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TECHNICAL EVALUATION OF THE DETAILED CONTROL ROOM DESIGN REVIEW FOR WISCONSIN PUBLIC SERVICE CORPORATION'S KEWAUNEE NUCLEAR POWER PLANT

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INTRODUCTION

This report documents the findings of Science Applications International Corporation's (SAIC's) evaluation of Wisconsin Public Service Corporation's (WPSC's) Summary Report of the Detailed Control Room Design Review (DCRDR) of the Kewaunee Nuclear Power Plant (Reference 1). This report also incorporates the findings of a February 12, 1986, DCRDR meeting attended by the licensee, Nuclear Regulatory Commission (NRC) staff, and an NRC consultant from SAIC (Reference 2). The purpose of this evaluation was fourfold:

1. To determine whether the DCRDR conducted by WPSC as documented in the Summary Report and described at the February 12, 1986 DCRDR meeting is acceptable.

2. To recommend to the NRC whether a pre-implementation audit or meeting should be conducted.

3. To provide an audit or meeting agenda where required.

4. To provide a basis for feedback to WPSC.

The requirements set forth in Supplement 1 to NUREG-0737, "Requirements for Emergency Response Capability," December 1982 (Reference 3), served as a basis for the DCRDR evaluation.

Wisconsin Public Service Corporation's DCRDR of Kewaunee Nuclear Power Plant began with the submittal of the Program Plan to the NRC on April 15, 1983 (Reference 4). A "clarification of Supplement 1 to NUREG-0737 Implementation Plan" was forwarded by the licensee to the NRC on August 4, 1983 (Reference 5). NRC staff comments on the Program Plan were forwarded to WPSC on December 7, 1983 (Reference 6).

Kewaunee was selected by the NRC staff for an in-progress audit of the DCRDR. An In-Progress Audit Plan (Reference 7) was sent by the NRC to WPSC by letter dated March 2, 1984. The Kewaunee in-progress audit was conducted May 1 through May 4, 1984. The consolidated observations, conclusions, and recommendations of the NRC audit team were issued by letter dated June 22, 1984 (Reference 8).

The Kewaunee DCRDR Summary Report was submitted to the NRC on June 28, 1985. SAIC reviewed the Kewaunee Summary Report and submitted a Preliminary Evaluation of the Detailed Control Room Design Review Summary Report for the Kewaunee Nuclear Power Plant on July 26, 1985 (Reference 9). In that preliminary evaluation of the Kewaunee Summary Report, SAIC identified a number of concerns and recommended a pre-implementation audit of the Kewaunee DCRDR. A draft technical evaluation report for the Kewaunee DCRDR was forwarded to the NRC by SAIC by letter dated August 16, 1985 (Reference 10). The draft technical evaluation report contained a recommendation for a phone conference or meeting to resolve DCRDR concerns.

The NRC requested a meeting with the licensee, by letter dated October 9, 1985, at NRC headquarters in Bethesda, Maryland, to resolve Kewaunee DCRDR concerns (Reference 11). During a telephone conversation on October 29, 1985, between the licensee's and the NRC's Kewaunee project managers, it was agreed that the Reference 11 request for a meeting would be considered a request for additional information, and a meeting would not be necessary.

Wisconsin Public Service Corporation responded with additional DCRDR information by letter dated November 20, 1985 (Reference 12). The additional DCRDR information was evaluated by NRC and SAIC, and it was determined that a meeting or audit would still be necessary to resolve NRC concerns regarding the Kewaunee DCRDR.

A meeting attended by WPSC, NRC, and SAIC personnel was held in Bethesda, Maryland, on February 12, 1986. The purpose of the meeting was to resolve NRC concerns regarding the Kewaunee DCRDR processes and results. The minutes of this meeting were published in Reference 2 by NRC letter dated February 18, 1986.

In order to provide a current and comprehensive evaluation of the Kewaunee DCRDR, SAIC combined its evaluation of the Kewaunee Summary Report with the results of the February 12, 1986, Kewaunee DCRDR meeting into this single report. The consolidated findings of the evaluation of the Summary Report and February 12, 1986, meeting follow a brief overview of the background of the DCRDR requirements.

BACKGROUND

Licensees and applicants for operating licenses are required to conduct a 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 1.D.1) (Reference 13). The need to conduct a DCRDR was confirmed in NUREG-0737 (Reference 14). DCRDR requirements in Supplement 1 to NUREG-0737 replaced those in earlier documents. Supplement 1 to NUREG-0737 requires each plant or licensee to conduct its DCRDR on a schedule negotiated with the NRC. Guidelines for conducting a DCRDR are provided in NUREG-0700 (Reference 15), while the assessment processes for the NRC are contained in NUREG-0800 (Reference 16).

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 implementation, and (4) reporting. The product of the last phase is a Summary Report which, according to Supplement 1 to NUREG-0737, 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, the NRC must prepare a Safety Evaluation Report (SER) indicating the acceptability of the DCRDR (not just the Summary Report). The NRC's evaluation encompasses all documentation as well as briefings, discussions, and audits, if any were conducted.

The purpose of this Technical Evaluation Report is to assist the NRC by providing a technical evaluation of the Kewaunee DCRDR process and results.

The DCRDR requirements as stated in Supplement 1 to NUREG-0737 can be summarized in terms of the nine specific elements listed below:

1. Establishment of a qualified multidisciplinary review team.

2. Use of function and task analysis 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 corrections.

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.

DISCUSSION

1. Establishment of a qualified multidisciplinary review team.

The licensee's management and staffing is described in Section 2-2 of the Summary Report. The DCRDR team members identified in the Summary Report are the same team members who served on the DCRDR at the time of the NRC's in-progress audit of the Kewaunee DCRDR during May 1 to 4, 1984. The resumes of the WPSC team members are included with the in-progress audit report (Reference 8). The resumes of the licensee's human factors consultant, Torrey Pines Technology, were reviewed by the in-progress audit team and judged appropriate for the tasks assigned during the DCRDR.

It is the reviewers' evaluation that the licensee did establish a qualified multidisciplinary review team which conformed to the guidance in NUREG-0800, subsection 2.1.2, and meets the requirements of Supplement 1 to NUREG-0737.

2. Use of function and task analysis.

SAIC's evaluation of the licensee's task analysis had two purposes. First, the task analysis description in the Summary Report was reviewed to determine whether the licensee corrected the task analysis problems identified during the in-progress audit (Reference 8). Second, the description of the task analysis was reviewed using the guidance provided in NUREG-0800, subsection 2.2, which described a process for conducting an acceptable task analysis.

In terms of correcting the task analysis problems identified during the in-progress audit, the licensee stated that it accomplished the following:

1. A comprehensive set of operator tasks performed during emergency operations were analyzed. In addition, the licensee stated that it analyzed operator tasks performed during cold shutdown to startup.

2. Branching tasks, the tasks associated with the Response Not Obtained column of the Westinghouse procedures, were analyzed.

3. Entry condition tasks were analyzed.

4. Annunciator tasks were analyzed.

5. The required instrumentation and control characteristics were identified independent of the control room in Torrey Pines Corporation home office in California.

Based on the above statements, it is SAIC's judgment that the licensee has resolved the open issues identified during the in-progress audit and has exceeded the requirement by analyzing normal operating tasks performed by the operators during startup.

The second purpose of the technical evaluation of the Summary Report is to determine whether the licensee has satisfactorily met the systems function review and task analysis requirement in Supplement 1 to NUREG-0737. The evaluation of the task analysis was based on NUREG-0800, subsection 2.2.

First, the licensee states in Section 4.2.1 that it performed a review of system functions in order to identify and evaluate the major and minor functions of the systems and descriptions of the system safety classifications. This information was documented on the licensee's DCRDR Systems Background Forms (Figure 4.2-2 in the Summary Report). The systems background information was used to compare systems and subsystems with the operator tasks identified in the Emergency Response Guidelines. In addition, the licensee conducted training sessions for the DCRDR team members to familiarize them with the functions of the systems.

Second, the licensee used the generic Westinghouse systems review and task analysis data to select a comprehensive set of event sequences to analyze. The emergency event sequences selected for task analysis are illustrated in Figure 4.2-3 of the Summary Report.

Third, the licensee identified and analyzed the operator tasks in the selected events in order to:

- o Develop information and control requirements.
- o Develop operator action descriptive data.
- o Identify information and control needs and characteristics.

The licensee stated that its plant-specific emergency operating procedures follow the generic Westinghouse emergency response guidelines closely. But, for any step which differed significantly from the corresponding generic emergency response guideline, a step documentation form, as shown in Figure 4.2-5 of the Summary Report, was completed in order to justify all plant-specific procedures/generic guidelines differences. This conforms to the NRC position on Westinghouse-based task analysis requirements guidance published April 5, 1984 (Reference 17).

The development of the task information and control requirements and instrumentation and control characteristics requirements was established independent of the existing control room and simulator. This was done by Torrey Pines Technology, the human factors consultant, in its home office in California. An example of the requirements form used in the analysis is provided in Figure 4.2-6 of the Summary Report. This figure provides an identification of the information sources used to identify the requirements.

All operator task data was entered on the DCRDR data base management system. An example of the printout of this information is provided in Figure 4.2-8 of the Summary Report. This figure demonstrates that the licensee identified the characteristics of the information and control capability needed to perform the tasks.

The reviewers conclude that the licensee has been responsive to the NRC guidance provided in the in-progress audit and has satisfied the task analysis requirement in Supplement 1 to NUREG-0737.

3. Comparison of display and control requirements with the control room inventory.

The control room inventory activity at Kewaunee was conducted in several phases, as listed below:

- The operator information and control requirements identified during the task analysis were compared with operator task data collected during simulator walk-throughs of the emergency operating events (see Figure 4.2-9 of the Summary Report).

- Every instrument, control and other equipment present in the control room as described on the DCRDR data base management system (Figure 4.3-1 in the Summary Report) was compared with the existing control room to verify accuracy.

- The verification of information and control availability was done by identifying the required device and device number during the simulator of the task analysis data. The verification that the information and controls in the simulator accurately reflect the control room information and controls was done by comparing the control room inventory information with the walk-through information by using the DCRDR data base management system.

- The verification of suitability was conducted to determine whether the controls and displays identified in the verification of availability are effectively designed to accomplish the required task. The NUREG-0700 criteria used in the evaluation of suitability are listed in Table 4.5-1 of the Summary Report. The list of human engineering observations (HEOs)identified during the verification of suitability is provided in Table 4.5-2 of the Summary Report.

- Validation exercises in the form of real-time simulation of a loss of coolant accident and a steam generator tube rupture were conducted on the simulator in order to evaluate control room layout with regard to time, workload, and workflow. A total of 39 HEOs were identified during this exercise. The validation HEOs are listed in Table 4.6-1 and are described in terms of NUREG-0700 criteria.

The reviewers conclude that the licensee responded to the NRC concerns identified during the in-progress audit and has demonstrated results which

meet the requirements of Supplement 1 to NUREG-0737 for the inventory activity.

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

During the in-progress audit, the NRC team evaluated the compliance checklists used in the control room survey to evaluate the control room against established human factors guidelines. The compliance checklists were based on Section 6 of NUREG-0700 and consisted of nine bound volumes corresponding to the sections of NUREG-0700. The topics of these checklists were:

- o Control Room Workspace
- o Communications
- o Annunciators Warning System
- o Controls
- o Visual Displays
- o Labels and Location Aids
- o Process Computers
- o Panel Layout
- o Control Display Integration

The compliance checklists used the same numbers and titles contained in NUREG-0700.

For each checklist item that was not satisfied, an HEO was prepared. Each HEO documented contains a brief statement explaining how the device or observation failed to meet the guideline, the potential for human error that could occur, and a suggestion for human engineering improvements. Each HEO was further documented with a photograph where appropriate.

Samples of checklist criteria forms, detailed control room design review control room survey reference/comment forms, and HEO forms are provided in the Summary Report.

During the in-progress audit, the NRC team conducted a sample survey which resulted in the identification of several HEOs that had not been

identified by the licensee's DCRDR team. This led the in-progress audit team to the recommendation that the licensee should validate the survey results to ensure accuracy.

The Summary Report indicates that the control room survey produced a total of 151 HEOs. Table 4.4.1 presents the summary of the number of HEOs found for each category, and Tables 4.4-2 through 4.4-10 list the HEOs for each category. Accuracy of the HEOs was supported by a correlation of the survey HEOs with observations made during the Operating Experience Review. The corresponding supporting Operating Experience Review observation is listed with each applicable survey HEO. The results of the correlation of survey and operating experience review HEOs verifies the accuracy of the survey HEOs.

In terms of completeness of the survey activity, the licensee did not address the sample HEOs identified by the in-progress audit team. However, the review of the 151 HEOs identified during the survey indicates that a systematic comparison of the control room features with human engineering guidelines was conducted. The Process Computer survey which had not begun at the time of the in-progress audit was completed and 12 HEOs resulted. As indicated in Reference 12, "Request for Additional Information Regarding the DCRDR," the control room survey checklists were also used to evaluate the Dedicated Shutdown Panel. Further, the Summary Report states that the control room survey examined the consistency of the control room conventions, as well as adequacy of the control room to fulfill some requirements determined from both the System Review and Task Analysis and Verification of Task Performance Capabilities. Based on the documented survey results, it is our judgment that the accuracy and completeness of the survey activity are adequate.

The in-progress audit team also recommended that the licensee validate and document any HEOs that were prematurely assessed and evaluate them during the assessment phase of the DCRDR. The HEO assessment process was discussed and evaluated in detail at the February 12, 1986, NRC/Licensee meeting (Reference 2). As a result of this review and clarification of the licensee's HEO assessment process, it was determined that preassessment of HEOs is not a concern.

In summary, the evaluation of the survey activity included review of the Summary Report survey results, in-progress audit concerns, and results of additional information provided by the licensee through documentation and a meeting. The reviewers concluded that the process and results of the survey activity adequately address the requirements of Supplement 1 to NUREG-0737.

5. Assessment of HEOs to determine which are significant and should be corrected.

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

The Kewaunee HEO/HED assessment process is described in Section 5.1 of the Summary Report. The Summary Report states that the assessment was performed by the Assessment and Improvement Team (AIT). All HEOs identified during the DCRDR were categorized 1, 2, 3, or 4. Invalid HEOs were not categorized. The HEO categorization was based on an evaluation of the impact of each observation on operating crew performance, overall plant safety and plant reliability.

Those HEOs judged by the AIT to have a high potential for affecting plant safety and reliability (Categories 1, 2, and 3) were categorized as HEDs. Nonsafety-significant Category 4 HEOs remained as HEOs. The HEOs categorized as HEDs were defined by levels A, B, C, or D, based on the HEDs actual or potential adverse effect on plant safety and operability.

In addition to the assessment of individual HEOs, the AIT assessed the aggregate HED effects. The Summary Report states that after the initial categorization process, remaining HEOs (Category 4) were reanalyzed to

identify any cumulative or interactive effects of multiple HEOs. When the cumulative effects of Category 4 HEOs were judged significant, a level was assigned based on an HEO's actual or potential adverse effect on plant safety or operability.

The in-progress audit team concluded that the assessment methodology developed by the licensee conformed to the requirements of Supplement 1 to NUREG-0737. However, the in-progress audit team also recommended that the licensee provide description of the rationale for documenting HEOs that were not classified in HEO Categories 1 through 4. In some cases the HEO category was left blank on the HEO form.

The licensee failed to provide the rationale for leaving HEOs uncategorized in the Summary Report. This led to questions and concerns on the part of the SAIC and NRC reviewers. The licensee addressed the question of uncategorized HEOs in Reference 12, Item 3 and Reference 2, discussion of agenda items 1. The licensee stated that those HEOs that were not categorized were observations determined to be invalid by the AIT and management. Therefore, assessing the potential significance of a human error resulting from a condition that does not exist at the Kewaunee Plant would have been an unnecessary drain on personnel resources. In order to achieve a final resolution of this issue, the licensee committed to provide a discussion of how the assessment decision process was implemented during the review in a Supplementary Summary Report.

In summary, the in-progress audit team determined that the HEO/HED assessment methodology conformed to requirements of Supplement 1 to NUREG-0737. However, review of the assessment results presented in the Summary Report produced concerns regarding uncategorized HEOs. Those concerns were resolved in References 2 and 12. The licensee committed to provide the documentation to support the resolution of the uncategorized HEO concerns in the Supplement to the Summary Report.

6. Selection of design improvements.

The purpose of selecting improvements is, as a minimum, to correct safety-significant HEDs. Selection of design improvements should include a

systematic process for development and comparison of alternative means for resolving HEDs. Both enhancement and design modifications may be considered.

The DCRDR of the Kewaunee Nuclear Power Plant resulted in 223 HEOs which are summarized in Table 6-1 of the Summary Report. The corrective actions and the scheduled implementation dates for the 65 HEDs are summarized in Table 6-2. Three correction methods available were Design Change Requests, used to correct HEDs through design change or design enhancements; Administrative Changes for which engineering analysis or design was not required; and Procedural Changes, to permit more efficient operation of the plant. Summary Report Table 6-2a defines the column headings for Corrective Action and Implementation Schedule.

In addition, the Summary Report states that to ensure an efficient and integrated approach for correcting the identified HEDs, a cross-reference (Table 6-3) was prepared. This cross-reference identifies all HEDs applicable to a particular instrument number. This cross-reference will also be helpful in evaluating proposed changes to the baseline control room.

The in-progress audit team determined that the selection of design improvements methodology was adequate. However, review of the results in the form of the Suggested Corrective Actions descriptions on the HEO forms raised concerns. The concern pertained to the role of the DCRDR team in the selection and implementation of the final design modifications and the use of Suggested Corrective Actions. Further, the licensee stated in Reference 12 that the review team's responsibilities will be limited to producing conceptual design recommendations.

These concerns created the impression that the DCRDR team considered the DCRDR completed with the conclusion of the review and assessment activities. NUREG-0800 clearly describes the role of the DCRDR team in the selection of design improvement process. The second concern pertained to the use of suggested corrective actions on the HEO forms versus the actual corrective action that the licensee had committed to implement. NUREG-0800 states that the Summary Report should include descriptions of all corrective actions that are proposed. These descriptions should be sufficiently detailed so that the NRC staff can determine whether the proposed corrective

actions adequately resolve the HED. In this case it appeared that development of actual design solutions was beyond the scope of the DCRDR.

In order to address the NRC/SAIC concerns regarding the selection of design improvements, the licensee prepared a Human Engineering Review Process for Control Room Modifications flow chart (See Figure I). This flow chart was presented by the DCRDR team to the NRC at the February 12, 1986, meeting (Reference 2). The steps in the design modification process are as follows:

a. Point of entry evaluated
b. System analysis
c. Task analysis
d. Prepare functional design
e. Equipment selection
f. Modify mockup

As noted, the enclosed flow chart (Figure 1) demonstrates the process.

Based on the licensee's description of the design improvement process, it is the reviewers' evaluation that the process and results should satisfy the requirements of Supplement 1 to NUREG-0737. However, two important pieces of documentation will be needed to fully satisfy the Supplement 1 to NUREG-0737 requirement. The supplement to the Summary Report should document the selection of the design improvement process described in the February 12, 1986, meeting. Second, the supplement to the Summary Report should outline the proposed control room changes, including their schedules for implementation. This second item is essential to satisfying the documentation requirements of Supplement 1 to NUREG-0737.

7. Verification that improvements provide the necessary corrections.

A key criterion of DCRDR success is a consistent, coherent, and effective interface between the operator and the control room. One good way to satisfy that criterion is through iteration of the process of selection of design improvements, verification that selected design improvements will provide necessary correction, and verification that improvements will not introduce new HEDs. Techniques for the verification process might include

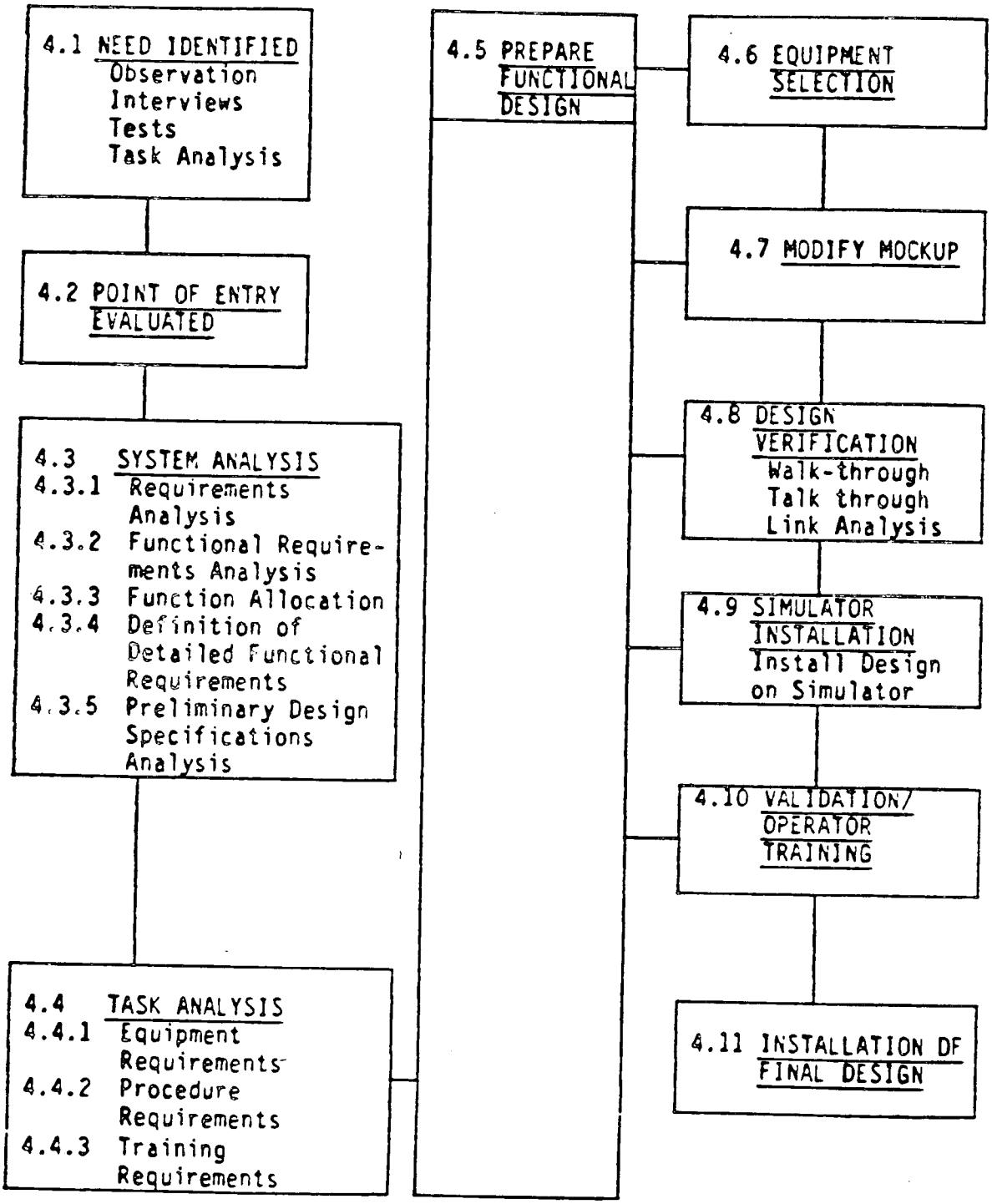

Figure 1- Design Modificaton Process

partial resurveys on mocked up panels, applied experiments, engineering analysis, environmental surveys, and operator interviews. Each iteration of the selection and verification process should reduce inconsistencies in the operator-control room interface while increasing coherence and effectiveness of that interface. The consistency, coherence, and effectiveneess of the entire operator-control room interface is important to operator performance. Thus, evaluation of both the changed and unchanged positions of the control room is necessary during the verification process.

The NRC in-progress audit team was unable to evaluate the licensee's method for verifying that improvements provide the necessary corrections since none was described in the Program Plan and no procedures existed at the time of the audit.

The Summary Report provided little additional information on the procedures for verification that the design modification would correct the HED. This raised an NRC/SAIC concern regarding this Supplement 1 to NUREG-0737 requirement.

In order to address the verification that the modifications would correct the HED concern, the licensee provided a Kewaunee Nuclear Power Plant DCRDR Status Update (Reference 18) dated October 31, 1985. The licensee stated that the methodology was not yet finalized; however, the verification process was summarized as follows:

- Incorporate the preliminary functional designs on a control board mock-up.
- Using the mock-up, perform a design verification performing operator walk- and talk-throughs and determine the preferred design.
- Install the selected design on the Kewaunee simulator.
- Validate the design during operator training on the simulator. This allows an evaluation under dynamic real time conditions.
- Install final design in the Kewaunee control room.

Further, the licensee noted that implementation methodology requires input from several disciplines. The intent is to provide sufficient human factors review and operator input during the design phase prior to making modifications to the control panels. This methodology will provide assurance that all installed design changes correct the original identified deficiency and that the corrected design does not introduce new human factors concerns.

In Reference 12, "Request for Additional Information Regarding the DCRDR" dated November 20, 1985, the licensee again addressed the NRC concern regarding the lack of a documented process for ensuring that the modifications correct the HEDs. In the November 20, 1985, letter, the licensee stated that the final definition of this process was provided in Section 7.0 of the Summary Report. In Section 7.0 of the Summary Report, the licensee stated that to ensure that this review is performed in an adequate manner, Engineering Control Directive (ECD) 4.1 will be revised to include instructions to have human factors review performed whenever a modification affects the control room. Guidance regarding the extent of review required and the methods for performing the review will be included in an ECD.

The outlines of the verification process described in the Summary Report, October 31, 1985, letter (Reference 18) and November 20, 1985, letter, (Reference 12) indicated the licensee's intent to establish a formal procedure. However, no documented process was presented for evaluation. Therefore, it was not possible for the SAIC Summary Report evaluation team to evaluate the adequacy of the verification process.

In an effort to resolve this concern, the licensee presented a "draft" flow chart and description of the verification process at the February 12, 1986, meeting (Reference 2). The Design Modification Process flow chart (see Figure 1) illustrates the process that will be followed to verify that the modification corrects the HED and does not introduce new HEDs. This flow chart will be part of Engineering Control Procedure No. 4.2, "Human Engineering Review Process for Control Room Modifications." The verification process, as described by the licensee and illustrated in the flow chart, should satisfy the requirements of Supplement 1 to NUREG-0737.

In summary, the verification processes outlined in draft form, should satisfy this Supplement 1 to NUREG-0737 requirement. However, the licensee should provide a description of the final Engineering Control Procedure 4.2 in the Supplement to the Summary Report.

8. Verification that selected design improvements can be introduced into the control room without creating any unacceptable HEDs.

The verification that the selected design improvements can be introduced into the control room without creating any unacceptable HEDs is integrated into the verification process described in Discussion Section 7 of this report. As a result, the final technical evaluation of this Supplement 1 to NUREG-0737 requirement cannot be completed until the licensee provides a description of the final Engineering Control Procedure 4.2, "Human Engineering Review Process for Control Room Modifications," in the Supplement to the Summary Report.

9. Coordination of control room improvements with changes from other programs such as the Safety Parameter Display System (SPDS), operator training, Reg. Guide 1.97 Instrumentation, and upgraded Emergency Operating Procedures (EOPs).

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

With regard to coordinating the SPDS with the DCRDR, WPSC is one of the original sponsors of the Safety Assessment System (SAS) project which was ultimately supported by ten domestic and two foreign utilities. The SAS system installed at Kewaunee is considered as an enhanced operator display which provides the following functions:

- o Safety Parameter Display System (SPDS)
- o Safety System Ready Monitor
- o Safety System Performance Monitor
- o Accident Identification Display Monitor
- o Channel Malfunction Monitor
- o Critical Safety Function Monitor

The licensee stated in the Implementation of Integrated Emergency Response Capability Plan (Reference 19), dated April 15, 1983, that the independent verification and validation program for the SAS implementation will result in a package of discrepancies. A formal review of these discrepancies through the design phase will support the Safety Analysis Report. In addition to supporting the Safety Analysis Report, the discrepancies will be submitted to the DCRDR project for evaluations. Where the SAS deviations are considered significant by the DCRDR team, changes will be recommended and system changes evaluated. Review of the HEOs indicated that twelve additional HEOs resulted in the application of the Computer Survey chapter of Section 6 of NUREG-0700 by the DCRDR team to the SAS. Therefore, the reviewers conclude that the SPDS and DCRDR are appropriately coordinated.

The coordination of the DCRDR with training is illustrated in the Engineering Control Procedure for Human Engineering Review Process for Control Room Modifications (Reference 2), see Figure 1 in this report. As part of the licensee's design modification process, the training requirements for modifications are defined along with equipment requirements and procedure requirements. The actual operator training on the modifications is implemented during the Validation/Operator Training step in the design modification process. Based on this information, it is the reviewers' evaluation that operator training is appropriately integrated into the DCRDR.

The licensee's coordination of Regulatory Guide 1.97 (Reference 20) is documented in the licensee's June 28, 1985, letter to the NRC (Reference 21), entitled "Accident Monitoring Instrumentation." In this letter, the licensee states that each step of the upgraded Emergency Dperating Procedures which were analyzed by the DCRDR was then analyzed by the Reg. Guide 1.97 group by reviewing the generic Emergency Response Guideline background documentation to determine whether the step controls a Critical Safety

Function. This review resulted in a listing of key instrumentation required for emergency operations. Qualifications for this instrumentation, except for ranges, were reviewed by the DCRDR study, and then compared with the Reg. Guide 1.97 criteria to assess acceptability. Reference 21 documents the results of the qualification review. Recommendations resulting from this effort are being reviewed by the Accident Monitoring Instrumentation review committee, and a response plan will be developed. Upgrades, if necessary, will proceed on a schedule which considers other plant improvements such as those required by the DCRDR program and 10 CFR 50 Appendix R. The reviewers conclude that the licensee is appropriately coordinating the Reg. Guide 1.97 activities with the DCRDR.

With respect to the coordination of the upgraded EOPs with the DCRDR, the licensee stated in the Summary Report, Section 4.2.3.a that the upgraded Kewaunee EOPs were used as a basis for the DCRDR task analysis. The EOPs for the Kewaunee Plant were directly adapted from the Westinghouse generic guidelines. The content of the EOPs follows the generic ERGs with plant-specific operations or values entered where indicated in the ERGs. For any step which differed significantly from the corresponding ERG step, a Step Deviation form (Summary Report Figure 4.2-5) was completed. This form provided a detailed description and a justification of the difference between the EOP and the ERG step. This form also provided information that was necessary in the EOP verification and in the development of the DCRDR task analysis information and control requirements. This process follows the NRC guidance resulting from the March 29, 1984, meeting on Westinghouse-based task analysis requirements (Reference 17) and indicated appropriate coordination of DCRDR and upgraded EOP programs.

In summary, the SPDS program, operator training, Reg. Guide 1.97 instrumentation project, and upgraded EOP project are appropriately coordinated with the DCRDR. It is the evaluation of the in-progress audit team and of the reviewers that this Supplement 1 to NUREG-0737 requirement has been satisfied.

CONCLUSION

This technical evaluation report documents the findings of SAIC's review of the Kewaunee DCRDR Summary Report. This evaluation also includes

additional information supplied by the licensee subsequent to the Summary Report submittal and information resulting from the February 12, 1986, NRC/Licensee DCRDR meeting in Bethesda, Maryland. Our conclusions and recommendations are listed below in order of Supplement 1 to NUREG-0737 requirements.

1. The licensee established a qualified multidisciplinary review team which satisfied this Supplement 1 to NUREG-0737 requirement.

2. The licensee performed a function and task analysis which satisfies this Supplement 1 to NUREG-0737 requirement.

3. The licensee performed a comparison of the display and control requirements with the control room inventory, thereby completing this Supplement 1 to NUREG-0737 requirement.

4. The licensee conducted a control room survey of the control room which meets this Supplement 1 to NUREG-0737 requirement.

5. The licensee performed an assessment of all HEOs/HEDs, thereby satisfying this Supplement 1 to NUREG-0737 requirement. The licensee committed to provide the NRC with documentation in the supplement to the Summary Report describing the process which resulted in a number of uncategorized (invalid) HEOs.

6. The licensee's description of the process for the selection of design improvements should satisfy this Supplement 1 to NUREG-0737 requirement. However, it will be necessary for the licensee to provide the NRC with a documented description of the design improvement process and a list of actual rather than suggested proposed HED modifications along with the licensee's proposed schedules for implementation.

7. The draft process used by the licensee for verification that the improvements provide the necessary corrections should satisfy this Supplement 1 to NUREG-0737 requirement. However, the licensee needs to provide the NRC with a finalized verification procedure.

8. The draft process used by the licensee for verification that the improvements do not introduce any unacceptable HEDs should satisfy this Supplement 1 to NUREG-0737 requirement. The licensee needs to provide the NRC with a documented and finalized procedure for verifying that improvements introduced into the control room do not introduce unacceptable HEDs.

9. The coordination of other control room improvement programs with the DCRDR satisfies this Supplement 1 to NUREG-0737 requirement.

In order to resolve the documentation needs for above items 5, 6, 7, and 8, the licensee agreed, during the February 12, 1986, meeting, to submit a Supplement to the Kewaunee DCRDR Summary Report. That supplement should contain:

- A description of the process for leaving invalid HEOs uncategorized during the assessment activity.

- A documented description of the design improvement process and a listing of actual rather than suggested proposed control room improvements.

- A documented final process for verifying that control room improvements provide the necessary corrections.

- A documented final process for verifying that no unacceptable HEDs are introduced into the control room as a result of the improvements.

REFERENCES

1. Letter from D.C. Hintz, Wisconsin Public Service Corporation, to H.L. Thompson, USNRC, dated June 28, 1985. Subject: Kewaunee Detailed Control Room Design Review Summary Report.

2. Meeting Minutes, Licensee: Wisconsin Public Service Corporation; Facility: Kewaunee Nuclear Power Plant; Subject: Detailed Control Room Design Review (DCRDR) Summary Report (TAC No. 56133), U.S. Nuclear Regulatory Commission, February 18, 1986.

3. Supplement 1 to NUREG-0737, "Clarification of TMI Action Plan Requirements," U.S. Nuclear Regulatory Commission, December 1982.

4. Letter from C.W. Geisler, Wisconsin Public Service Corporation, to D.G. Eisenhut, USNRC, dated April 15, 1983, Subject: Kewaunee Nuclear Power Plant Detailed Control Room Design Review Program Plan.

5. Letter from C.W. Geisler, Wisconsin Public Service Corporation, to D.G. Eisenhut, USNRC, dated August 4, 1983, Subject: "Clarification of Supplement 1 to NUREG-0737 Implementation Plan."

6. Letter from S.A. Varga, USNRC, to C.W. Geisler, Wisconsin Public Service Corporation, dated December 7, 1983, Subject: "Review Comments on Kewaunee's Detailed Control Room Design Review Program Plan Report."

7. Draft Audit Plan for the Staff's In-Progress Audit of Kewaunee's Detailed Control Room Design Review (DCRDR), U.S. Nuclear Regulatory Commission, March 2, 1984.

8. Letter from S.A. Varga, USNRC, to C.W. Geisler, Wisconsin Public Service Corporation, dated June 22, 1984, Subject: Results From Detailed Control Room Design Review In-Progress Audit for the Kewaunee Power Plant.

9. Informal Technical Communication from M.L. Fineberg, SAIC, to R. Ramirez, USNRC, dated July 26, 1985, Subject: Preliminary Technical Evaluation of the Detailed Control Room Design Review Summary Report for the Kewaunee Nuclear Power Plant.

10. Informal Technical Communication from M.L. Fineberg, SAIC, to R. Ramirez, USNRC, dated August 16, 1985, Subject: Draft Technical Evaluation Report for Wisconsin Public Service Corporation's Kewaunee Nuclear Power Plant Detailed Control Room Design Review Summary Report.

11. Letter from S.A. Varga, USNRC, to D.C. Hintz, Wisconsin Public Service Corporation, dated October 9, 1985, Subject: Request for a Meeting to Resolve Concerns Regarding Kewaunee's Detailed Control Room Design Review.

12. Letter from D.C. Hintz, Wisconsin Public Service Corporation, to H.L. Thompson, USNRC, dated November 20, 1985, Subject: Request for Additional Information Regarding the Detailed Control Room Design Review.

13. NUREG-0660, Vol. 1, "NRC Action Plan Developed as a Result of the TMI-2 Accident," U.S. Nuclear Regulatory Commission, May 1980, Revision 1, August 1980.

14. NUREG-0737, "Requirements for Emergency Response Capability," USNRC, Washington, D.C., November 1980.

15. NUREG-0700, "Guidelines for Control Room Design Reviews," U.S. Nuclear Regulatory Commission, September 1981.

16. NUREG-0800, Section 18.1, Revision 0, "Standard Review Plan for Review of Safety Analysis Reports for Nuclear Power Plants," U.S. Nuclear Regulatory Commission, September 1984.

17. Letter from H. Brent Clayton, NRC, to Dennis L. Ziemann, NRC, dated April 5, 1984, Subject: Meeting Summary Task Analysis Requirements of Supplement 1 to NUREG-0737, March 29, 1984, meeting with Westinghouse Owners Group (WDG) Procedures Subcommittee and other interested persons.

9. Informal Technical Communication from M.L. Fineberg, SAIC, to R. Ramirez, USNRC, dated July 26, 1985, Subject: Preliminary Technical Evaluation of the Detailed Control Room Design Review Summary Report for the Kewaunee Nuclear Power Plant.

10. Informal Technical Communication from M.L. Fineberg, SAIC, to R. Ramirez, USNRC, dated August 16, 1985, Subject: Draft Technical Evaluation Report for Wisconsin Public Service Corporation's Kewaunee Nuclear Power Plant Detailed Control Room Design Review Summary Report.

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17. Letter from H. Brent Clayton, NRC, to Dennis L. Ziemann, NRC, dated April 5, 1984, Subject: Meeting Summary Task Analysis Requirements of Supplement 1 to NUREG-0737, March 29, 1984, meeting with Westinghouse Owners Group (WOG) Procedures Subcommittee and other interested persons.

18. Letter from D.C. Hintz, Wisconsin Public Service Corporation, to H.L. Thompson, USNRC, dated October 31, 1985, Subject: Kewaunee Nuclear Power Plant DCRDR Update.

19. Letter from C.W. Geisler, Wisconsin Public Service Corporation, to D.G. Eisenhut, USNRC, dated April 15, 1983, Subject: Implementation of Integrated Emergency Response Capability Plan.

20. Regulatory Guide 1.97, Instrumentation for Light-Water-Cooled Nuclear Power Plants to Assess Plant and Environs Conditions During and Following an Accident, U.S. Nuclear Regulatory Commission, May 1983.

21. Letter from D.C. Hintz, Wisconsin Public Service Corporation, to S.A. Varga, USNRC, dated June 28, 1985, Subject: Accident Monitoring Instrumentation.

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