysis of the LERs would be helpful in determining how this review contributed to the determination of HEDs.

Ref. 5 p. 2-8 — The use of "All applicable guidelines" in the second line should be expressed as "All applicable guideline topics."

Ref. 5 p. 2-9 — The responses from the management portion of the questionnaire were reported as yielding little relevant data to the DCRDR. Discussions clarified that since managers used to be operators they produce responses that presented an operator's point of view. It would be helpful if this explanation were included in the Supplementary Report.

Ref. 5 p. 2-9 — The responses from the Shift Technical Advisor Questionnaire were apparently susceptible to the same problem as the Management Questionnaire responses. The inclusion of an explanation would be helpful.

Ref. 5 p. 2-15 — The Summary Report only briefly described the survey checklist used. Additional information was provided to the audit team. The checklists were found primarily to be from NUREG-0700 chapter 6 and to cover all sections and guidelines. A more detailed explanation of the checklist would be helpful.

Ref. 5 p. 3-3 — It was determined that HED #4A003.4.4 "Reactor Mode Switch" is a maintenance problem and should not be addressed by the DCRDR. This fact should be included in the Supplement to the Summary Report.

Ref. 5 p. 4-1 — In section 4.1, the report incorrectly states that Tables 4-2 through 4-6 include HED implementation schedules. However, BECo has committed to provide a schedule for the implementation of the HED solutions.

ATTACHMENT 2

ATTENDANCE LIST FOR

PRE-IMPLEMENTATION AUDIT

PRE-IMPLEMENTATION AUDIT MEETING

November 26, 1984

Joel Kramer	NRC/DHFS
Joe Moyer	Science Applications International Corp.
Gary Bethke	Comex Corporation
Errol Gagnon	TPT/DRT
Sal Luna	TPT/DRT
John Stokley	Science Applications International Corp.
Charles Minott	BECo/CRDR Project Manager
Warren Babcock	BECo/Principal of DRT
Peter Kahler	BECo/RA&P

ATTENDEES - PILGRIM DCRDR PRE-IMPLEMENTATION AUDIT

November 28, 1984

Name	Affiliation
Joel J. Kramer	NRC/DHFS DCRDR Team Leader
Joe Moyer	NRC/SAIC
G. W. Bethke	NRC/Comex
Sal F. Luna	TPT
Errol P. Gagnon	TPT
John R. Stokley	SAIC/NRC
Charles Minott	BECo
Warren Babcock	BECo

Additional BECo Personnel for HED Review

Robert E. Grazio	BECo
William J. Armstrong	BECo
S. Dasgupta	BECo

PRE-IMPLEMENTATION AUDIT MEETING

November 27, 1984

Joel Kramer	NRC/DHFS DCRDR Team Leader
Joe Moyer	NRC/SAIC
Gary Bethke	NRC/Comex
Errol Gagnon	TPT/DRT
Sal Luna	TPT/DRT
C. Stephen Brennion	BECo/DRT
Jeff Rogers	BECo/DRT
John Stokley	SAIC/NRC
Charles Minott	BECo Project Manager
Warren Babcock	BECo
Siben Dasgupta	BECo Control Systems Group Leader
Peter Kahler	BECo/RA&P

EXIT MEETING - AUDIT

November 30, 1984

Joel Kramer	DHFS/DCRDR Team Leader, NRC
Siben Dasgupta	Group Leader - Control Systems, BECo
Warren Babcock	I&C Engineer Principal Investigator, BECo
Charles Minott	CRDR Project Manager, BECo
John Stokley	Mech. Eng., SAIC
Robert E. Grazio	Group Leader, Systems and Safety Analysis Engineering, BECo
James Ashkar	Nuclear Engineering Deputy Manager, BECo
William J. Armstrong	Nuclear Operations, BECo
A. L. Oxsen	VP - Nuclear Operations, BECo
Paul Leech	Project Manager, NRC
Peter M. Kahler	RA&P, BECo
Sal F. Luna	Project Engineer/Human Factors, TPT
G. W. Bethke	OPS Consultant, Comex
Joe Moyer	Human Factors, SAIC