EVALUATION
OF THE
DETAILED CONTROL ROOM DESIGN REVIEW
PROGRAM PLAN
FOR
WISCONSIN ELECTRIC POWER COMPANY'S
POINT BEACH NUCLEAR PLANT, UNITS 1 AND 2

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TABLE OF CONTENTS

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INTRODUCTION

Science Applications International Corporation (SAIC) has evaluated the Program Plan (Reference 1) submitted by Wisconsin Electric Power Company (Wisconsin Electric) for conduct of a Detailed Control Room Design Review (DCRDR) at the Point Beach Nuclear Plant (PBNP). The disciplines of human factors engineering, instrument and control (I&E) engineering, nuclear engineering, and reactor operations were represented on the evaluation team. All team members were familiar with nuclear power plant control rooms and experienced in evaluating DCRDRs. The purpose of the evaluation was:

1. To determine whether the planned program would result in a successful DCRDR

2. To determine whether an in-progress audit was necessary

3. To provide an audit agenda where appropriate

4. To provide constructive feedback to Wisconsin Electric

Evaluation was against the requirements of Supplement 1 to NUREG-0737 (Ref. 2). Additional guidance was provided by NUREG-0700 (Ref. 3) and Section 18.1, revision 0, of NUREG-0800 (Ref. 4). This report provides the results of the evaluation. Comments of the Nuclear Regualtory Commission (NRC) staff member responsible for evaluation of the PBNP DCRDR have been integrated into the report in order to represent the consolidated observations, conclusions, and recommendations of the NRC staff and its consultants (SAIC).

DISCUSSION

1. Establishment of a qualified multidisciplinary review team

The PBNP Program Plan states that the review team will provide the management oversight to ensure the fulfillment of program objectives and full compliance with NRC requirements. In addition, each of the DCRDR procedures contains sections which clearly define management responsibilities and coordination requirements. This follows the guidance provided in Subsection 2.2 of NUREG-0700.

The PBNP Program Plan contains a description of the review team organizational structure and resumes of all PBNP team personnel. The resumes of the human factors consultant (HFC) were not included in the Program Plan, since an HFC had not been selected at the time the report was written. However, the qualifications the HFC will be expected to meet were provided. The PBNP review team consists of:

1. Review team leader (nuclear engineer)
2. I&C Engineer
3. Nuclear plant engineer
4. Nuclear systems engineers (2)
5. Senior reactor operator
6. Human factors consultant (unspecified contractor)

Other specialists will be used to support the review team on an as-required basis. Those specialists will include personnel selected from the following groups:

1. Other Nuclear Systems Engineering and Analysis Section (NSEAS) personnel
2. PBNP Operations
3. PBNP Technical Services
4. Training
5. Licensing
6. Procedures Group

The disciplines identified for the review team structure are consistent with the guidance provided in Subsection 2.3 of NUREG-0700. Our review of the responsibilities and qualifications for the PBNP personnel indicate that qualified PBNP personnel were selected for the DCRDR. The minimum qualifications specified for the HFC are consistent with the guidance in Section 18.1, revision 0, of the Standard Review Plan, although the contractor had not been selected.

One concern related to the multidisciplinary review team involves staffing. Section 18.1, revision 0, of the Standard Review Plan provides guidance for technical task assignments by discipline. Participation of engineering and operations personnel in several review phase (execution phase in Wisconsin Electric's terms) activities is recommended. In apparent contrast, PBNP indicates that the HFC will be responsible for accomplishing most of those tasks alone. PBNP personnel will only be responsible for review and comment on the HFC's findings. In our judgment active participation of PBNP engineering and operations personnel appears essential to satisfactory completion of the systems function review and task analysis, control room inventory, verification of instrumentation, and validation of control room functions.

The PBNP Program Plan states that Wisconsin Electric does intend to have an orientation for the review team. It will consist of a human factors and Program Plan orientation. This should contribute to a successful completion of the DCRDR. However, inclusion of a plant orientation which will assist the HFC in the performance of their tasks is recommended by Section 18.1, revision 0, of the Standard Review Plan and would be appropriate for the PBNP DCRDR.

In summary, Wisconsin Electric has demonstrated general understanding and the intent to satisfy the Supplement 1 to NUREG-0737 requirement to establish a qualified multidisciplinary review team. However, the Program Plan description of the review team has produced two concerns. First, the HFC is given the responsibility for performing the review phase tasks of the DCRDR, while the PBNP team members are assigned the responsibility of checking the findings of the HFC. This suggests that the HFC alone, rather than the multidisciplinary review team will be performing most of the review

phase tasks. The second concern is that the Program Plan does not indicate that the HFC will receive a plant orientation.

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

Based on review of the PBNP Program Plan, it appears that the system function review and task analysis (SFRTA) has two purposes. They are:

1. "... to systematically identify and assess operator tasks, information, instrumentation, and control requirements for postulated accident conditions."

2. "... provide feedback regarding EOP (emergency operating procedure) compliance with specified writers guidelines."

Wisconsin Electric notes that plant-specific EOPs will be the starting point of the SFRTA process. Each operator task, information requirement, instrument requirement, and control requirement established in revision 1 of the Westinghouse Owners Group (WOG) generic Emergency Response Guidelines (ERGs) and background documentation, as well as plant-specific background documentation, will be analyzed. The Program Plan states that task data will be collected for the "steps" and "substeps" in both the "Action/Expected Response" and the "Response Not Obtained" columns of the EOPs. Task data will also be collected for any "Cautions or Notes" and any substeps not explicitly identified that may be part of a system/equipment operation. By using this approach, Wisconsin Electric should be able to correctly identify all operator tasks performed during PBNP emergency operations.

One omission from the PBNP data collection process is a description of how they will document repeated tasks such as verifying reactor trip. NUREG-0700, Subsection 3.4.2.4 provides "repeated task" guidance which states that "In many cases a set of operator tasks associated with the operator function/system interface will be identical for more than one sequence. In those cases, the analysis of the task requirements need not be repeated for each sequence." Consistent with that suggestion we recommend that PBNP develop a methodology for identifying and analyzing repeated

tasks. This will save PBNP time and effort while producing the required analysis of all operator tasks.

The PBNP Program Plan describes how the needed characteristics of each required instrument and control will be determined. An SFRTA data base will be developed. That data base will then be searched for all values/positions associated with the variables (e.g., pressurizer pressure) which must be monitored or controlled during emergency operations. The compilation of this data will be used to determine the needed ranges, positions, scale graduation, direct feedback, system/equipment response feedback, and backup or secondary indications of instruments and controls in the control room. It is our judgment that the proposed PBNP methodology will correctly identify the needed characteristics of required instruments and controls.

The PBNP Program Plan states that "An auditable record of how the needed characteristics were determined will be developed by preparing lists of EOPs steps, and substeps that are associated with each variable and maintaining a record of the display values and/or control requirements associated with the variable." In addition, the PBNP "SFRTA FORM" and the "NEEDED CHARACTERISTICS OF INSTRUMENTATION AND VERIFICATION OF INSTRUMENTATION FORM" will be part of the auditable record of how the needed characteristics were determined.

The Program Plan states that, "The HFC shall be responsible for reviewing each EOP and Attachments and completing the SFRTA form." The review team is responsible for reviewing the SFRTA data to verify that it is complete and that the needed characteristics have been identified. The HFC is also responsible for preparing a "Task Report" for review and approval by the remainder of the review team, the review team leader, and the General Superintendent, NSEAS. Finally, the project engineer in charge of EOP verification and validation will be notified of any discrepancies the SFRTA process identifies in the EOPs.

In summary, the PBNP SFRTA methodology indicated an understanding and intent to satisfy the requirement in Supplement 1 to NUREG-0737. The stated purpose of the SFRTA conforms to the requirements of Supplement 1 to NUREG-0737. The procedures for data collection and data analysis indicate that the SFRTA can identify required tasks as well as information and control

needs. However, our review did identify several concerns. The first is that persons with direct knowledge of PBNP systems and operations appear to have only a review function. The HFC, who will probably be much less familiar with PBNP, will do the day-to-day work of the SFRTA. In our judgment, regular participation of plant operations and engineering personnel may enhance the quality of the SFRTA. Another concern is that Supplement 1 to NUREG-0737 requires EOP development to be based on a process which identifies operator tasks, and information and control needs (i.e., a task analysis). Wisconsin Electric appears to propose the reverse process (i.e., a task analysis which follows EOP development). Given this situation, the Supplement 1 to NUREG-0737 DCRDR requirement can only be satisfied if EOPs developed for PBNP are complete and technically adequate. Based on its citation of an April 5, 1984 memo from H.B. Clayton to D.L. Ziemann (NRC Procedures and Systems Review Branch), Wisconsin Electric appears to understand this position. Review of the PBNP Procedures Generation Package (PGP) by the Procedures and Systems Review Branch may result in changes to the PGP (and ultimately to the EOPs) to assure that procedures are complete and technically adequate. Feedback to the EOP project engineer from the SFRTA may also result in revised procedures. To the extent that the final plant-specific EOPs differ from those used in the SFRTA, the task analysis supporting the DCRDR should be redone. Finally, we do recommend that the SFRTA procedures include a specific methodology for documenting and analyzing repeated tasks.

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

The PBNP Program Plan describes several tasks related to this element of the DCRDR. They are:

1. A control room inventory
2. A verification of instrumentation
3. A validation of control room functions

The PBNP Program Plan states that, "The purpose of the inventory is to provide a data base against which the needed characteristics of instruments and controls identified in the SFRTA can be verified in terms of the presence of appropriate instruments and controls in the control room and the

human factors suitability of the existing instruments and controls." This conforms to the objective of the control room inventory as described by guidance in Subsection 3.5.1 of NUREG-0700.

The Program Plan states that the information source for the inventory will be the "mockup or actual control boards" when required. This conforms to guidance provided in Subsection 3.5.3 of NUREG-0700 which recommends that a photograph mosaic be used to prepare much of the inventory outside of the control room.

The responsibility for conducting the control room inventory has been assigned to the HFC, with review responsibilities assigned to the rest of the review team. This provides a pre-defined check of the completeness and accuracy of the HFC's inventory results. The documentation will consist of completed inventory forms. These forms contain entry spaces for: Panel, Seq. No., Type C/D, Nameplate Data, I.D. Number, Loc., Range/Positions, and Graduations/Control Precision. As recommended in Subsection 3.5.2 of NUREG-0700, the PBNP form is designed to be readily compared to the requirements derived from the Task Analysis activity. The final review and approval for the inventory will rest with the PBNP Review Team Leader and the General Superintendent, NSEAS. This is consistent with the other DCRDR activities.

Subsection 3.5.5 of NUREG-0700 recommends that the inventory staff include or have access to one or more nuclear systems engineers and instrumentation and control engineers. This staffing is recommended in order to provide personnel familiar with the nomenclature of functions of (1) plant process equipment systems, (2) control room instruments, and (3) control room equipment necessary to perform the inventory. We are therefore concerned that neither a nuclear systems engineer nor an instrumentation and control engineer appear to be available to the HFC.

The PBNP Program Plan indicates that the objective of the verification of instrumentation is to determine the availability and the suitability of existing instrumentation and controls for satisfying the needs identified in the SFRTA. That objective is consistent with the objectives for the verification of task performance capabilities described in Subsection 3.7.1 of NUREG-0700. The information source for instrument and control data will be the control room inventory. This corresponds to the guidance provided in

Subsection 3.7.2.1 of NUREG-0700. The Program Plan also indicates that this activity will identify "instruments/controls that (1) display system response information after a control action, (2) may serve as an alternate display of information, or (3) may serve as an alternative control action."

The PBNP Program Plan indicates that human engineering suitability will be determined by comparing the needed characteristics associated with task requirements to existing instrument/control characteristics. The Program Plan calls for evaluating human engineering suitability in terms of component level characteristics. With regard to documentation, the "NEEDED CHARACTERISTICS OF INSTRUMENTATION AND VERIFICATION OF INSTRUMENTATION FORM" which is included in the Program Plan is compatible with the "SFRTA FORM" and the "INVENTORY FORM." The verification of instrumentation will result in a list of human engineering discrepancies (HEDs) that includes missing and unsuitably human engineered instruments and controls. This conforms to the guidance provided in Subsection 3.7.4 of NUREG-0700.

The Program Plan indicates that the HFC is responsible for identifying both the availability and suitability of the instrumentation and controls, while the remainder of the review team provides only a review and confirmation of HEDs identified during the verification process. It is our judgment that the proposed staffing would diminish the contributions of the experienced operator on the PBNP review team. Subsection 3.7.5 of NUREG-0700 suggests that "At least one member of the team be an experienced control room operator, familiar with the particular control room." The experienced operator has a knowledge of the plant systems and control room instruments and controls that the HFC does not possess.

The PBNP Program Plan states that the purpose of validating control room functions is to determine whether the control room's physical and organizational design has been integrated so that the functions allocated to the control room operating personnel during postulated accident conditions can be accomplished effectively. Validation of control room function is not specifically required by Supplement 1 to NUREG-0737, but guidance for the validation process is provided in NUREG-0700. The purpose stated by PBNP for the validation of control room function is consistent with the guidance provided in Subsection 3.8.1 of NUREG-0700. Satisfaction of that purpose

should enhance the results of the comparison of display and control requirements with the control room inventory.

The PBNP Validation procedures follow the guidance provided in Subsection 3.8.2 of NUREG-0700. The proposed events to be used for the PBNP validation are even more extensive than the minimum list recommended by NUREG-0700. The PBNP validation procedure includes a set of criteria to be used for the data analysis. The criteria include a list of specific questions relating to panel layout and control display integration. HEDs will be identified as the result of this process. It is our judgment that the PBNP Validation methodology can be used to thoroughly evaluate the adequacy of the control room from the perspective of integrated functional requirements.

The validation of control room function will be coordinated with the EOP validation and verification effort. However, the Program Plan does not address the issue of control room validation after procedure corrections have been made. We recommend that the review team re-perform the validation control room function using any revised procedures in order to confirm the adequacy of the physical and organizational design of the control room.

As in the control room inventory and verification of instrumentatic tasks, PBNP indicates that the HFC will be responsible for all aspects of the validation of control room function task. Subsection 3.8.5 of NUREG-0700 recommends that the staffing for the validation of control room function be the same as the verification of control room capability (i.e., instrumentation) task. We are concerned that the remainder of the review team, the review team leaders, and the General Superintendent, NSEAS only have review and approval responsibilities with respect to the validation of control room functions.

In summary, our evaluation of the PBNP plan for comparison of display and control requirements with a control room inventory included review of the methodologies for control room inventory, verification of instrumentation, and validation of control room functions. The PBNP procedures for these activities indicate that the DCRDR can produce the results required by Supplement 1 to NUREG-0737. However, we are concerned about the staffing for these activities because PBNP personnel are not included with the HFC in

the actual execution of the review. As a result, we suggest that the PBNP Review Team Members be included as participating team members, along with the Human Factors Consultant. In addition, we are concerned that EOPs may be revised as the result of NRC review of the PGP or feedback from the SFRTA. Control and display requirements derived from analysis of the revised EOPs should be compared against the control room inventory.

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

The PBNP Program Plan states that, "The purpose of the survey will be to compare the design features of the existing control room with applicable human engineering design guidelines." This is consistent with the guidance provided in Subsection 3.6.1 of NUREG-0700.

In terms of staffing, the PBNP Program Plan states that the actual survey along with its extensive documentation requirements will be conducted by members of the review team directed by the HFC. The disciplines thus represented are consistent with guidance provided in Subsection 3.6.5 of NUREG-0700. The final responsibility for the survey task rests with the Review Team Leader and the General Superintendent, NSEAS. This is consistent with the PBNP DCRDR tasks.

The Program Plan states that the survey will be conducted in both the full-scale mock-up and in the PBNP control room, as appropriate, and in a manner that will minimize distractions to the operators, yet ensure a complete and effective survey. It is our judgment that the use of the full-scale mock-up for the survey will contribute significantly to the systematic survey of all instruments and controls in the control room.

The PBNP Program Plan also states that the survey checklists will be compiled from the "CRDR Survey Development Guideline -- INPO 83-042" prepared by the Nuclear Utility Task Action Committee (NUTAC) on Control Room Design Review and from NUREG-0700. The NUTAC document has been reviewed by the NRC. Findings of that review are presented in an NRC letter dated April 11, 1984 (Reference 5). The NRC letter states that in too many cases the principles, as presented in Section 6 of NUREG-0700, have been "dropped, relaxed, or put off to other undefined portions of the DCRDR." We compared

the sample checklists provided in the program plan to INPO 83-042 and NUREG-0700 guidance (see Appendix). That comparison indicated almost total reliance on INPO 83-042 in preparation of the PBNP checklists. As shown in the Appendix, the PBNP survey section headings, item designations, and item descriptions correspond to those in INPO 83-042 rather than to NUREG-0700. Furthermore, the checklists presented in the Program Plan are a condensed and edited version of those in INPO 83-042. Many items have been omitted while others have been modified or shortened. Our comparison indicated that the survey checklists, in their present form, will not produce results that would satisfy the survey requirements in Supplement 1 to NUREG-0737.

As stated in the PBNP Program Plan, the human factors consultant will be responsible for ensuring that: (1) all survey items are measurable; (2) no significant evaluation criteria from NUREG-0700 Section 6.0 have been omitted; and (3) any redundant or nonessential items are eliminated from the survey. Accomplishment of these tasks would possibly result in completion of a control room survey that would satisfy the requirements of NUREG-0737. However, the current degree of reliance on INPO 83-042 will probably not result in successful completion of the survey activity.

In summary, the objectives of the control room survey task conform to the guidance provided in NUREG-0700 as does the overall management responsibilities and proposed staffing. The use of the full-scale mock-up should contribute significantly to a thorough and complete effort. One concern is that current checklists, which rely heavily on INPO 83-042 will probably not result in successful completion of this task.

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

The PBNP Program Plan (Table 5-1, Level of Participation Summary) indicates that the HFC, I&C Engineer, Senior Reactor Operator, and Nuclear Systems Engineer will be participating as workers in the HED evaluation task. It is our judgment that this multidisciplinary staffing is appropriate for the assessment of HEDs.

The descriptions of the methodologies for the assessment and categorization of HEDs are presented in Sections 4.3.3 through 4.3.5 of the Program

Plan. Essentially, the assessment includes screening of HEDs, categorization of HEDs, and error analysis. The outcome of these processes will be a sorting out of "invalid" HEDs and a prioritization of valid HEDs in terms of scheduling of their resolutions.

The screening process considers each HED identified. HEDs that have been identified as having caused problems in the past will be judged valid. Each HED that has not been identified as having caused problems in the past, will then be screened to determine whether or not it is valid. Rationales for finding HEDs invalid will be documented. Although some general criteria for exclusion of HEDs from future consideration are provided, it is not clear what specific factors will be used to assess the discrepancies for their potential plant safety consequences. There is no discussion as to whether cumulative and interactive effects with other HEDs is planned. Section 18.1, revision 0, of the Standard Review Plan recommends determining the effect of each HED on operator performance, both alone and in combination with other HEDs.

HEDs identified as having caused problems in the past and those deemed valid from the screening process will then be assessed for safety consequences in terms of impact on operations. Each HED will be categorized as: (1) one that caused or may cause/contribute to an operator error related to accident conditions; (2) one that caused or may cause/contribute to operator error that resulted in a violation of a Technical Specification; or (3) one that caused or may cause/contribute to operator error unrelated to accident conditions or Technical Specification violation.

This may be a feasible categorization scheme for assessing HEDs but it assumes that HEDs that could lead to an accident can be differentiated from HEDs that could simply lead to a violation of Technical Specifications. It also assumes that each of the above is of lesser importance in terms of schedule for correction than HEDs that have actually caused operator errors. Wisconsin Electric has not documented assessment factors that will be used in the categorization process and has provided little description of the method that will be used in applying those factors to the assessment process in order to prioritize HEDs.

Wisconsin Electric has also proposed the use of an error analysis which will contribute to the scheduling of an HED's resolution. This analysis will determine if the operator is made aware of an error before system or operator performance degradation occurs. It will also result in assessment of potential errors associated with an HED to determine if the system will self-correct. Although this assessment may help differentiate HEDs in terms of safety consequences and may impact HED resolution scheduling, the process to conduct the analysis has not been described sufficiently to evaluate its utility.

Overall, the proposed staffing for the assessment of HEDs is appropriate. The management for the task lies with the review team leader. This is consistent with other PBNP DCRDR activities. The PBNP methodology does represent an approach for systematically assessing the effects of the HEDs on the operators' ability to perform necessary tasks and considers the resultant consequences of an error on plant safety. However, it is unclear how the review team will categorize HEDs as accident or technical specification related and how HEDs will be prioritized within categories. Furthermore it is unclear as to whether assessment of the aggregate effect of HEDs is proposed. This is important in that aggregate effect of HEDs could affect operator performance with resulting safety consequences (despite the fact that on an individual basis the HEDs might not have safety consequences).

6. Selection of design improvements

The PBNP Program Plan (Table 5-1, Level of Participation Summary) indicates that the HFC, I&C Engineer, Senior Reactor Operator and Nuclear Systems Engineer will participate as workers in the selection of design improvement. It is our judgment that this represents an appropriate multidisciplinary team structure for this activity.

The management responsibility for the selection of HED resolutions rests with the Review Team Leader. This is consistent with the other PBNP DCRDR activities.

The PBNP Program Plan does not provide a comprehensive methodology for the actual selection of HED resolutions. However, it does note that

proposed corrective techniques will include training, procedural change, surface enhancements, design changes, use of the Safety Assessment System (SAS) or a combination of these mechanisms. As part of the selection of design improvement process, Wisconsin Electric proposes an assessment to determine the relative cost of implementing the design solution for each of the HEDs and evaluating costs in terms of the consequences of the potential errors associated with the HED. A cost/benefit analysis may be appropriate to differentiate between proposed design improvement alternatives. However, we are concerned that the cost/benefit analysis will be used to decide whether or not an HED should be corrected. In our judgment, failure to obtain a favorable cost/benefit ratio is not sufficient justification to leave an HED uncorrected.

The selection of design improvements process should ensure a consistent, coherent, and integrated control room interface with operators. We are concerned that selection of design improvements using a HED-by-HED approach may result in piecemeal corrections. There are several means for reducing the above concern. One example is developmert of design conventions (e.g., a labeling convention or control room-wide color convention) which will be applied throughout the control room and remote shut-down panel (and other operator stations if desired). A second example is to take the fullest advantage of mock-up techniques to refine the total correction package.

In summary, the PBNP staffing for the selection of HED resolutions will include the appropriate multidisciplinary team members. The management of the task is consistent with the other DCRDR activities. Possible HED resolutions will be in the form of training, procedural changes, surface enhancement, design changes, SAS modifications, or a combination of these mechanisms. A cost/benefit analysis could facilitate the selection of HED resolutions where alternatives have been developed but should not be the sole basis for decidiing whether or not an HED should be corrected. It is recommended that PBNP develop a methodology for avoiding piecemeal corrections of HEDs during the selection of design improvements.

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

The PBNP Program Plan (Table 5-1, Level of Participation Summary) indicates that this activity will be staffed by the review team leader, HFC, I&C engineer, senior reactor operator, nuclear engineer, and technical assistance as required. This is judged to be the appropriate multidisciplinary team for this activity.

The Program Plan did not contain a procedure for this activity. However, the Program Plan did state that "Before any changes are approved, proposed modifications will be evaluated to determine their effectiveness." In addition, PBNP states that before any changes are made, even small-scale changes, a review by operations personnel will be obtained. This indicates the intent to satisfy the requirement in Supplement 1 to NUREG-0737, but we are concerned that no mechanism for accomplishing the task was described.

The management responsibility for this task rests with the Review Team Leader. This is consistent with the other DCRDR tasks.

8. Verification that improvements will not introduce new human engineering discrepancies

The PBNP Program Plan (Table 5-1, Level of Participation Summary) indicates that this activity will be staffed by the review team leader, HFC, I&C engineer, senior reactor operator, nuclear systems engineer, and technical assistance as required. This is judged to be the appropriate multidisciplinary team for this activity.

The Program Plan did not include a procedure for this task. However, the Program Plan did state that "Before any changes are approved, proposed modifications will be evaluated to determine their effectiveness and to ensure that new HEDs do not result." This statement indicates the intent to satisfy the requirement in Supplement 1 to NUREG-0737, but we are concerned that no mechanism for accomplishing the task was described. Formal mechanisms for accomplishing this element and the one previously discussed are expected as part of the DCRDR. Those mechanisms may incorporate techniques such as: partial re-surveys of control panels, walkthrough/talkthroughs on

improved panels, environmental surveys, and operator interviews. Use of the full-scale mock-up is recommended.

The management responsibilities for this task rest with the Review Team Leader. This is consistent with the other DCRDR activities.

9. Coordination of control room improvements with changes resulting from other programs such as the safety parameter display system, operator training, Reg. Guide 1.97 instrumentation, and upgraded emergency operating procedures

During the PBNP DCRDR, determination of HEDs and the implementation of corrective actions will be coordinated with Wisconsin Electric programs to: (1) upgrade emergency operating procedures; (2) install the SAS which would integrate the requirements of the safety parameter display system (SPDS), some aspects of Reg. Guide 1.97 instrumentation, and emergency response facility plant data requirements; and (3) improve operator training. Procedural modifications, the SAS and its enhancements, and training will be considered as approaches to correcting HEDs identified during the DCRDR. The improvement programs and their complex interfaces are described by the licensee on page 3-11 of the program plan. Additional information and tentative program schedules have been submitted (Ref. 6).

As an example of coordination, the WOG ERGs will serve as the starting point for EOP development and will be closely integrated with the DCRDR. Interfaces will occur during the SFRTA the verification of instrumentation, and the validation of task performance capabilities. To facilitate coordination the project engineers for the DCRDR and the EOP effort are both in the Nuclear Systems Engineering and Safety Analysis Section.

The DCRDR also will interface with the Reg. Guide 1.97 effort. Outputs from the SFRTA will be submitted for review for impact on the evaluation of instrumentation for Type A variables. Also Reg. Guide 1.97 instrumentation requirements will be considered in evaluating HEDs and scheduling corrective actions.

In summary, the PBNP Program Plan has described a methodology for coordinating the DCRDR results with control room improvements resulting from other programs such as SPDS, operator training, Reg. Guide 1.97 instrumentation and upgraded EOPs. As a result, we have concluded that PBNP should satisfy the DCRDR coordination requirement in Supplement 1 to NUREG-0737.

10. Other

Review of Operating Experience

A review of operating experience is not explicitly required by Supplement 1 to NUREG-0737. However, it is an activity recommended by NUREG-0700 guidelines as contributing to the accomplishment of review phase activities.

As described in the Program Plan, review of operating experience will include: (1) a review of plant-specific documentation including "SOEs" and Licensee Event Reports (LERs); and (2) the organization of information on actual and potential operational errors from operating personnel through questionnaire administration and conduct of interviews. Such activities are consistent with guidelines in NUREG-0700.

To accomplish the review of plant operating history, guidelines and criteria have been developed for analyzing SOEs and LERs in order to identify instances of control room operation or design deficiencies that may have resulted in reported events at PBNP. Findings from this analysis will be documented for further consideration in subsequent DCRDR activities.

The PBNP operator survey effort entails distribution of a confidential, self-administered questionnaire to operations personnel, including Duty Shift Supervisors, Duty Technical Advisors, Operating Supervisor, and Control Operators, which should ensure a representative sampling of operations staff. The survey questionnaire itself will consist of statements to which respondents will indicate the need for eliminating the problem using a 5-point scale. Space will be provided to encourage respondents to provide specific details about each problem statement.

As some respondent-provided or historical document information relevant to operator experience may need to be clarified, follow-up interviews may be conducted by the human factors consultant with selected operating personnel. If there is no need for interviews, they will not be conducted.

In summary, Wisconsin Electric has proposed an extensive operating experience review which should enhance the DCRDR. Consistent with NUREG-0700 guidelines and objectives, it entails a systematic examination of plant-specific documents. Questionnaires which are structured as well as open-ended will be administered to operating personnel. To ensure that questions are simple, clear and objective, it is recommended that the questionnaire be pretested. We also recommend a plan for analysis of open-ended responses to questions be developed. If need be, trained staff will also conduct interviews with selected respondents. We recommend that interview protocols be developed for use in the conduct of semi-structured rather than structured interviews.

PBNP DCRDR Summary Report

The Program Plan indicates that the PBNP DCRDR Summary Report will contain the following items:

1. Summary of the Review Process.
2. Listing and description of all HEDs.
3. Listing and descriptions of all HED resolutions.
4. Implementation schedule for HED resolutions.
5. Listing and justification descriptions for HEDs left uncorrected or partially corrected.
6. Descriptions of deviations from the DCRDR methodology that appeared in the Program Plan.

It is our judgment that the PBNP Summary Report should contain all of the necessary elements to evaluate the PBNP conformance to the DCRDR requirement in Supplement 1 to NUREG-0737.

CONCLUSIONS

The PBNP program plan addressed all of the DCRDR requirements stated in Supplement 1 to NUREG-0737. Information in the program plan indicated understanding and intent to satisfy most of the requirements. The review did, however, identify some concerns. Those concerns were:

1. Except for the survey activity, the HFC will be performing all of the review tasks without the rest of the review team's active participation. The role of the rest of the review team is reduced to reviewing the results of the HFC.

2. There is no indication in the Program Plan that the HFC will receive a plant orientation prior to the DCRDR.

3. The Program Plan does not address the DCRDR review team validation of EOPs that are revised as a result of the Validation activity.

4. The use of NUTAC Control Room Survey guidelines for the Survey Activity should be reconsidered in light of the April 11, 1984 NRC position paper (Reference 5) on NUTAC guidance. That is, the NRC has determined that in many cases, the principles, as articulated in Section 6 NUREG-0700, have either been dropped, relaxed, or put off to other undefined portions of the DCRDR by the NUTAC Guidance. Our review of the Survey Checklists included in the Program Plan showed that they relied very heavily on the NUTAC.

5. The PBNP Program Plan does not describe how the aggregate effects of HEDs will be assessed.

6. The PBNP Program Plan assessment methodology does not describe what criteria will be used to determine the accident related potential of an HED.

7. The PBNP Program Plan does not provide a methodology to show how design improvements will be selected in an integrated fashion.

8. The PBNP Program Plan does not contain a methodology for the verification that selected design improvements will provide the necessary corrections.

9. The PBNP Program Plan does not contain a methodology for the verification that improvements will not introduce new HEDs.

Resolution of the above concerns would increase the benefits of the DCRDR.

Several recommendations also resulted from the program plan review. The recommendations are not intended as additional requirements. They are intended to encourage the fullest possible benefit from the DCRDR. They do not appear to require major changes to the current organization and process of the DCRDR. Those recommendations are:

1. Inclusion of a specific methodology for documenting and analyzing repeated tasks in the SFRTA.

2. To take the fullest advantage of mock-up techniques to refine the total correction package.

3. Pretesting of the questionnaire.

4. Development of a plan for analyzing open-ended responses.

5. Development of protocols for conduct of semi-structured rather than structured interviews.

Based on our review of the Program Plan, an in-progress audit of the PBNP DCRDR is recommended. A list of proposed agenda topics is provided in the following section.

PROPOSED AGENDA TOPICS FOR AN IN-PROGRESS AUDIT

The main purpose of the in-progress audit is to obtain information which will aid evaluation of the organization, process, and results of the DCRDR. A second purpose is to provide a constructive critique which can lead to improvement of the DCRDR. The following topics should be addressed:

1. Evaluation of allocation of staffing resources in the review phase of the DCRDR.

2. Verification of the adequacy of the control room survey.

3. Evaluation of the PBNP assessment methodology.

4. Evaluation of PBNP methodology for selection of design improvements.

5. Evaluation of PBNP methodology for verifying that selected design improvements provide the necessary design corrections.

6. Evaluation of PBNP methodology for verifying that the design improvements do not introduce new HEDs.

REFERENCES

1. Point Beach Nuclear Plant Control Room Design Review Program Plan, Wisconsin Electric Power Company, July 31, 1984.

2. NUREG-0737, "Clarification of TMI Action Plan Requirements," United States Nuclear Regulatory Commission, November 1980; Supplement 1, December 1982.

3. NUREG-0700, "Guidelines for Control Room Design Review," United States Nuclear Regulatory Commission, September 1981.

4. NUREG-0800, "Standard Review Plan for the Review of Safety Analysis Reports for Nuclear Power Plants," Section 18.1, revision 0, United States Nuclear Regulatory Commission, September 1984.

5. Letter from Voss A. Moore, Chief, Human Factors Engineering Branch, Division of Human Factors Safety, Office of Nuclear Reactor Regulation, United States Nuclear Regulatory Commission, to H. C. Fish, Jr., Chairman, CRDR NUTAC, April 11, 1984.

6. Letter from C.W. Fay to H.R. Denton. Subject "Additional Information Generic Letter 82-33, Schedule Requirements for Control Room Design Review, Point Beach Nuclear Plant, Units 1 and 2," May 3, 1984.

Point Beach, Units 1 and 2
TAC Numbers 51190/51191
SAIC/1-263-07-351-53/54
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APPENDIX

SAIC COMPARISON OF PBNP CONTROL ROOM SURVEY CHECKLISTS TO NUTAC AND NUREG-0700 SURVEY GUIDELINES

1. Comparison of PBNP Survey Checklists with NUTAC

NUTAC Categories

*Overview Checklist

NUTAC Questions omitted from PBNP Checklists

OC-10, OC-11, OC-13
OC-14, OC-15, OC-16
OC-17, OC-18, OC-20
OC-21, OC-22, OC-23

*Operator-assisted Checklist

Complete + couple of extra.

*Labeling, Mimics, Demarcation Checklist

Complete + extra

*General Panel Checklist

Missing G-3, G-4, G-5, G-6, G-7, G-8, G-9, G-10, G-11, G-12

*C-R Computer Checklist

Missing CRCC-29, 30

*General Survey

G-10, 11, 12, 13, 14 missing

*Anthropometric Survey

Changed AS-19 (less stringent than NUTAC)

*Annunciator Survey

No discussion of test procedures.
Also missing CS-5 and list of words.

*Abbreviation and Acronym Survey

Missing

*Color Code

Same - not consistent with 0700

*Control Room Computer Survey

Changed CRCS-1 (less specific than 0700)
Changed CRCS-3 (less specific than 0700)
Changed CRCS-4 (less specific than 0700)
Missing CRCS-5

2. Comparison of Display Section (6.5) of NUREG-0700 and PBNP Survey Checklists

0700 Section not covered by PBNP version of NUTAC documents

Not covered by PBNP	Covered by Engineering Operator Questionnaire (may be subjective)
6.5.1.2.E	6.5.1.1.1.E1
6.5.1.4.B	6.5.1.1.1.E2
6.5.1.4.C	6.5.1.1.1.F
6.5.1.5.B	6.5.1.2.A
6.5.1.5.C	6.5.1.2.B
6.5.1.5.F	6.5.1.2.C
6.5.1.6.A	6.5.1.2.D.1
6.5.1.6.B.1,2	6.5.1.2.D.2
6.5.1.6	6.5.1.2.D.3
6.5.1.6.E.1	6.5.1.2.E
6.5.2.2.A.1	
6.5.2.3.A,B	
6.5.3.1.A,1.2.3	
6.5.3.1.C.1,2	
6.5.3.1.D	
6.5.3.2.A.1	
6.5.5.1.A.3	
6.5.5.1.C.1	
6.5.5.2.B	

3. PBNP modified from NUTAC and less explicit than Section 6.5 in NUREG-0700.

0700

6.5.1.3.C.2
6.5.1.6
6.5.1.4.a,1,2
6.5.1.4.e
6.5.1.4.F
6.5.1.5.E
6.5.1.6.C.1,2
6.5.1.6.D.1,2,3
6.5.1.6.E.2
6.5.2.3.C
6.5.3.1.B
6.5.3.2.A.2,3
6.5.3.2.B
6.5.3.3.A.1,3
6.5.3.3.B.1,3,6
6.5.3.3.D
6.5.4.1.A,D,E,F,G,H,I,J,K
6.5.4.2.A.1,2
6.5.4.2.B,1,3,4
6.5.5.1.B.1,3