PSNH PUBLIC SERVICE
Company of New Hampshire

SEABROOK STATION
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May 12, 1982
SBN-274
T.F. B 7.1.2

United States Nuclear Regulatory Commission
Washington, D. C. 20555

Attention: Mr. Frank Miraglia, Chief
Licensing Branch #3
Division of Licensing

References:
(a) Construction Permits CPPR-135 and CPPR-136, Docket Nos. 50-443 and 50-444
(b) USNRC Letter, dated March 26, 1982, "Human Factors Engineering Branch Control Room Review," F. J. Miraglia to W. C. Tallman
(c) Telecon, dated April 21, 1982, D. A. Maidrand to R. Eikenrode
(d) PSNH Letter, dated February 12, 1982, "Implementation of TMI Action Plan Requirements of NUREG-0737," J. DeVincentis to F. J. Miraglia

Subject: Seabrook Station Control Room Design Review Preliminary Report

Dear Sir:

In response to the NRC task action requirements established in NUREG-0737, PSNH has committed to conduct a Control Room Human Factors Design Review to identify those areas in the Seabrook Station Control Room design where human factor guidelines have not been met [Reference (d)]. This review will be conducted in a large part by utilizing the full scale control board simulator, which will allow us to substantially complete the review prior to the issuance of an operating license. Those few items which cannot be accomplished prior to plant operation (such as noise level measurements) will be completed after the plant reaches full power operation. Because the Detailed Control Room Design Review (DCRDR) will be substantially complete before startup, we do not plan to perform a Preliminary Design Assessment (PDA) of the control room. This decision has been discussed with Mr. Richard Eikenrode of your staff [Reference (c)]. He concurred with our position that since we will not be performing a PDA, the information requested in Reference (b) is not required, and that the NRC would not perform a Control Room Design Review (CRDR) at this time. He indicated that a final decision regarding the necessity for an NRC CRDR review would be made after the review of the Seabrook DCRDR submittal.

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We have enclosed a preliminary or planning report entitled, "Seabrook Station Control Room Design Review," as recommended in the guidelines of NUREGs-0700 and -0801. This report briefly outlines the methods which will be employed to conduct the review and contains a schedule for that review.

Yours truly,

Allen P. Legendre Jr.

for: J. DeVincentis
Project Manager

Enclosure

SEABROOK STATION CONTROL ROOM DESIGN REVIEW

I. INTRODUCTION

Pursuant to the guidelines established in NUREG-0700, Seabrook Station has elected to perform a control room human factors design review to point out those areas in the design where human factors guidelines have not been met. As will be discussed in subsequent sections of this report, Public Service Company of New Hampshire (PSNH) and Yankee Nuclear Services Division (YNSD) spent a great deal of time and effort during the control board design review and the full-scale simulator design review to ensure that any potential operating problems were discovered and fixed. For any Human Engineering Discrepancies (HED's) discovered, their significance will be assessed, and methods will be developed to alleviate or ease their impact.

Because the control room is currently under construction, the review will be done using the full-scale simulator. Any part of the review process that cannot be done on the simulator, such as lighting and sound checks, will be done when the control room is completed.

II. BACKGROUND

A. Industry Human Factors Activity

Since TMI, increased emphasis has been placed on human factors engineering within the industry. New industry groups have been formed, workshops have been conducted, and many projects aimed at increasing the understanding of operator performance and decision making have been initiated by EPRI. The BWR Owners' Group has taken the initiative in performing control room design reviews on BWR plants. YNSD has taken an active role in many of these activities - most notably the BWR Owners' Group Control Room Design Review.

The reason for this increased emphasis is the perceived need to increase the effectiveness and performance of the operator. Some of the specific areas now being addressed include the layout of control panels and work stations, adequacy of the information presented, control room staffing, training of the operators, and emergency procedures used by the operators. The objective of this activity is to decrease the probability of operator error and to improve the detection and correction of operator errors.

B. Prior Control Room Design Review Activity

The main control board (MCB) for Seabrook has undergone extensive design reviews during the course of its development. The basic layout of the MCB was developed by YNSD & PSNH, assisted by United Engineers & Constructors (UE&C).

Two major reviews of the MCB for operability and maintainability were performed. The first major review was performed in the time period from June - August, 1975. A full size mockup of the MCB was reviewed by personnel from YNSD, Central Maine Power, PSNH and UE&C. These persons had extensive engineering and operating experience, much of it obtained in other operating nuclear plants.

This expertise ensured the performance of a thorough operational analysis and review. This review process resulted in significant changes and improvements to the MCB. Details of this review are on file at YNSD offices.

The second major review of the MCB was performed in October of 1980, and included changes recommended by the Seabrook Operations Department. These changes were developed as a result of the acceptance testing of the simulator. Participating in this review were YNSD, PSNH and UE&C. Details of the results of this review are also on file at YNSD offices.

Although not formally called "Human Factors" reviews, these reviews did in fact address many human factors concerns. In addition, YNSD/PSNH involvement has been maintained throughout the development of control board philosophies.

III. PROGRAM OBJECTIVES

The objective of the Seabrook Station control room human factors review is to detect those factors of the man-machine interface in the control room which could adversely affect the operator's function in operating the plant and to assess the importance of those factors. Those which are deemed to be significant to the safe operation of the plant will be changed as necessary to alleviate any problems. The planned program will meet the intent of NUREG-0700.

IV. PLANNED REVIEW PROCESS

A. Management Review Team

A management team composed of representatives from YNSD and PSNH has been put together to review the overall progress of the Control Room Review. The team members have expertise in the areas of operations, administration, and project management.

B. Survey Team Composition

The survey team for the Seabrook Station Control Room Review will consist of a core group of persons experienced in program management, plant operations, instrument and controls engineering and human factors engineering. This core group will be aided as required by persons experienced in other disciplines.

Seabrook Station, through Yankee Nuclear Services Division has contracted with the firm of Thomas B. Sheridan Associates to provide human factors engineering expertise. The qualifications of the review team are available at the offices of YNSD.

C. Training

Several people on the review team have aided in the performance of control room design reviews at other nuclear power plants. More

will take part in similar activities over the next few months. In addition, a training program will be held for the entire team by the human factors consultant prior to the Seabrook Station review.

D. Schedule of Major Activities

While not yet final, it appears that the Seabrook Station control room human factors review will follow the schedule below:

Team Training Session	August, 1982
Survey of the Control Room Hardware (In Simulator)	August, 1982
Task Analysis, Talkthrough and Walkthrough of Emergency Procedures	August-December, 1982
Operator Interviews	December, 1982
Survey of the Control Room	March, 1983
Final Report Submittal	April, 1983

E. Scope of Review

1. LER Analyses

Because Seabrook Station is not an operating plant, plant specific LER's cannot be reviewed. It is our intent to review, through INPO, some number of LERs from plants with similar NSSS designs. While these will not be entirely indicative of a problem at Seabrook Station, they will provide some indication of potential problem areas to be explored.

2. Task Analysis Talkthrough and Walkthrough of Emergency Procedures

a) Overview

As visualized, task analysis, procedures talkthroughs, and follow-up walkthroughs, (tasks (2) and (6) of NUREG-0700), are considered as a single inseparable effort. It is stipulated by our HFE consultants that a proper model of operator actions can best be obtained by observations based on actual talkthroughs/walkthroughs. Accordingly, the formal paper task analysis will be limited to a small subset of procedures. This paper task analysis will include a definition of operator functions and decision criteria, and a listing of associated controls and displays employed for each. Decomposition of operator functions into subtasks, with appropriate analysis of each, will then be carried out in concert with the proposed talkthroughs and selected follow-up walkthroughs. The latter are to be

carried out in real time, without operator commentary, and will be used to confirm the validity of observations gleaned during the earlier phases.

b) Task Analysis

As stated above, task analysis cannot readily be segregated from procedures talkthroughs. The goal of this effort is to understand the operator tasks required to operate the plant under various plant operating conditions.

It seeks to ensure that the operator has available to him the information, control, and equipment support under various operating conditions - both normal and abnormal.

In accordance with this goal, formal paper task analysis on selected scenerios will be performed in conjunction with the talkthrough/walkthrough activity. Particular attention will be given to those aspects of control board-operator interaction identified as deficient during the component level segment of the survey.

An important element of the evaluation will be a determination of operator information requirements, including information feedback requirements associated with critical actions.

c) Talkthrough

The talkthrough process will involve senior Seabrook operating personnel and senior HFE consultants.

The purpose of the talkthrough and subsequent walkthroughs will be to: (a) simulate actions by operators in operating, managing and maintaining safe operation of the plant; (b) identify errors stimulated by design inadequacies; (c) exercise most elements of the main control boards that are frequently used or for which human error probability is considered significant due to high usage or potential impact on plant operation. Historical data from prior plant reviews will guide the final selection of cases to be observed.

The actual talkthrough will be an unconstrained step-by-step very detailed reconstruction of anticipated operator actions in implementing each procedural step. Audio recordings may be employed to complement the detailed observations and note taking of data used to document this process.

d) Walkthroughs

Selected procedures will be executed in real-time at the culmination of the task analysis - talkthrough phase. The main purpose will be validation of observations made during the preceding phases and to bring out time critical effects that may not have been noticeable during the non-real-time analysis.

Documentation may include TV records, stopwatch time charting and possibly background commentary. The observations will be non-intrusive (no operator commentary) but may be supplemented by an audio recording by an observer at the rear of the control room.

Unusual effects noticed during the walkthroughs will be analyzed during the "post-hoc" evaluation sessions. The HFE consultant and review team personnel will participate in the "post-hoc" evaluation sessions to assure completeness and objectivity of the evaluation.

3. Operator Interviews

Since Seabrook is not an operating plant, operator interviews will, of necessity, be conducted differently than if it were operating. The Operations' staff does consist of many senior people with operations experience on other plants and with limited experience on the simulator. To make use of this experience, some of these operators will be interviewed during the review process.

These interviews will be structured based on formats developed by various human factors groups and will be modified as needed to take into account the fact that Seabrook is not an operating plant. Questions on training and the use of the simulator will be emphasized. The final format will be developed jointly by the Control Room Review team and the human factors consultant.

The interviews will be conducted by persons from the Control Room Review team. The persons selected will not be on the Seabrook staff to assure a reasonable level of independence.

4. Survey of the Control Room Hardware

The survey of the control room hardware will be conducted on the Seabrook simulator. This simulator is an exact duplicate of the Seabrook Unit 1 MCB and will be used extensively in the training of the operators. The layout of the simulator room and the environmental aspects (lighting, sound, etc.) duplicate those of the main control room as much as possible.

The survey will be conducted using a detailed checklist developed jointly by YNSD and the human factors consultant.

The panels to be reviewed will be determined jointly by YNSD and the Seabrook Operations staff prior to the review. These will include, as a minimum, the MCB and the remote safe shutdown panel. The review of these panels will take place in either the simulator (if available) or in the completed main control room.

This survey will be conducted in two phases: The first phase will be conducted on the simulator and will include as many items as possible on the checklist; the second phase will be conducted in the completed control room and will include those items which could not be reviewed during the first phase. These items are mainly environmental measurements and administrative procedures, such as control of keys for keylock switches.

The personnel to be used in the hardware survey include an I&C engineer, an operator, a systems engineer, an operations engineer and the human factors consultant. This is the minimum complement of persons to be used in this survey; additional personnel may be used to assist in the survey. However, all participating personnel will have participated in the training sessions detailed above. In addition, personnel from UE&C will be available by telephone to answer questions that arise during the review.

Photographs of each panel will be taken for documentation purposes. These will be used to document what was reviewed and in the assessment process as required to assess HED's.

The checklists will be organized into functional categories, e.g., panel layout, controls, annunciators, etc. For each panel, or MCB section, a checklist for each functional area will be completed. Specific examples of any HED's found will be noted with each item. This will allow assessment of individual as well as generic HED's.

F. Record Keeping

A human factors engineering file will be set up to handle all of the raw data generated during the review. This file will be set up and maintained by YNSD. Breakdown of this data into logical categories will be done by the review team prior to the assessment. Typical categories include HED's by system, HED's by equipment type, and HED's by control board section. This breakdown will help the review team perform the assessment in a logical manner.

The MCB equipment list will serve as an inventory of all equipment mounted on the MCB. This list is currently maintained by UE&C but will be turned over to PSNH/YNSD upon start-up of the plant. This list will then be maintained current by the YNSD Engineering Department as a reference for future design changes.

A list of standard plant conventions is being developed by YNSD and the Seabrook Operations staff. This list will be used in the Control Room Survey and for making future design changes to the MCB. This list will be maintained by the YNSD Engineering Department with input from the Seabrook Operations staff.

A list of standard plant abbreviations has been developed by the Seabrook Operations staff and will be used during the Control Room Survey. This list will be maintained by the Seabrook Operations staff with copies in the YNSD Engineering Department for reference for future design changes.

V. ASSESSMENT PROCESS

The review team will take the raw data from the Control Room Review and organize it in a logical manner. A thorough assessment will then be carried out by the "core" group mentioned above. The remainder of the team that participated in the actual review will be available on an as-needed basis for assistance in assessing HED's in their areas of expertise.

For all HED's, an assessment of the consequences will be made by the core group with assistance from YNSD Nuclear Engineering Department and the Seabrook Operations Department. This assessment will take into account whether or not the potential operator error is detectable and/or correctable, the system consequences as a result of the error, and the potential for serious system consequences. This assessment will be the first step in the classification of HED's.

These HED's will be evaluated for possible correction by the review team. HED's will be prioritized according to their potential for operator error by the review team. Emphasis will be placed on any significant HED's for possible correction. Alternatives such as enhancement, design change, procedure change or no change will be considered for each HED. An analysis of the costs and benefits of each alternative will be considered to maximize the cost-effectiveness of any changes made. The final report will detail any significant HED's, the disposition of each, and the logic for the disposition. Less significant HED's and their disposition will remain on file in YNSD offices.

The cumulative impact of minor HED's will be assessed to ensure that a number of minor HED's do not constitute a significant HED.

VI. FINAL REPORT

The final report on the Detailed Control Room Design Review will be prepared after the assessment phase. This report will summarize the findings of the review. It will list the significant HED's and their disposition. Any enhancements made or design improvements proposed will also be shown in this report.