May 23, 1985

Docket No. 50-336

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Mr. John F. Opeka
Senior Vice President
Northeast Nuclear Energy Company
P. O. Box 270
Hartford, Connecticut 06141

Dear Mr. Opeka:

SUBJECT: DETAILED CONTROL ROOM DESIGN REVIEW PROGRAM PLAN FOR MILLSTONE UNIT 2

The NRC staff has reviewed your Implementation Plan (Program Plan) for conducting the Detailed Control Room Design Review (DCRDR) at Millstone Unit 2. The enclosure contains our comments on your Program Plan. Since our approval of this Program Plan is not required, you have initiated work on the DCRDR and will submit a Summary Plan no later than September 26, 1986. We will provide a Safety Evaluation addressing the adequacy of the DCRDR approximately 3 months after submission of your summary report.

We have several concerns as outlined in the enclosure. You will be contacted within the next week by the NRC project manager for setting up a meeting at Millstone 2 to discuss these concerns and to ensure that you are proceeding with a satisfactory DCRDR. The suggested agenda for the meeting is contained on pages 22-25 of the enclosure.

Sincerely,

Original signed by

E. G. Tourigny, Acting Chief
Operating Reactors Branch #3
Division of Licensing

Enclosure:
As stated

cc w/enclosure
See next page

ORB#3:DL	ORB#3:DL	ORB#3:DL
PKreutzer	DOsborne:dd	JRMiller
5/23/85	5/23/85	5/23/85

Gerald Garfield, Esq.
Day, Berry & Howard
Counselors at Law
City Place
Hartford, Connecticut 06103-3499

Regional Administrator
USNRC, Region I
Office of Executive Director for
Operations
631 Park Avenue
King of Prussia, Pennsylvania 19406

Mr. Charles Brinkman, Manager
Washington Nuclear Operations
C-E Power Systems
Combustion Engineering, Inc.
7910 Woodmont Avenue
Bethesda, Maryland 20814

Mr. Lawrence Bettencourt, First Selectman
Town of Waterford
Hall of Records - 200 Boston Post Road
Waterford, Connecticut 06385

Northeast Utilities Service Company
ATTN: Mr. Richard R. Laudenat, Manager
Generation Facilities Licensing
Post Office Box 270
Hartford, Connecticut 06101

Arthur Heubner, Director
Radiation Control Unit
Department of Environmental
Protection
State Office Building
Hartford, Connecticut 06116

Mr. John Shedlosky
Resident Inspector/Millstone
Box 811
Niantic, CT 06357

Office of Policy & Management
ATTN: Under Secretary Energy
Division
80 Washington Street
Hartford, Connecticut 06115

Mr. Wayne D. Romberg
Superintendent
Millstone Nuclear Power Station
P. O. Box 128
Waterford, Connecticut 06385

Mr. Edward J. Mroczka
Vice President, Nuclear Operations
Northeast Nuclear Energy Company
P. O. Box 270
Hartford, Connecticut 06101

ENCLOSURE

NUCLEAR REGULATORY COMMISSION

STAFF COMMENTS

ON THE MILLSTONE 2

DETAILED CONTROL ROOM DESIGN REVIEW

PROGRAM PLAN

BACKGROUND

Licensees and applicants for operating licenses shall conduct a Detailed Control Room Design Review (DCRDR). The objective is to "improve the ability of nuclear power plant control room operators to prevent accidents or cope with accidents if they occur by improving the information provided to them" (NUREG-0660, Item I.D.). The need to conduct a DCRDR was confirmed in NUREG-0737 and Supplement 1 to NUREG-0737. DCRDR requirements in Supplement 1 to NUREG-0737 replaced those in earlier documents. Supplement 1 to NUREG-0737 requires each applicant or licensee to conduct a DCRDR on a schedule negotiated with the Nuclear Regulatory Commission (NRC).

Northeast Nuclear Energy Company (NNECO) submitted a DCRDR Program Plan for Millstone 2 by letter dated February 26, 1985. The Program Plan was reviewed against the requirements of Supplement 1 to NUREG-0737 and the additional guidance provided in NUREG-0700 and NUREG-0800. Consultants from Science Applications International Corporation (SAIC) assisted the staff in the review. The results of their review are enclosed. The staff agrees with the technical content and conclusions of the contractor's report.

The Program Plan for Millstone 2 does not indicate that the equipment and tasks necessary for remote shutdown will be included in the scope of the Millstone 2 DCRDR. The staff recommends that a human factors evaluation of the remote shutdown capability provided to meet 10 CFR Part 50, Appendix A, GDC-19 and 10 CFR Part 50, Appendix R be conducted to assure an adequate scope of the DCRDR. To the extent practicable, without delaying completion of the DCRDR, the NRC staff recommends that the DCRDR address any control room modifications and additions (such as controls and displays for inadequate core cooling and reactor system vents) made or planned as a result of other post-TMI actions, as well as the lessons learned from operating reactor events such as the Salem ATWS events. Implications of the Salem ATWS events are discussed in NUREG-1000 and required actions are described in Section 1.2, "Post Trip Review - Data and Information Capability," of the enclosure to Generic Letter 83-28.

CONCLUSIONS

From its review of the Millstone 2 Program Plan, the staff believes that a DCRDR is planned that generally meets the intent of Supplement 1 to NUREG-0737. However, the Program Plan does not reflect the level of understanding necessary to successfully complete all DCRDR activities and meet the requirements of Supplement 1 to NUREG-0737. Concerns identified are

summarized below. A more detailed discussion is provided in the attachment to this report.

Review Team

The qualifications and multidisciplinary nature of the review team seem good. However, the Program Plan should include the following:

a. Identify the Human Factors consultant and his role and the identities and expertise of other consultants.

b. Identify the person(s) responsible for the final approval and sign-off of HED resolutions.

c. Explain the exclusion of a nuclear engineer from the Core Review Team.

d. Detail the levels of efforts of the DCRDR participants.

e. Provide details regarding the methods and duration of instructions during the review team orientation.

Function and Task Analysis

The Program Plan lacks sufficient, detailed information regarding the proposed Function and Task Analysis for an adequate evaluation of this activity.

The following should be addressed by NNECO:

a. What specific event scenarios will be covered by the CEOG EPGs.

b. The personnel and their qualification involved in identifying and analyzing deviations from the CEOG EPGs.

c. The task analysis methodology used to identify parameters and other information and control needs.

d. The Task Data Forms lack the necessary space for recording information and control requirements resulting from the Function and Task Analysis.

Comparison of Display and Control Requirements With a Control Room Inventory

The methodology described by NNECO appears adequate. However, the success of this activity depends upon the adequacy of the Task Analysis.

Control Room Survey

The Control Room Survey appears acceptable, but the discussion of the Control Room Survey should address the following concerns:

a. Use of other guidelines besides NUREG-0700

b. Human factors staffing and their role in the survey

c. "Classification" in reference to documenting core team member opinions

d. Means for addressing all dynamic criteria in NUREG-0700 (and other guidelines).

Assessment of HEDs

The description of the HED assessment lacks detailed information and as outlined does not meet the requirements of Supplement 1 to NUREG-0737 for the reasons detailed in the attached report. In addition, it appears from Figure 6 of the Program Plan that the assessment activity which evaluates the HEDs ends before the task analysis has been completed and the resultant HEDs identified.

Selection of Design Improvements

The Program Plan provides a listing of a variety of ways for selecting design improvements. NNECO should identify and submit to the NRC for review which methodology will be used in the selection of design improvements as well as the criteria upon which NU management will base its decisions for approval.

Verification of Design Improvements

The Program Plan does not address the methodology and criteria of verifying that design improvements provide the necessary correction and do not introduce new HEDs.

Coordination With Other Programs

The coordination of activities as described in the Program Plan is acceptable. However, NNECO does not identify who is responsible for the integration of changes and what mechanism is available to process these changes.

Summary

Overall, thc Northeast Nuclear Energy Company Program Plan demonstrates its intent to comply with the requirements of Supplement 1 to NUREG-0737. However, in view of the foregoing concerns, we recommend that a meeting be held between the licensee and the NRC to discuss our review of Millstone 2 Program Plan.

DCRDR PROGRAM PLAN EVALUATION
FOR THE NORTHEAST NUCLEAR ENERGY COMPANY
MILLSTONE NUCLEAR POWER STATION
UNIT NO. 2

Science Applications International Corporation (SAIC) has evaluated the Program Plan for conducting a Detailed Control Room Design Review (DCRDR) submitted by the Northeast Nuclear Energy Company (NNECO) for the Millstone Nuclear Power Station, Unit No. 2 (MP2). The purpose of the evaluation was fourfold: (1) to determine whether the plan would lead to a successful review; (2) to recommend to the NRC whether a meeting with the utility representatives or an in-progress audit should be conducted; (3) to provide a meeting or audit agenda where appropriate; and (4) to provide a basis for constructive feedback to the Northeast Nuclear Energy Company. The specific document reviewed is listed as Reference 1.

The evaluation was conducted relative to the requirements of Supplement 1 to NUREG-0737 (Reference 2). Additional guidance was provided by NUREG-0800 Section 18.1 (Reference 3), NUREG-0700 (Reference 4), and the NRC Memorandum documenting the NRC's conclusions on the Combustion Engineering Owners Group Task Analysis (Reference 5).

The Program Plan submitted by NNECO consists of an Executive Summary followed by 45 pages of plan description, supplemented by five appendices. The Program Plan is comprised of 11 Sections. The first section is an introduction. Section 2 is an overview of the Program Plan which defines its purpose, scope and objectives, and presents a brief description of DCRDR activities and a definition of terms. NNECO states in this section that the scope of the DCRDR includes not only a review of the control room but also the hot shutdown panel (p. 4). The third section is devoted to management and staffing. Section 4 describes the investigative phase of the Program Plan and details an Operating Experience Review, Control Room Survey, and Task Analysis. Section 5 defines the objectives of the Assessment Phase and presents the criteria to be used in its effectuation. The sixth section describes the kinds of corrections anticipated for control room improvement. Section 7 is devoted to correction implementation scheduling and the criteria for schedule development. Section 8 provides a brief description

of the form and contents of the Summary Report. Section 9 deals with documentation requirements, contents and control. Section 10 provides a description of the coordination of DCRDR activities with those of other improvement programs. Section 11 consists of a summary of the Program Plan.

Appendix A is comprised of resumes of some of the management personnel and Core Review Team members. Appendix B provides a sample of the questionnaire to be used during the Operating Experience Review. Appendix C is a copy of the Human Engineering Discrepancy report form to be used during the DCRDR. Appendix D provides the DCRDR Task Analysis HED principles. Appendix E presents the Assessment Triage Methodology.

1. Establishment of a Qualified Multidisciplinary Review Team

MP2 is operated by NNECO, a wholly owned subsidiary of Northeast Utilities (NU). The DCRDR is to be conducted under the normal project policy and organization of the NU System which utilizes the services of Northeast Utilities Service Company (NUSCO) for its engineering and operational functions. The ultimate responsibility for the conduct of the DCRDR will reside with Mr. W. G. Counsil, Vice President of Nuclear Engineering and Operations (NNECO).

The project organization diagram in the Program Plan (Figure 5) shows the Program Manager and the Project Engineer will be T.A. Shaffer and Z.A. Ufnal, respectively. It also identifies all members of the Core Review Team but the consultants. Two of the Core Review Team members are from NUSCO and two are from NNECO. The number of consultants and their affiliations is not discussed. The team's composition consists of the following:

- Controls Engineer
- Operations Engineer
- Human Factors Specialist
- Assistant Training Supervisor
- Consultants

Resumes of the identified Core Review Team members show that they are well qualified for the positions assigned them. However, neither the consultants' identities, fields of expertise, nor qualifications have been

provided. The Program Plan later indicates expertise in Nuclear Engineering can be provided, but that such expertise is not included in the Core Review Team makeup.

The names and disciplines of the support group are presented in Figure 5. The disciplines represented coincide with those recommended in NUREG-0800, Section 18.1, Part 2.1.2 except for A&E expertise. Further, it is stated in the Program Plan that any additional specialists required for specific tasks will be made available as needed.

The Program Plan states: "The review team has been provided with specific support as a part of the charge for enacting the CRDR, including the following:

- Access to information (records, documents, plans, procedures, drawings, etc.)
- Access to required facilities
- Access to personnel with useful or necessary information (reactor operators, management, consultants)
- Freedom to document dissenting opinions."

The Program Plan has provided a listing of the responsibilities of a number of persons who will be involved in the DCRDR (pp. 14-18). The responsibilities listed herein are not all-inclusive but present the principal responsibilities of the positions mentioned.

Program Manager

- Ensures that the review is conducted in a professional, objective, and timely manner, consistent with the Program Plan.
- Interfaces with upper management.

Project Engineer

- Supervises Team Coordinator.
- Directs all phases of the review.
- Directs and supports day-to-day team activities.
- Identifies the need to management for specialists' support when necessary.
- Provides management with regular status reports of team's activities and progress.

Controls Engineer

- The Controls Engineer is also the Project Engineer.
- Provides input to the team during the assessment phase when the review team considers proposals for mitigation of HEDs.

Operations Engineer

- Provides the review team with the operational aspects and constraints in assessing the discrepancies found during the investigation phase of the review.
- Assists in all phases of the DCRDR.

Human Factors Specialist

- Directs team with regard to human factors guidelines for the entire project.
- Provides the team with human interface aspects in assessing discrepancies found during the investigation phase of the review.
- Assists in all phases of the DCRDR.

Assistant Training Supervisor

- Provides the review team with operator training aspects and constraints during the assessment and correction phase.

- Directs liaison with training and operations.

Consultants

- Assists in the review and provides input to all phases of the review through to the summary report.

The foregoing list of Core Review Team positions and primary responsibilities and the expanded list of individuals' responsibilities given in the Program Plan, in conjunction with Figure 6 (DCRDR schedule of activities), provide an indication of some of the personnel/disciplines to be involved in the DCRDR and a suggestion of their levels of effort.

The Program Plan also includes provision for the conduct of a review team orientation prior to commencement of the DCRDR. The purpose of this orientation is to ensure that the team will be able to conduct the DCRDR from a common basis of understanding and to acquaint each member with other disciplines represented on the team -- not to make each team member an expert in all specialties. The orientation is to consist of the following instructional areas:

- Human Factors
- Plant Familiarization
- DCRDR Familiarization
- Miscellaneous - Any additional areas identified as requiring orientation to meet review needs

The Program Plan indicates the licensee understands and responds to the requirement for a multidisciplinary team (Core Review and Support) which is structured to assure adequate communications, freedom of team activity and access to necessary support. However, the following items were not addressed or insufficiently described: (1) the person(s) responsible for the final approval and sign-off of HED resolutions; (2) an explanation for

not including a nuclear engineer in the Core Review Team; (3) the numbers, identities, expertise, qualifications, and roles of the consultants; (4) the levels of effort of DCRDR participants; and (5) the methods and duration of instruction during the review team orientation and the topics covered within each of the instructional areas.

Conclusion

Due to the absence of more definitive information regarding the items described above, the adequacy of the DCRDR team as a whole and NNECO's plans for meeting this requirement of NUREG-0737, Supplement 1 cannot be conclusively evaluated.

2. Function and Task Analysis to Identify Control Room Operator Tasks and Information and Control Requirements During Emergency Operations

NNECO is basing its task analysis upon the Millstone 2 upgraded Emergency Operating Procedures (EOPs). These EOPs were written from the Combustion Engineering Owner's Group (CEOG) Emergency Procedures Guidelines (EPGs), Revision 1. Millstone Unit 2 is the same class plant as that used as a generic plant in the development of the CEOG EPGs.

CEOG is currently developing additional documentation to identify all operator information and control requirements to support emergency operations of a generic Combustion Engineering (CE) plant in accordance with the previously developed Revision 1 EPGs. The Program Plan indicates that the generic information and control requirements will provide the bulk of the information required for the MP2 plant-specific task analysis. The Program Plan further indicates that plant-specific requirements unique to MP2 and deviations from those developed by CEOG will be determined, as necessary, by NU.

The Millstone 2 EOPs will be used by the DCRDR Core Review Team to generate Task Sequence Charts (Figure 7 in the Program Plan) which will document each step of the EOP sequence. Individual operator tasks for each step in the EOP sequence will then be determined and recorded on the Task Data Forms (Figure 8 in the Program Plan).

After the operator tasks are recorded, corresponding information and control requirements will be added to the Task Data Forms. Associated information and control characteristics will be recorded on supplemental forms which will include such specific information characteristics as parameter type, dynamic range, setpoint, resolution/accuracy, speed of response, units, and the need for action such as trending and alarming; and control characteristics such as type (discrete or continuous) information feedback associated with control use, response requirements, mode of operation, resolution, and range. With the operator tasks, information and controls requirements, and associated characteristics recorded, the next step is to verify that such exist in the control room (see the Comparison of Display and Control Requirements With A Control Room Inventory section of this report).

The Program Plan indicates that the CEOG is developing documentation to identify all operator information and control requirements to support emergency operations in accordance with generic EPGs (p. 27), but it is not clear what specific event scenarios will be used or whether multiple failures have been considered by the CEOG. In fact, nowhere in the description of the Task Analysis are any specific scenarios mentioned with which a context would be established to walkthrough the EOPs. The Plan also indicates that plant-specific requirements for tasks unique to Millstone 2 and deviations from EPGs developed CEOG will be determined by NU. It would seem more appropriate, because of its charter/qualifications, that any such deviations would be handled by NUSCO and that NUSCO would accomplish these changes in concert with NNECO and the DCRDR Core Review Team, supplemented by the Support Group and such other specialists that might be required. In this connection, the NRC memorandum documenting the NRC's conclusions on the CEOG task analysis (Reference 5) states that the licensee "must describe the process used to identify parameters and other information and control needs that are not provided in, or are different from those specified in, the CEOG EPGs." The licensee "must also describe how the characteristics of the needed controls and instrumentation are determined." The Program Plan does not provide any such descriptions. Likewise, after operator tasks are recorded, NNECO states that "...the corresponding information and control requirements will be added to the Task Data Forms. Associated information and control characteristics will be recorded on supplemental forms...." NNECO has not described how parameters and other information and control

needs will be identified or how the characteristics of the needed controls and instrumentation will be determined.

Inspection of the Task Data Forms raises two concerns: (1) Where on the form is space provided for recording information and control requirements; and (2) On the Task Data Form, under the heading, "Immediate Object of Action," subcolumns "Plant I.D." and "Location," it is not clear when this information is recorded or what the source is of this information. If this information is available during task analysis, the possibility exists that information and control requirements for any specified task may be biased (i.e., tailored to fit the instrumentation and controls existing in the Control Room). Should this occur, the validity of the task analysis would be in question. Finally, it is not clear how the instrumentation and control characteristics will be identified, recorded, and used to verify instrument and control suitability since a "supplemental form" was not included in the Program Plan for review.

Conclusion

In summary, there appears to be a lack of sufficient, detailed information regarding the proposed Function and Task Analysis for an adequate evaluation to be performed on NNECO's plans for this activity. Conclusions regarding the adequacy of NNECO's task analysis for meeting the requirements of NUREG-0737, Supplement 1 should await further information on the following items: (1) the event scenarios covered by the CEOG EPGs; (2) the personnel (and their qualifications) involved in identifying and analyzing deviations from the CEOG EPGs; (3) the task analysis methodology; and (4) the recording of task analytic information on Task Data Forms.

3. A Comparison of Display and Control Requirements With A Control Room Inventory

NNECO states that a control room inventory exists in the plant Bill of Materials and detailed drawings. From this inventory, the drawings and numerous photographs of the actual control boards were used to develop a full-scale mockup. Using this mockup, the Core Review Team will determine the presence and/or absence of the required instrumentation and controls by systematically comparing the recorded instrumentation and control require-

ments to the mockup. Discrepancies will be identified as HEDs and recorded on the HED forms.

Concurrent with this review, a computer data base will be developed for all emergency-utilized equipment. NNECO states that "This data base will contain the instrument's identification number, its location, and all operator tasks utilized. By computerized sorting process of this data base, an inventory of emergency instruments and equipment by location, and by tasks will be generated" (p. 28).

The sequence and data charts used in the task analysis will be reviewed for the "Status vs. Demand" criteria. Demand items will be noted on the Task Data Forms and reviewed during a walk/talk-through for potential discrepancies in the feedback information.

NNECO states that "The human engineering suitability of the required information and control requirements will be verified by performing walk/talk-through of the emergency tasks at the mockup. The suitability review will be performed by the members of the core team including the human factors specialist, the operations engineer, the assistant training supervisor, and the controls engineer. Appropriate material extracted from the NUREG-0700 will be used as the review criteria (see Appendix D of the Program Plan). Discrepancies will be recorded as HEDs on the HED form" (pp. 28-29).

The planned methodology for conduct of the comparison of display and control requirements with the Control Room inventory appears to be satisfactory.

Section 4.3.4 of the Program Plan presents a description of a plan for conduct of the validation of control room functions. Walk-throughs will be conducted using several selected plant-specific procedures. A normal complement of the control room crew will perform the walk-throughs for observation and critique by the Core Review Team. Any problems in crew structure, human factors, or procedures will be recorded, assessed and dispositioned. Since the scenarios to be walked through are not identified, there is no assurance that all controls and instrumentation associated with emergency tasks will be exercised and evaluated. There is no indication of how the

evaluators' observations are to be made (e.g., recording on spatial-OSDs, questioning of operators after each scenario, etc.). In addition to determining whether the operators can perform their functions effectively in the control room, NNECO intends to use the scenario walk-throughs to verify whether the DCRDR enhancements and changes correct the HEDs without introducing new HEDs. This process seems to create a conflict in NNECO's overall plan in that the scenario walk-throughs will be performed prior to the assessment of HEDs and the determination of enhancements and other control room improvements.

Conclusion

In summary, NNECO's approach for comparing the display and control requirements with a control room inventory appear to be satisfactory. However, the success of this activity is dependent upon the adequacy of the task analysis. Until a complete evaluation on the task analysis can be performed, conclusions regarding the adequacy of the comparison activity in meeting the requirements of NUREG-0737, Supplement 1 cannot be made. Also, conclusions regarding the adequacy of the validation of control room functions cannot be made until there is a resolution for the apparent conflict between the use of the validation activity to verify HED corrections and its performance prior to the assessment and resolution of HEDs.

4. A Control Room Survey to Identify Deviations From Accepted Human Factors Principles

NNECO's control room survey will be based upon the criteria listed in NUREG-0700 Section 6. NNECO states that human factors personnel from the Core Team will administer the checklists at the control room and mock-up (p. 25). The control room will be used, where possible, to evaluate functionally oriented type criteria. The mockup will be used to evaluate the static or nondynamic criteria.

NNECO states that the survey will determine what items in the control room layout, equipment, instrumentation, controls, environmental conditions, and process computer are not in compliance with the criteria and that these items will be documented in HEDs.

NNECO states that "Upon completion of the survey, the Core Review Team will review the checklist results for completeness prior to commencement of the assessment phase. Any team member can document opinions concerning potential classification of the control room features under concern, which may be in conflict with the opinion of the majority of the team. This opinion will be forwarded to the DCRDR Project Manager for inclusion in the review documentation" (p. 26).

The Program Plan mentions the use of NUREG-0700 and "... other guidelines, as may be applicable to Millstone Unit No. 2." These other guidelines were not clearly identified in the Program Plan. NUTAC guidelines were referenced as guidance for the overall DCRDR (p. 2). However, if NUTAC guidelines were used in the control room survey, NNECO should identify how much of the NUTAC guidelines was used and how redundant they were with NUREG-0700 guidelines. Our concern here is for the effect the use of NUTAC and other guidelines will have upon those from NUREG-0700.

NNECO states that "Human Factors personnel from the core team will administer the checklists...." Although this statement seems to indicate that there may be more than one human factors person in the core team, only one human factors specialist has been clearly referred to in the Program Plan. Our concern here is that the persons occupying the role of human factors specialists should be qualified and not only administer the checklists but also ensure the quality of the overall survey effort.

NNECO states that "Any core team member can document opinions concerning potential classification of the control room features under concern, which may be in conflict with the opinion of the majority of the team." It is not clear what NNECO considers the word "classification" to mean, although it probably means that some degree of assessment will be done concurrently with the administration of the survey.

NUREG-0700 contains some criteria that can be applied to the control room without needing to know the tasks that are involved (static criteria) and also that criteria can only be validly applied to the control room with some knowledge of the tasks involved (dynamic criteria). NNECO's control room survey effort, with perhaps some assistance from operations personnel, can evaluate all the static criteria and some of the dynamic criteria.

However, there are some dynamic criteria or questions that can only be resolved using a dynamic situation, such as scenario walk-throughs and a comparison with the requirements identified from the task analysis. Appendix D in the Program Plan lists the NUREG-0700 dynamic criteria that NNECO will be addressing in its verification of instrument and control availability and suitability. In a comparison of the criteria NNECO will address in its verification activity and the criteria of NUREG-0700 that should be addressed in a dynamic or task-related context, we found thirty-five criteria that NNECO has not indicated it will address in either the scenario walk-throughs or the verification activity. Criteria addressing such areas as control room manning (NUREG-0700, 6.1.1.2a and b) and control-display functional grouping (NUREG-0700, 6.9.2.1.a) are among the dynamic criteria that NNECO did not reference in Appendix D of the Program Plan. Whether NNECO will not address these criteria in a dynamic context or has just not said so in the Program Plan is not known.

Conclusion

In summary, we have several concerns regarding the control room survey. These are (1) the nature of the other guidelines to be used; (2) the human factors staffing and role in the survey; (3) the meaning of the word "classification" in reference to documenting core team member opinions; and (4) the means for addressing all dynamic criteria in NUREG-0700 (and other guidelines). Until these concerns can be resolved, conclusions cannot be made regarding the adequacy of NNECO's plans in meeting this NUREG-0737, Supplement 1 requirement.

5. Assessment of HEDs to Determine Which Are Significant and Should be Corrected

NNECO states in the Program Plan that "Human engineering discrepancies found during the control room survey, the operating experience review, and task analysis review, will be evaluated and prioritized according to their potential to adversely affect emergency operation. The following four categories are designed to be unique so a consensus can be obtained from the team as to which priority each HED should be assigned.

Priority 1 (Safety Significant) HEDs that are judged likely to adversely affect the management of emergency conditions by control room operators.

Priority 2 (Operational/Reliability) HEDs that are known to have caused problems or appear to cause problems during normal operations.

Priority 3 (Minor Consequences) HEDs that can be determined to have minor effect on the safety of operations.

Priority 4 (No Consequences) HEDs that do not fit into any of the above categories, judged as not affecting emergency operations and not previously documented as causing problems during operations" (p. 30).

NNECO states that the assessment will be performed in two stages. The first stage consists of reviewing each HED using a "triage methodology" (see Appendix A of this report). NNECO states that this questioning routine will allow the team to resolve HEDs with obvious solutions and reduce the number requiring in-depth consideration for the second and final assessment stage.

The second stage or final assessment will be conducted in the same manner as the first stage but with an additional "tie-breaker" criterion: HED significance relative to operator performance. To determine this the Core Team will consider the following:

- The potential for causing or contributing to operator error.
- The potential of detecting and recovering from an error.
- The consequence of the error to plant operation and safety.

They then will use the following formula:

$$\text{Significance} = \frac{\text{Potential for error}}{\text{Potential for recovery}} \times \text{Consequence}$$

NNECO states that "A scale of 1 to 10 shall be applied to the considerations." In addition, NNECO states that "Northeast Utilities has

developed and is using Probabilistic Risk Analysis (PRA) for evaluating operator and equipment performance. These methodologies may be used by the review team to assist them in the priority classification of HEDs" (p. 32).

Our review of NNECO's discussion in HED assessment did not identify any particular methodology for assigning HEDs to the four HED categories or find the categories mutually exclusive. According to the guidance in paragraph 2.5 of NUREG-0800, "All HEDs that are known to have previously contributed to operating crew error ... should be considered significant." Previously documented HEDs being placed or prioritized in Category/Priority 2 is not appropriate for its obvious significance. In addition, no detailed criteria have been provided by which the team can assess HED significance (i.e., impact of HED on operator performance and plant safety). There are no evident criteria discussed in the Program Plan upon which the first stage questions in the "triage methodology" are based. In fact, the latter questions seem more related to resolution of HEDs than assessment.

During the second stage of assessment, the three considerations previously described are factors in a formula to determine HED Significance. NNECO states that the significance ratings are scaled from 1 to 10 but does not indicate what any of the numbers signify. A functional meaning attached to each possible rating is not provided.

According to the DCRDR phase schedule in Figure 6 of the Program Plan, HED assessment will end prior to completion of the task analysis. Assessment as well as subsequent DCRDR activities should be done after all HEDs have been identified in order to identify and adequately consider aggregate and interactive effects of HEDs in the backfit selection process.

Conclusion

In summary, the description of the HED assessment approach provided in the Program Plan by NNECO lacks detailed information, and as outlined, does not appear to be adequate. The concerns we have with NNECO's HED assessment documentation and approach follow:

- The methodology for assigning HEDs to the four HED categories either is not provided in the Program Plan or has not been developed.

- The structure and content of the four categories is somewhat ambiguous (e.g., how is "problem" defined?) and is not adequate as the basis for assigning HED correction implementation priorities.

- There is an apparent lack of criteria on which to base the answers to the questions in the triage assessment.

- The triage approach precludes the assessment of HEDs for significance relative to operator performance which is a consideration that should be given to all HEDs and incorporated in the categorization scheme.

- The questions in the triage methodology for assessment of HEDs seem to be partially for resolving the HEDs as well.

- No functional meanings have been described or attached to the 1 to 10 significance ratings.

- The assessment of HEDs according to Figure 6 of the Program Plan appear to end before the task analysis has been completed.

Based on these concerns, we conclude that the approach for assessing HEDs, as described in the Program Plan, will not meet the requirements of NUREG-0737, Supplement 1.

6. Selection of Design Improvements

NNECO states (p. 33) that it will group HEDs into three broad improvement categories.

- Enhancement - The use of several techniques of surface demarcation, coloring, mimics, labeling and swapping.

- Class Improvements - A combination of minor changes to a particular type of control or indicator that will correct a whole class of problems.

- Individual Discrepancy Corrections - A solution or combination of solutions that will correct one particular discrepancy.

Additional solution/design improvement methods that may be used are listed as follows:

- Operator organization and communications
- CRT display alternatives
- Procedural and administrative solutions
- Special training requirements
- Component replacement and panel alteration

NNECO also mentions in the Program Plan (Section 4.1.3, p. 24) that a documentation file of control room conventions will provide a frame of reference for resolving human engineering discrepancies. NNECO states that "Criteria for satisfactory completion of HEDs is provided in Section 2.2 (Scope). These criteria have been consolidated and assigned a resolution code and as HEDs are resolved, will be assigned one of these codes" (p. 35). The codes NNECO is referring to are as follows:

Code	Description
A.	Meets Human Factors Engineering (HFE) guidelines originally or as improved.
B.	Minor deviation, but satisfies the underlying performance principle implied by HFE guidelines.
C.	Meets HFE guidelines through a combination of solutions.
D.	Does not meet HFE guidelines.
E.	Solutions do not meet all guidelines but are judged to be acceptable for safe operation for the reason stated.

Although the Program Plan provides a listing of a variety of ways for selecting design improvements, it does not provide a selected methodology or associated criteria for doing this activity. The factors to be considered in connection with implementation scheduling (p. 37) might be useful in serving as some design improvement selection criteria, but are not so mentioned in the Program Plan. In addition, NNECO indicates that final approval of recommended changes will be by NU management. However, no criteria upon which NU management will base its decision for approval is presented in the Program Plan.

Conclusion

In summary, NNECO presents neither a methodology nor criteria which incorporate the groupings and codes into an integrated, systematic approach for identifying, analyzing, and selecting design improvements. Until such a methodology and criteria are provided for review, we cannot fully evaluate the adequacy of NNECO's approach for selecting design improvements and satisfying this requirement of NUREG-0737, Supplement 1.

7. Verification that Selected Improvements Will Provide the Necessary Corrections and Verification That Improvements Will Not Introduce New HEDs

Program Plan Sections 4.3.4, 6.4.2 and 10.0 contain references to a verification activity which appears to address the NUREG-0737, Supplement 1 requirement that improvements should provide the necessary corrections and not introduce new HEDs. However, as discussed earlier in the Comparison of Display and Control Requirements With The Control Room Inventory section of this report, the verification of corrections process appears to occur prior to the HED assessment and resolution activities. According to the Program Plan, the HED corrections will be verified during the scenario walk-throughs conducted as part of the validation of control room functions (p. 29). In addition to this apparent contradiction, a detailed methodology and criteria for verifying HED corrections is not presented in the Program Plan.

Conclusion

Until the concerns described above can be resolved, NNECO's plans for verifying HED corrections will not adequately meet the requirements of NUREG-0737, Supplement 1.

8. 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 Operation Procedures (EOPs)

In the Program Plan, NNECO indicates that an activity which will serve to integrate NUREG-0737, Supplement 1 initiatives will be the walk-through verification. NNECO states that "As the core team walks through the specific operator tasks, they will record any shortcoming or discrepancy (e.g., special training required, control location, lack of computer display, etc.) as a HED" (p. 43). NNECO further indicates such HEDs could include:

- o Plant Process Computer/SPDS display additions
- o Training to enhance operators' cognitive analysis
- o Requirements for additional or modified staffing
- o Utilization of Reg. Guide 1.97 instrumentation
- o Modification of EOPs.

NNECO points out in the Program Plan that the DCRDR team includes personnel involved with certain aspects of the Supplement 1 to NUREG-0737 activities including the operations representative involved in the writing of the upgraded EOPs and the Human Factors specialist involved with the development of the SPDS. Also, during the assessment and correction phases of the DCRDR, disciplines involved with other improvement programs are intended to supplement the Core Review Team in the resolution of these HEDs.

Although the discussion provided in the Program Plan indicates NNECO's awareness of the need to coordinate the improvement programs and some of the areas of possible integration, there is a lack of information on certain aspects of NNECO's coordination functions. NNECO does not identify who is responsible for the integration of changes among the initiatives or what mechanism is available to process these changes. Also, it is not entirely

clear at what level of effort the core team members will be involved in other improvement programs. The Program Plan notes that the DCRDR Core Review Team includes an operations representative who is involved in writing upgraded EOPs and a Human Factors specialist who is involved in SPDS development. In the description of the DCRDR team members and their responsibilities (Section 3.0 of the Program Plan), these persons and their responsibilities are not expanded. In addition to these items of information described above, a flow or bar chart to display how the DCRDR and other improvement programs are integrated/interrelated would have been a very useful inclusion in the Program Plan.

Conclusion

In summary, it is evident from a review of the Program Plan that NNECO is aware of the need to coordinate the DCRDR with other improvement programs. However, more information relative to the points made above is needed in order to evaluate the adequacy of this DCRDR activity in meeting the requirements of NUREG-0737, Supplement 1.

9. Additional Activities and Findings

NNECO's discussion in this section of the Program Plan consists of two areas: (1) a review of operational events; and (2) a survey of operations personnel. However, the operating experience review to be performed under the scope of NNECO's DCRDR only consists of a survey of the Millstone Unit No. 2 operating personnel. The information obtained from the survey of operations personnel will be used for the identification of possible HEDs on this unit in the other review activities. In addition, discrepancies identified by the Millstone Unit No. 3 DCRDR will be reviewed, where appropriate, for potential applicability to Millstone Unit No. 2.

NNECO states in the Program Plan that NU has had a mechanism for the past four years which provides for an assessment of operational event data and that a re-review of this data during the DCRDR is unnecessary (p. 21). In its ongoing review of operational events, the NUSCO Nuclear Safety Engineering (NSE) Department reviews all Licensee Event Reports (LERs) for Connecticut Yankee in Haddam, Connecticut, and Millstone Unit No. 1 and No. 2 in Waterford, Connecticut. In addition, it reviews all Significant

Operating Experience Reports (SOERs) and Significant Event Reports (SERs) distributed by the Institute of Nuclear Power Operations (INPO) for applicability to the four nuclear plants involved in the NU system. NSE is comprised of a number of personnel with a variety of different engineering backgrounds including human factors and operations.

A member of the NSE, designated by one of two supervisors, first performs an initial assessment of the operating experience data (i.e., LER, SER, SOER, etc.) to evaluate the potential significance relative to any of the NU four nuclear units. If any data is found to be "significant" relative to some or all of the plants, then an in-depth study is performed and a detailed report is issued for company distribution. During the screening process, the need to interface with INPO, other utilities, and vendors becomes a common occurrence. Routinely, the licensee interfaces with an INPO information contact when reviewing SERs and SOERs.

NNECO stated that in light of the ongoing assessment of operational events, a review of the operational events by the CRDR team was unnecessary. Although the operating experience review under the scope of the DCRDR will provide useful data, we suggest that NNECO consider an expansion of the review and assessment of operational events dating back to commercial operation of Millstone 2. Although NNECO states that the personnel involved includes individuals with backgrounds in human factors and operations, this does not clarify which of these disciplines is involved in the review of operational events. The fact that NNECO states in the Program Plan that "a member" of the NSE will perform the initial assessment of operating experience data suggests that only one person is involved in at least the initial review of operational events. To ensure that operational experience data is adequately reviewed and considered for in-depth study, human factors and operations personnel should be involved.

The intent of NNECO's survey of operating personnel is to make use of the experience gained during the years of MP2 operation by asking selected operational staff about the good and bad aspects of the control room. A self-administered questionnaire approach has been adopted by NNECO. NNECO states that by this method the operating personnel can be questioned while still maximizing the use of their time and that of the core team. The survey will cover the following topics:

- o Work Space Layout (Ergonomics) and Environment
- o Panel Design
- o Annunciator Warning System
- o Communications
- o Displays
- o Procedures
- o Staffing
- o Training
- o Other areas for operator comment

A sample of NNECO's initial questionnaire is included in Appendix B of the Program Plan. NNECO is assembling the questionnaire so that each topic area is sampled completely in item content. NNECO states that suggestions for improvements in each topic area are solicited. A cover letter will be included with the questionnaire which serves to (1) explain the purpose; (2) describe the questionnaire and provides instruction; (3) convey what will be done with the results; and (4) request biographical information.

NNECO states that the questionnaire will be given to selected operations personnel of the Millstone Unit No. 2 Operations Department. At the time of distribution the recipients will receive a briefing by the Operations Supervisor and/or a CRDR core team member. The briefing will emphasize the elements discussed in the cover letter.

NNECO states that after the questionnaires have been completed, responses will be summarized for further evaluation. NNECO anticipates that both positive and negative features will be identified by the respondents. Positive responses will be recorded and retained for consideration in subsequent review processes (e.g., as possible recommendations for corrective action to HED's). Negative responses will be investigated further by the control room design survey and the task analysis reviews.

NNECO states that interviews may be conducted depending upon the answers received by the questionnaire and that the purpose of any interviews will be to clarify any unclear information obtained by the questionnaire and to ensure that all important areas have been addressed. The interviews will be performed by selected members of the core team.

Conclusions

In summary, the operating experience review as proposed in the Program Plan should provide valuable data for the remainder of the DCRDR. NNECO may be able to improve its review of operating experience by (1) expanding its review of operational events to include those events occurring earlier than four years ago at Millstone 2; (2) ensuring that it involves human factors and operations personnel as a team which reviews the operational events; (3) distributing the questionnaire to 50% of the operators from all shifts; (4) ensuring candid and complete responses by conducting the operator interviews with trained interviewers who are not members of the licensee's organization and who will protect the respondent's anonymity; and (5) including questions regarding the plant computer system (Appendix B of the Program Plan).

CONCLUSIONS

The Northeast Nuclear Energy Company Program Plan demonstrates the licensee's intent to comply with the requirements of Supplement 1 to NUREG-0737. However, the Program Plan does not reflect the level of understanding necessary to successfully complete all the DCRDR activities and meet the requirements of NUREG-0737, Supplement 1. A number of activities do not appear to have an adequate methodology, such as HED assessment. Other activities, such as the selection of design improvements, are not adequately or completely described in the Program Plan. In order to obtain the information needed to fully review NNECO's DCRDR plans, to provide NNECO with timely feedback on its DCRDR, and to ensure NNECO is proceeding with a satisfactory DCRDR, we recommend that an in-progress audit be conducted at Millstone 2. Below is a list of topics we suggest be covered during an in-progress audit.

Suggested Agenda

1. Qualifications and Structure of the DCRDR Team

   - The need for a Nuclear Engineer on the Core Review Team or in the Support Group.

- The identity of the Consultants on Core Review Team (names, numbers, specialties, qualifications).

- A more definitive description of the levels of effort for all DCRDR participants.

- The identity and qualifications of the person(s) who will give final approval for HED resolutions.

2. Function and Task Analysis

- The event scenarios covered by CEOG EPGs.

- The personnel (and their qualifications) involved in identifying and analyzing deviations from the CEOG EPGs.

- Identification of the methodology for the plant-specific requirements, including: tasks, information and control requirements, and the characteristics of needed controls and instrumentation.

- Where/how are information and control requirements recorded on Task Data Forms and the required characteristics of needed instruments and controls recorded on the supplemental forms.

- The identification of instrument and control "Plant I.D." and "Location" in the Task Data Forms relative to the identification of information and control requirements and required characteristics of needed instruments and controls.

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

- The adequacy, inadequacy of the comparison or verification activity relative to the task analysis.

- The comprehensiveness of the scenarios selected in the validation walk-throughs for exercising all emergency-related instruments and controls.

- The data collection and evaluation approach in the validation activity.

4. Control Room Survey

- The nature and use of the "other guidelines" and its effect upon the use of NUREG-0700.

- The personnel involved in performing and supervising the checklists.

- The meaning of the word "classification" in reference to documenting core team member opinions.

- The means for addressing all dynamic criteria in NUREG-0700 (and other guidelines?)

5. HED Assessment

- The methodology and criteria for assigning HEDs to the four HED categories.

- The structure and content of the four categories.

- The nature of the questions comprising the triage assessment phase.

- The criteria used to base the answers to the questions in the triage assessment phase.

- The functional meanings attached to each of the possible significance ratings.

- The plans to begin the HED assessment and resolution activity prior to completion of the task analysis.

6. Selection of Design Improvements

   - The criteria and methodology.

   - The criteria used by NU management to base its decision for approval of selected improvements.

7. Verification That Improvements Provide the Necessary Corrections and Do Not Introduce New HEDs.

   - The performance of this activity during the validation scenario walk-throughs and prior to the HED assessment and resolution activities.

   - The detailed methodology and criteria.

8. Coordination of the DCRDR With Other Improvement Programs

   - The identity of the person(s) responsible for the coordination function and the mechanism by which the function can be carried out.

   - The nature and level of the effort of the core team members

9. Operating Experience Review

   - The percentage of operators receiving questionnaires.

   - The interviewers' qualifications and affiliations.

   - The questionnaire respondents' anonymity.

REFERENCES

1. Millstone Unit No. 2 Control Room Design Review Implementation Plan, February 26, 1985.

2. NUREG-0737, Supplement 1, "Requirements for Emergency Response Capability," Generic Letter No. 82-33, USNRC, Washington, D.C., December 17, 1982.

3. NUREG-0800, "Standard Review Plan for the Review of Safety Analysis Reports for Nuclear Power Plants," USNRC Washington, D.C., September 1984.

4. NUREG-0700, "Guidelines for Control Room Design Reviews," USNRC, Washington, D.C., September 1981.

5. "Meeting Summary - Task Analysis Requirements of Supplement 1 to NUREG-0737, August 29, 1984, Meeting with Combustion Engineering Group (CEOG) Operations Committee," Memorandum from H.B. Clayton, USNRC, to D.L. Ziemann, USNRC, dated September 7, 1984.

APPENDIX A

TRIAGE ASSESSMENT METHODOLOGY