BOSTON EDISON
Pilgrim Nuclear Power Station
Rocky Hill Road
Plymouth, Massachusetts 02360

Ralph G. Bird
Senior Vice President — Nuclear

July 6, 1989
BECo 89-102

U.S. Nuclear Regulatory Commission
Document Control Desk
Washington, DC 20555

License DPR-35
Docket 50-293

NUREG-0737, ITEM I.D.1: DETAILED CONTROL ROOM DESIGN REVIEW

This letter describes Boston Edison Company's approach to enhancing control panels as part of our Detailed Control Room Design Review (DCRDR). A description of enhancements already made to panel CP-600 is included as an example.

This submittal completes a Boston Edison commitment to evaluate human factors during the Power Ascension Program. The commitment is stated in NRC Inspection Report No. 50-293/88-21, Section 2.4.10.

The actions described in the enclosed report do not constitute changes to the Long Term Program. The report provides information on activities that are part of item No. 24, "CRDR - Control Panel Enhancements," in the Additional Items List, Attachment 1 to the Long Term Program Semi-Annual Report submitted by BECo letter 89-040 dated March 27, 1989.

K. L. Highfill
for R. G. Bird

PMK/amm/3440

Attachments: (A) Report on Control Panel Enhancements
(B) Augmented Off-Gas Control Panel CP-600 Surface Enhancements

A046
1/1

cc: Mr. D. McDonald, Project Manager
Division of Reactor Projects - I/II
Office of Nuclear Reactor Regulation
Mail Stop: 14D1
U. S. Nuclear Regulatory Commission
1 White Flint North
11555 Rockville Pike
Rockville, MD 02852

U. S. Nuclear Regulatory Commission
Region I
475 Allendale Road
King of Prussia, PA 19406

Senior NRC Resident Inspector
Pilgrim Nuclear Power Station

ATTACHMENT (A) TO BECo 89-102

REPORT ON CONTROL PANEL ENHANCEMENTS

BOSTON EDISON COMPANY

DETAILED CONTROL ROOM DESIGN REVIEW PROJECT

June, 1989

I. INTRODUCTION

A. Commitments

The purpose of this report is to satisfy two commitments to the NRC. These commitments are as follows:

1. "The licensee will evaluate control room human factors during the power ascension program and include an update regarding the schedule and scope of 'Paint, Label and Tape' items in their report to the NRC at the completion of the Power Ascension Program." (Item 2.4.10 in NRC Inspection Report No. 50-293/88-21.)

   In the Detailed Control Room Design Review Project Supplementary Summary Report dated April 1989 (forwarded by BECo letter 89-064 dated May 2, 1989), Boston Edison committed to submit the report on the panel enhancements program by June 30, 1989.

2. Also in the Supplementary Summary Report, we committed to establish what portion of the enhancements program scope of work would be completed by the end of the October 1989 outage and to report that in the report to be submitted by June 30. (See Section III B for the scope commitment.)

B. BACKGROUND

Boston Edison has been developing main control room human engineering improvements as part of the Detailed Control Room Design Review (DCRDR) required by NUREG-0737. The project includes a program of control panel enhancements of the type sometimes referred to as "paint, label and tape."

The enhancements designs were developed by a control panel design consultant, Management Analysis Co. (MAC). The program includes preparation of a set of control panel design standards based upon NUREG-0700, to establish consistency of colors, label formats, terminology, abbreviations, and other details. The standards and the specific enhancements designs were reviewed by Boston Edison Nuclear Engineering and Operations groups.

Components of the enhancements program include:

- Meter and recorder scale improvements
- Removal of abandoned equipment
- Installation of shape-coded switch handles and new switch escutcheons
- New hierarchical label system, including revised component labels plus added system and sub-system labels
- New or revised mimics in selected areas
- Area-type demarcation, using color patches, to separate and group logical sets of controls and indicators.

At the time of the IATI inspection of Pilgrim Station in August 1988, Boston Edison had approved enhancements designs for several panels and was planning their implementation. As a result of the inspection, Edison agreed to consider whether some of the planned control panel enhancements could be installed before or during the Power Ascension Test Program planned to begin in late 1988.

The design selected for the permanent enhancements was to include painted area-type demarcations. The discussion of how to accelerate enhancements installation therefore focused on how to perform the desired demarcation and label changes with the unit on-line. No final decision had been made, but a question had arisen as to whether it would be feasible and prudent to paint the panels during operation.

II. EVOLUTION OF THE INTERIM ENHANCEMENTS PROGRAM

A. Scope

Of the six categories of work listed above, the first three (meter and recorder scales, removal of abandoned equipment, and switch improvements) are being implemented as three separate tasks, largely independent of the label-mimics-demarcation.

Because of the complexity and inter-relatedness, the labels-mimics-demarcation work is done as an integrated design for one panel at a time. The remainder of this report will focus on these elements, which include the scope commonly referred to as "paint, label and tape."

B. Initial Interim Version

The initial objective was to quickly install a partial set of the label-mimic-demarcations, based upon but simpler than the designs already done. The first approach was to:

- Use taped lines for demarcation, because no proven way was known to be available to quickly add an area-type demarcation.
- Avoid all operating procedure changes, which meant no component label content would be changed.
- Generally use the concept already developed.
- Review the concept with designated operations personnel before installation (drawing review).

The first panel attempted with this approach was panel 903, which contains core standby cooling systems. Design of the interim enhancements was reviewed and agreed upon by operations section personnel, including one staff SRO. The design included taped demarcation, hierarchical labels, and one small mimic. Because of the modest changes, the arrangement was not installed on a mockup or in the simulator.

During and immediately after installation of the first interim enhancements, a substantial number of improvements were suggested by operating crews, both on the overall concept and on the details. A written survey was conducted in order to collect specific feedback. It was concluded that the first interim version could be made more understandable by removing one level of demarcation and the mimic. In addition, it was concluded that additional operator input to the design prior to implementation would be helpful on future panels.

C. Revised Interim Approach

In order to address the problems encountered with taped demarcation lines, we reviewed alternative demarcation techniques. We selected a demarcation method that consisted of a thin plastic (acetate) film that was applied to the panels, with cutouts around components. This is a substitute for painted demarcation areas. Four shades of gray were obtained and used. We decided to install an "interim" enhancements design, using this method, that would look like the final (painted) design, except that the area demarcation would be produced by gray acetate overlays.

This method was implemented on panel CP-600, the Augmented Off-Gas System Panel, in December 1988. This panel was chosen for two principal reasons:

- CP-600 was not then in use and could be modified with minimal impact on operations, even after power ascension began;

- CP-600 had been the subject of many operator comments and would benefit greatly from clarifying enhancements.

The entire planned enhancements scheme was used on CP-600, including area-type demarcation using color patches, added mimics, and revised labels. (New component labels were fastened over the existing labels with tape, to allow a test of the final version's appearance without actually removing the existing component labels.)

Design of the CP-600 enhancements is described in detail in the enclosed report from Management Analysis Co., who designed and installed the enhancements.

Following installation of the enhancements, operator questionnaires were distributed, seeking feedback on how well the enhancements achieved their objective. A total of 16 replies were received and reviewed by the designer. In several instances, operator comments led to further refinement of the enhancements.

Operator reaction to CP-600 was generally very positive, based on the operator questionnaires and oral comments. A number of refinements and corrections were identified by the operators, and incorporated.

After CP-600 was enhanced, plant start-up was initiated. To avoid disruption of startup activities, the interim enhancements effort was transferred temporarily to the simulator.

The next panel to be enhanced was panel C-1, the Feedwater and Condensate panel. The area demarcation, mimics, and hierarchical labels were added to the simulator panel in February 1989. To obtain operator input, operating crews were sent to the simulator to review the panel. Operator comments were then incorporated into the design.

CP-600 was also enhanced in the simulator to match the plant, and Panel 903 was begun, using the same approach. (Panel 903 is not yet completed nor has it been reviewed by operators.)

In summary, the implementation progress is as follows:

Panel 903 at PNPS -- First version, interim enhancements (taped demarcation, minimal labelling, no mimics).

Panel CP-600 at PNPS -- Second interim version with shaded area demarcation (temporary materials), mimics and hierarchical labels (permanent) and component labels (temporary).

Panels C1, CP-600 at Simulator -- Second interim version, as above.

Panel 903 at Simulator-- Partial installation of second interim version; to be completed.

III. FINAL ENHANCEMENTS PLAN

A. Demarcation

The colored acetate demarcation has been well received. It offers the advantage of being capable of installation during plant operation. The principal drawback of the material used so far is that the only colors readily available were shades of gray, which were not as distinguishable from each other as is desirable. Therefore we investigated alternate materials for demarcation.

We have selected a self-adhering vinyl material, available in custom colors. We are now finalizing color selection (to provide a range of shades compatible with the panel base colors). We have decided to use this for demarcations on all panels, to be completed by the end of the next refueling outage (as committed earlier).

After installation and operating experience accumulates, we will decide whether the vinyl demarcation material is permanent or whether it will be replaced with painted areas whenever the panels are next re-painted (tentatively, in RFO 8).

B. Overall Enhancements

The overall enhancements program is currently planned to include the following elements:

- Install meter scales on-line as an individual activity (between now and end of October 1989 outage).*
- Remove abandoned equipment from the control panels (individual activity), to begin in October 1989 outage.*
- Install shape-coded switch handles beginning in 1989 (individual activity).
- Install a complete version of the mimics, labels and demarcations on at least three panels (CP-600, C1, and C2) by the end of the outage currently scheduled to begin in October.*
- Complete the installation of mimics, labels and demarcations on all panels in the DCRDR scope by the end of RFO 8, as previously committed.

The mimics, labels and demarcation scope is what is usually referred to as "paint, label and tape" and will be performed as an integrated design on each panel. The version to be installed will include the vinyl demarcation discussed above and will include a new hierachical labelling scheme, including component labels and associated procedure changes. Thus, if the vinyl demarcation proves to be satisfactory, this will be the final enhancements, not an "interim" version.

In each case, the plan is to install the labels, mimics and demarcation on the simulator first. This is being done particularly because of the extensive label changes and associated procedures changes. Following operator review of each panel, the simulator version will be finalized and then the corresponding panel in the plant will be done.

The sequence will be to first revise panels C1 and CP-600 which are essentially completed at the simulator, followed by panel C2. These are to be done by the end of the October outage. The probable sequence is to then continue with panels 903, 904 and 905.

*Commitment being made in this report.

C. Detailed Report on CP-600

The enclosed report on panel CP-600 illustrates the details of the type of enhancements being done (mimics, labels, and demarcations). Similar reports will be prepared for each panel.

Additional details on other aspects of the enhancements program were included in the Supplementary Summary Report forwarded in May 1989.