Docket No. 50-423

Attachment No. 1

Millstone Nuclear Power Station, Unit No. 3

Supplement No. 1 to NUREG-0737

Control Room Design Review

Addendum No. 1 to Summary Report

September, 1985

MILLSTONE UNIT NO. 3

CONTROL ROOM DESIGN REVIEW

SUMMARY REPORT

ADDENDUM NO. 1

NUREG-0737, Supplement 1, NRC Task Action Plan requests all licensees of nuclear power plants and applicants for operating licenses to conduct a control room design review. This is Northeast Nuclear Energy Company's Addendum No. 1 to the Summary Report for its Millstone Unit No. 3 plant.

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EXECUTIVE SUMMARY

This Executive Summary discusses Addendum No. 1 to the Control Room Design Review (CRDR) Summary Report for Millstone Unit No. 3 (MP3). The CRDR and associated documentation are in response to NUREG-0737, Supplement 1. The purpose of the CRDR is to ensure that the control room provides safe and effective facilities during emergency operation.

The Summary Report was submitted to the NRC Staff on November 1, 1984 and identified the following six (6) items which were yet to be completed and which would be subsequently reported in an addendum to the Summary Report:

i. Task Analysis of Procedure I&C Parameters - This item is now complete.

ii. Task Analysis of Plant-Specific EOPs - This item is now complete.

iii. Environment, Computer, and Communications Surveys - This item is currently 75% complete, with the remaining 25% (11 checklist items) scheduled to be completed by the end of October, 1985. We do not expect to find any safety significant Human Engineering Discrepancies (HEDs) as a result of the remaining checklist items. All HEDs identified will be evaluated in accordance with the CRDR methodology.

iv. Validation of Control Room Functions - This item is essentially complete.

v. Outstanding HED Assessment and Correction - This item is now complete, except for any HEDs yet to be identified as a result of the remaining surveys (11 checklist items).

vi. Finalization of the Enhancement Design - This item is now complete, with at least 75% of the enhancements implemented on the control boards and the remaining 25% scheduled to be implemented by fuel load.

As a result of the completion of the above items, thirty (30) additional HEDs were identified, assessed and dispositioned in accordance with the CRDR methodology. There are currently no outstanding HEDs to be reviewed.

The NRC Staff's Safety Evaluation Report, Supplement No. 1, dated April 11, 1985, for MP3 identified four (4) items related to the CRDR as being either incomplete, not addressed or not meeting the criteria of Supplement 1 to NUREG-0737. These concerns pertain to the above items, and are fully addressed in the body of this addendum report.

In summary, the CRDR for MP3 is essentially complete, with the exception of the eleven (11) checklist items. Confirmation of their completion, including any findings and associated dispositions, will be provided in a subsequent addendum report.

INTRODUCTION

This document constitutes Addendum No. 1 to the Control Room Design Review (CRDR) Summary Report for Millstone Unit No. 3 (MP3). This report documents the results of the open items identified in the Summary Report which was submitted to the NRC on November 1, 1984. In addition, this report addresses NRC concerns delineated in Supplement No. 1 to the Safety Evaluation Report (SER) for MP3. The sections of this report correspond to those of the Summary Report.

The open items listed in Section 1.5 of the Summary Report include the following:

1.5.1. Task Analysis of Procedure I&C Parameters

1.5.2. Task Analysis of Plant-Specific EOPs

1.5.3. Environment, Computer, and Communications Surveys

1.5.4. Validation of Control Room Functions

1.5.5. Outstanding HED Assessment and Correction

1.5.6. Finalization of the Enhancement Design

The NRC concerns expressed in the Section 18.1 of Supplement No. 1 of the SER are as follows and are addressed as part of the above open items:

1. The system function and task analysis process is presently incomplete - This is discussed in Section 1.5.1.

2. The comparison of display and control requirements with a control room inventory is only partially completed because the system function and task analysis is not complete - This is discussed in Section 1.5.1.

3. The assessment of HEDs did not meet the requirements - This is discussed in Section 1.5.5.

4. The verification program leaves some gaps and does not fully meet the requirements - This is discussed in Section 1.5.4.

Other items were identified in Appendix I of Supplement No. 1 of the SER and are addressed throughout this report.

SECTION 1.5.1 - TASK ANALYSIS OF PROCEDURE I&C PARAMETERS

As reported in Section 1.5 of the Summary Report and as expressed as the first concern in Section 18.1 in the SER, the task analysis was not yet completed. Specifically, the instrument and control parameters were not defined nor were the actual instruments and controls compared against the defined parameters.

Methodology

Revision 1 to the WOG ERGs provided the basis for generically identifying the information and control needs. Information and control needs related to the plant-specific EOPs and deviations from the WOG ERGs have been identified by the NUSCO Reactor Engineering Branch. The information and control needs

were then compared against our control room inventory and the appropriate instruments and controls were selected for use in the EOPs.

The remaining item was the determination of the specific characteristics of these instruments and controls. Westinghouse was retained to determined these characteristics (i.e., setpoints, units, range, resolution, accuracy, response time, and type of control or displays) by conducting an Instrumentation Characteristics Review Program (ICRP). This program addressed the identification, development, and justification of instrumentation and control characteristics based on operator information and control needs, both generic and plant-specific. The process and documentation addressesed the specific instrumentation used in the Millstone Unit No. 3 EOPs.

The ICRP identified the generic characteristics based on the WOG high-pressure reference plant design, followed by the identification of plant-specific deviation characteristics. Characteristics are justified through development of or reference to appropriate generic or plant-specific basis documentation.

The ICRP process was as follows:

1) The plant instrumentation generic characteristics were identified based on the required information and control needs.

2) A Characteristics Justification Table was developed for the instrumentation. This table lists the operator action categories and associated operator information needs, criteria (e.g., specific values for

instrumentation) and characteristics (e.g., range, resolution, accuracy, etc.). The basis for each action category or information need is described or a reference to other documentation given.

The Characteristics Justification Tables are formatted to present both generic and plant-specific characteristics, facilitating their development and the comparison of generic to plant-specific characteristics. An example of a Characteristics Justification Table is included in Enclosure 1.

3) Following identification of the generic characteristics, the plant-specific characteristics were identified. The plant-specific characteristics consist of applicable generic characteristics and plant-specific deviations (i.e., characteristics that differ from generic due to design differences and characteristics for plant-specific design features beyond the scope of the generic design.)

To identify plant-specific instrumentation characteristics, the plant-specific deviations from the generic ERG were evaluated with respect to Item (1) above. Characteristics for deviations were identified consistent with Item (2) above. These plant-specific characteristics (consisting of identified deviations and applicable generic characteristics) were then entered on the Characteristics Justification Tables.

4) Generic and plant-specific characteristics were reviewed and worst case(s) characteristics were summarized on the MP3 I&C Characteristics Requirements Form, an example of which is included in Enclosure 2. Worst case characteristics include extreme (e.g., high and low) values, where appropriate.

Subsequently, a comparison of the characteristics of the required instruments and controls against the information provided by the ICRP was performed. The actual characteristics were recorded on the I&C Characteristic Requirement Form in the column marked VALID. (See Enclosure 2). Those characteristics which did not satisfy the specified criteria were noted as HEDs, assigned a priority, and evaluated for corrective action.

Findings and Corrections

Four (4) HEDs were written involving twenty-two (22) devices which consisted of eighteen (18) meters and four (4) controls. The deviations were for range and resolution/accuracy. These are HED Nos. D-029 through D-032.

HED No. D-029 has been dispositioned as a NON-HED as the ranges of the meters used were later found to be appropriate. The ICRP documentation will be corrected accordingly.

HED No. D-030 has been assigned as priority 1, code C, justifiable, since the required resolution is adequately displayed on the Safety Parameter Display System. In addition, a recommendation has been made to the Operations Department to review the criteria for possible adjustment in the procedure setpoints. (This HED is included in Enclosure 8).

HED No. D-031 has been recommended for meter scale correction prior to fuel load with a N/R priority, code A.

HED No. D-032 has been recommended for adjustment to the procedure for a more applicable setpoint (conservative) to satisfy the criteria of resolution on the controllers with a code A, N/R priority and dispositioned prior to fuel load.

Finally, as recommended in Appendix I of Supplement No. 1 of the SER, the "meters review" is an all encompassing review of the instrumentation rather than one of meters alone. The original use of the term "meter review" was not meant to be indicative of the extent of the review.

SECTION 1.5.2 -- TASK ANALYSIS OF PLANT-SPECIFIC EOPS

Methodology

The five (5) plant-specific EOPs were task analyzed using the same methodology used for the forty-three (43) WOG ERG-based procedures. The review entailed the main control boards, the transfer switch panel and the Auxiliary Shutdown Panel. The instrumentation characteristics for the five (5) plant-specific EOPs were included in the ICRP. Three-loop operation was also task analyzed.

Findings and Corrections

Six (6) additional HEDs (TA-213 through 218) were written from task analyzing the five (5) plant-specific EOPs, scheduled for implementation prior to fuel load, and all dispositioned as code A. Three (3) are to be corrected by enhancements, one (1) by an instrument relocation and two (2) by procedural changes.

No HEDs were identified as a result of task analyzing three-loop operation. Some recommendations (mostly related to procedure changes) were identified and are being implemented as appropriate.

SECTION 1.5.3 -- ENVIRONMENTAL, COMPUTER, AND COMMUNICATIONS SURVEYS

Methodology

The Summary Report indicated that the control room had not yet been reviewed against three (3) sections of NUREG-0700. These were Sections 6.1, 6.2 and 6.7 for the environmental, communications and computer surveys, respectively. With the exception of the following eleven (11) checklist items, these three (3) sections are now complete:

6.1.5.1 Temperature and Humidity

6.1.5.2 Ventilation

6.1.5.3 Emergency Lighting

6.2.1.2 Conventional Powered Telephone System

6.2.1.3 Sound Powered Telephone System

6.2.1.6 Announcing System

6.2.1.8 Emergency Communications

6.2.2.1 Use of Auditory Signals

6.7.1.7 Computer Response Times

6.7.1.8 Access Aids

6.7.2.7m(1) Red-Green Combinations

The above checklist items have not yet been completed due to plant construction, but are scheduled to be completed by the end of October, 1985. However, pertinent design documents (e.g., the design of the emergency lighting system) have been reviewed by the CRDR core team. As such, we do not anticipate that any safety significant HEDs will be identified. All HEDs identified will be evaluated in accordance with the CRDR methodology and summarized in a subsequent addendum report.

In addition, Enclosure 3 is the revised schedule for the CRDR, which supersedes the schedule provided in the Summary Report.

Findings and Corrections

The checklists completed disclosed no HEDs written against the Environmental Section, one (1) HED (CM-001) against the Communications Section and twenty-four (24) HEDs (CP-001 through CP-024) against the Computer Section. These HEDs have been assessed, prioritized and scheduled for implementation as shown in Enclosure 7.

SECTION 1.5.4 -- VALIDATION OF CONTROL ROOM FUNCTIONS

Methodology

The validation of the control room functions was performed as indicated in the Summary Report. The procedures specified in Figure 16 in the Summary Report were used except for Procedures FR-I.1 and FR-I.2. Procedure ES-1.1 was substituted for these to enable the simulator to provide the necessary entry conditions for Pressurizer Level Control.

As stated in Figure 16 of the Summary Report, a trained operating crew first walked through the six (6) selected procedures on the mock-up to validate that the HEDs were indeed corrected and no further HEDs were introduced. In addition, the five (5) functional procedures were reviewed on the simulator to validate the time-sensitive aspects of the procedures.

Prior to the validation of the EOPs, the verification activity was an ongoing process. As the class and individual improvements were being selected, they were first implemented, whenever practical, on the full-scale control room mock-up for review and approval by the core team. An integral part of the approval was to verify that each corrective action resolved the HED in question. These improvements were then added to the control board enhancement drawings for inclusion into the enhancement design. Those of a nature unsuitable for implementation on the mock-up (e.g., computer software, ESF panel circuit modifications, etc.) are being reviewed/validated on the control boards as they are implemented.

The enhancement design was an iterative process of review and approval. The first step was the initial design by the 1/2 scale Computer Aided Drafting System to enable the core team to review the entire hierarchical labelling that was recommended. This iteration was then reviewed by the core team and the operations and training departments for their comments and suggestions.

The second iteration was a revised issue of these drawings incorporating the comments of the first. This version of the enhancement design was implemented on the mock-up. The core team then reviewed (e.g., talk and walk throughs) this design for further corrections and/or improvements. In addition, the operators undergoing training in the same building were queried for comments and suggestions which were then incorporated into a third and last iteration. (Note: - Last winter, the mock-up was moved from the Mystic Site to the Simulator Building at the Millstone Nuclear Power Station).

The mock-up was then updated to the last iteration for review and approval by the core team. Walk and talk throughs were performed to verify that the HED concerns were indeed addressed.

The various iterations discussed above assured that the HEDs were corrected by the enhancement and that new HEDs were not introduced. The validation of the review was then subsequently performed in the manner outlined above.

Findings and Corrections

One HED (TA-219) resulted from the validation of the control room functions,

prioritized as category 3 and resolved as code A for implementation prior to commercial operation. This HED addresses suggestions (made by the operating crew during the validation) concerning adding caution notes in the procedures, the omission of two (2) valves in procedures FR-H.2 and FR-H.3 as part of a specific step, the restating of a task for conformity of the procedure to the switch escutcheon nomenclature, and the possible restructuring of a procedure sequence to reduce travel between boards.

None of the above caused operator error or a problem in performing his tasks, but rather were noted as possible changes that could assist him. Consequently, a HED was written to document the findings and for inclusion in the process of transmittal for corrections.

SECTION 1.5.5 - OUTSTANDING HED ASSESSMENT AND CORRECTION

Methodology

As stated in the Summary Report, HED assessment was performed in accordance with prior stated methodologies and has been completed. The purpose of assessment is to determine HED significance and "suggest the priorities according to which the HEDs are considered for corrective action" (See NUREG-0700, Section 4.3). This section indicates that early implementation is desirable wherever possible. NNECO has recognized the importance of early implementation and has proceeded to correct, where practical, all HEDs prior to fuel load. Consequently, during the assessment phase, those HEDs which were scheduled to be corrected prior to fuel load were not prioritized. If they were

significant enough to warrant correction (safety and non-safety), they were included and a priority for scheduling became secondary, for they were scheduled to be done immediately.

In order to be conservative, HEDs were written for all cases so they could be assessed by the full core team to insure a problem was not overlooked. Also, HEDs were written for any item that was questionable by the reviewer and in some cases was caused by an unclear understanding of the system/process involved. It is important to understand that the triage methodology was a screening of all HEDs for practical workability of the assessment process.

The outsanding HEDs listed in Figure 19 of the Summary Report were deferred not because the team could not decide on relatively simple solutions, but rather since further study and assessment was required. (See category 7 of the Triage Methodology.) For example, HED CC-010 states: "The use and meaning of a white light is not consistent". This HED was deferred for further review to determine the use of each white light identified in the HED as it was not immediately obvious to the team. A priority could not be assigned without a full understanding of the HED itself.

Although the criteria of safety significance is not listed in the Assessment Triage Methodology Flowchart (Figure 14a in the Summary Report), this criteria was uppermost in the core team's evaluation of all HEDs. Although not included in the chart, it is stated in the methodology discussion of assessment on page 13, Section 1.4, of the Summary Report. The Assessment Triage Methodology Flowchart has been revised to more accurately reflect the decision-making process that took place and is included in Enclosure 4.

Safety significance was also included as a criterion in the "tie-breaker" methodology shown in Figure 15 of the Summary Report. However, we have deleted this "tie-breaker" concept because it was never used. (See Enclosure 5.)

As shown in Enclosure 6, all HEDs which will not be corrected by fuel load or justified as "no change" have been prioritized and include a disposition code as stated in the CRDR Implementation Plan. The forty-nine (49) HEDs which are to be corrected by enhancements to the control boards but were not prioritized or scheduled for correction in the Summary Report, are scheduled to be corrected prior to fuel load. On a related matter, we have revised the definition of a Priority 3 HED to delete any reference to safety significance since Priority 3 HEDs only relate to minor consequences to the reliability of operations. (See Enclosure 7 which revises page 41 in the CRDR Implementation Plan.)

In conclusion, we believe that the safety significance of each HED was adequately addressed by the core team during the assessment phase. It is recognized that scheduling did have an influence on the assessment phase of the review, however, this influence was one of a constructive nature (i.e., to promptly correct deficiencies found) rather than an adverse one.

SECTION 1.5.6 - FINALIZATION OF THE ENHANCEMENT DESIGN

Methodology

As stated in the Summary Report, the enhancement design had not been completed at the time of its submittal. The enhancement design is now complete and enhancements to the control boards are being implemented at this

time. A concern was stated in Appendix I to the Supplement No. 1 of the SER that "more information is needed to adequately outline the proposed control room changes". With the exception that only one example was given for the Individual Type Correction, the Summary Report provides an adequate summary of the corrections, except that it requires updating for all of the HEDs found at the conclusion of the review.

Further examples to supplement the one given in the Summary Report for the Individual Type Correction include:

- HED No. TA-8 required corrections to the Emergency Safety Features Annunciator to light all blank tiles to enable the operator to verify a safety actuation without the confusion of unlit spaces.

- HED No. PE-5 required the replacement of a number of Master Specialties Switches due to their alternate action which was not evident from appearance to the operator.

- HED No. CC-009 required the replacement of yellow and blue indicating lights on the panel with red lights for convention consistency and relocated in the mimic flow path to indicate flow.

Findings and Corrections

An update of the findings previously provided in the Summary Report is shown in Enclosure 6. A summary by category and the number of HEDs involved is as follows:

CATEGORY	NO. OF HEDS
Annunciators	20
Codes and Conventions	11
Controls	45
Communications	1
Displays	32
Labels	17
Panels	38
Process Computer	24
Workspace	15
Experience	35
Task Analysis	220
Total	458

The discussion of the findings remains as stated in the Summary Report, Section 2.0.

Section 3.0 of the Summary Report described the corrections made to the control room. The following tabulation updates Section 3.0.

The 458 HEDs generated were dispositioned in the following manner:

TYPE OF DISPOSITION	NO. OF HEDS
Type 1 - Duplicate of other HEDs	48
Type 2 - Determined to be NON-HEDs	40

Type 3 - Determined to be of no significance	27
Type 4 - Non-significant	40
Type 5 - Corrected by enhancements	49
Type 6 - Corrected by class or individual improvements	89
Type 7 - Justifiable with no change, those of a safety significant nature are included in Enclosure 8.	18
Type 8 - Sequential step requirements for assistance in development of operating crew structure and training.	103
Type 9 - Status vs. demand type HEDs which were referred to Operations and Training for emphasis in training.	10
Type 10 - Referred to Operations for incorporation in the EOPs.	26
Type 11 - Referred to Operations for Administrative Control.	8