P10R

UNITED STATES
NUCLEAR REGULATORY COMMISSION
WASHINGTON, D. C. 20555

November 20, 1985

Docket No. 50-346

LICENSEE: Toledo Edison Company

FACILITY: Davis-Besse Unit No. 1

SUBJECT: SUMMARY OF MEETING WITH TOLEDO EDISON COMPANY

On October 9, 1985, the staff and its consultants (SAIC) met with representatives of Toledo Edison Company and its contractor (Essex Corporation) in Bethesda, Maryland. The meeting attendees are identified in Enclosure 1. The purpose of the meeting was to discuss the issues identified in the NRC letter dated July 2, 1985 and attachments regarding the findings of the preimplementation audit conducted at Davis Besse in late April 1985 and to address questions relating to the Davis Besse Course of Action report.

Enclosure 1, prepared by SAIC, summarizes the discussions and commitments made at the meeting. Enclosure 2 is information presented by Toledo Edison Company.

Albert De Agazio, Project Manager
Operating Reactors Branch #4
Division of Licensing

Enclosures:
As Stated

cc w/enclosures:
See next page

66

DF01
1/1 Per Pat Kreutzer

NRC Meeting With Toledo Edison
Concerning the Detailed Control Room Design Review of
Davis-Besse Nuclear Power Station

The NRC met with Toledo Edison (TED) on October 9, 1985, to discuss the Detailed Control Room Design Review (DCRDR) for Davis-Besse Nuclear Power Station. Specifically, the areas addressed during the meeting were (1) the concerns of the NRC from the pre-implementation audit conducted at Davis-Besse the week of April 29, 1985; and (2) the questions the NRC had concerning TED's System Review and Test Program. The results of discussion in these areas are presented in this report. This report represents the observations, conclusions, and recommendations of the NRC staff and SAIC. The meeting attendees are listed in Attachment 1 of this report.

DCRDR

Based on the results of the pre-implementation audit, the NRC concluded that none of the DCRDR elements could be closed out. The NRC audit team found that TED had made minimal progress and expended minimal effort toward completing the DCRDR requirements since submittal of its Summary Report. The October 9, 1985, meeting was held to discuss the status of the DCRDR and to resolve the problems associated with the DCRDR. Meeting attendees received a draft of TED's plans for responding to each of the NRC's concerns. The results of the DCRDR portion of the meeting are presented below as they pertain to each of the nine elements that comprise the NUREG-0737, Supplement 1 requirements for a DCRDR.

1. Qualifications and Structure of the DCRDR Team

The NRC audit team found during the pre-implementation audit that TED's plans for performing the activities remaining to be completed did not include an adequate level of involvement of human factors specialists. The remaining DCRDR activities were the development and conduct of the special studies, and the development and verification of HED corrections. In the meeting, TED and its human factors consultant, Essex Corporation, stated that human factors specialists for these and other activities will be involved as follows:

- o A dedicated project leader from Essex Corporation has been established.

- o A human factors specialist will be dedicated to each special study.

- o Human factors specialists will be involved in the development and verification of HED corrections.

- o Human factors specialists will be involved in the upgrading of the System Function and Task Analysis, the survey of components added to the control room since the survey was last performed, the reassessment of HEDs, the production of control room design standards and conventions, and the upgrading of DCRDR data collection and HED forms.

The NRC found this commitment for involvement of human factors specialists in the DCRDR to satisfy the concerns of the NRC audit team. For the NRC to close out on this element of the DCRDR, TED should provide documentation describing this commitment.

2. Function and Task Analysis

During the pre-implementation audit, the NRC audit team found TED's System Function and Task Analysis (SFTA) to be incomplete. The NRC audit team concluded that the following activities should be performed in order to meet the Function and Task Analysis requirement:

1. Analyze operator tasks, information and control requirements, and required characteristics of instruments and controls necessary to monitor and assess the various challenges and failure modes of the Radioactivity Release critical safety function.

2. Comprehensively analyze information and control requirements and required characteristics of instruments and controls for Steam Generator Tube Rupture.

3. In addition to items 1 and 2, analyze required characteristics of instruments and controls for all emergency operator tasks.

In the meeting, TED stated that it will upgrade the SFTA. TED stated that the SFTA upgrade activities will include the following:

1. An analysis of operator tasks, information and control requirements, and required characteristics of instruments and controls necessary to monitor and assess the various challenges and failure modes of the Radioactivity Release critical safety function including the following scenarios and applicable steps from the emergency operating procedures:

   - o A small break SBLOCA
   - o A major release up main vent stack
   - o An unmonitored release path

2. An analysis of required characteristics of instruments and controls for all emergency operator tasks.

During the pre-implementation audit, the NRC audit team found that the analysis of information and control requirements and required characteristics of instruments and controls for Steam Generator Tube Rupture was performed to a limited extent. That is, the identification or listing of information and control requirements and needed design characteristics of instruments and controls was not as comprehensive as that suggested by the ATOGs. In the meeting, TED stated that the analysis of information and control requirements (not including the needed characteristics of I&C) performed for Steam Generator Tube Rupture appeared to be comprehensive. In order to demonstrate that its analysis of information and control requirements is as comprehensive as the ATOGs suggest, TED should provide documentation of this analysis for Steam Generator Tube Rupture.

A review of TED's proposed "Method For Updating SFTA and I&C Requirements Verification" found no problems with the proposed approach. However, TED should be explicit in its documentation of the final methodology of which characteristics of needed instruments and controls will be identified as requirements to be subsequently verified in the control room.

In summary, TED's upgrade of its SFTA appears to satisfy the NRC's concerns if it (1) follows the methodology proposed in its "Method For

Updating SFTA..."; (2) demonstrates a comprehensive analysis of information and control requirements for Steam Generator Tube Rupture; (3) describes explicitly the type of required characteristics identified for instruments and controls; and (4) identifies these required characteristics at a level to the satisfaction of the NRC. The SFTA performed to satisfy DCRDR requirements should be an extension of the NRC approved SFTA performed to develop the upgraded plant-specific EOPs. The NRC will conclude on the adequacy of the SFTA performed to satisfy DCRDR requirements after TED receives NRC approval of the SFTA performed to develop the plant-specific EOPs.

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

The NRC audit team concluded that due to the incompleteness of the SFTA, the comparison or verification of the information and control requirements and required characteristics of instruments and controls with the control room mock-up could not be considered complete. The NRC audit team concluded that in order to close out this element of the DCRDR requirements, TED must perform a verification of equipment availability and human engineering suitability for the requirements that are developed from the activities necessary to upgrade the SFTA to completion. In the meeting and in its proposed SFTA upgrade approach, TED indicated that this will be done. In order to close out this DCRDR requirement, TED should provide documentation of this verification process and identify any resulting HEDs. The adequacy of this verification process will be dependent on the adequacy of the SFTA.

4. Control Room Survey

The NRC audit team found that the control room survey conducted up to the time of the pre-implementation audit was satisfactory. However, the following aspects of the control room were not evaluated:

- The new components added to the control room since the survey was performed.

- The annunciator system flash patterns.

TED stated in the meeting that the new or added components in the control room will undergo a human factors evaluation. In addition, the annunciator system flash patterns have undergone a review by Essex and will be handled as an HED in the annunciator study. In order to close out this element of the DCRDR, TED should provide documentation describing the results of the human factors review of new or added components to the control room, including any resultant HEDs. Documentation of the assessment and resolution of the HED associated with annunciator system flash patterns should be included in the documented results of the annunciator study.

5. Assessment of HEDs

The NRC audit team concluded during the pre-implementation audit that TED's assessment of HEDs was not acceptable due to deficiencies in the following areas:

- o The consideration of cumulative and interactive effects of individual HEDs.

- o The reprioritization of 29 safety-related HEDs.

The NRC audit team found that there was no systematic review of individual HEDs to determine the presence of cumulative and interactive effects upon the assessment of HEDs. In the meeting, the NRC learned that through the use of an HED database possessed by Essex, TED will consider the cumulative and interactive effects of individual HEDs upon the HED assessments. A review of the capabilities of the computerized HED database found that the approach proposed should be effective in identifying cumulative and interactive effects. The proposed approach is to use various HED database fields (e.g., problem type or NUREG-0700 guideline discrepancy, component title or type) to enable the identification of component or problem interactions. TED stated that in instances where interrelated HEDs with varying categorizations are found, lower categorized HEDs will be upgraded.

TED's intent in the reprioritization of the 29 safety-significant HEDs associated with the special studies was to establish scheduling priorities in the completion of the ten special studies. A result of this reprioritization was the downgrading of the safety-significance of all 29 HEDs as it

relates to the implementation of HED corrections. The reprioritization assigned later implementation dates to the corrections of these 29 safety-significant HEDs. In addition to this delay in the implementation schedule of corrections to safety-significant HEDs, the NRC audit team found the reprioritization to be unsatisfactory due to the absence of human factors input. Overall, the NRC found the reprioritization of the 29 safety-significant HEDs to be unacceptable since (1) the safety-significance of each of these 29 HEDs was downgraded from its original assessment, (2) the reprioritization did not include human factors input whereas the original assessment did, and (3) the justification for reprioritizing these 29 safety-significant HEDs was not satisfactory.

In the meeting, TED stated that it and Essex will reassess the 29 safety-significant HEDs. TED stated that while some of the HED corrections will be performed prior to the rest, all corrections to the 29 HEDs will get priority attention. The NRC requires that the corrections of safety-significant HEDs associated with the Steam Feedwater Rupture Control System (SFRCS), Feedwater (FW) System, and Post Accident Monitoring (PAM) System be implemented prior to restart. All other safety-significant HED corrections should be implemented by the end of the fifth refueling outage (presently scheduled for Spring of 1986). All other HED corrections should be implemented by the end of the sixth refueling outage (presently scheduled for Fall of 1987).

In summary, the plans TED has proposed for reassessing HEDs for cumulative and interactive effects and its implementation of HED corrections relative to HED assessment appear to be acceptable. TED should submit documentation of its finalized plans for these DCRDR activities, including the HED corrections to be performed prior to restart, in order for this element to be closed out.

6. Selection of Design Improvements

Based on the findings of the pre-implementation audit, the NRC audit team concluded that the following activities were necessary in order for TED to meet this DCRDR requirement:

- o Carry out and document a systematic process of selecting design improvements.

- o Ensure cumulative and interactive effects of individual HEDs that will be corrected, not corrected, or partially corrected upon the whole integrated control room improvement package are considered.

- o Improve HED documentation for completeness, clarity, accuracy, and auditability.

- o Develop solutions to HEDs and implementation schedules that are agreeable to the NRC.

At the time of the pre-implementation audit, TED had made little progress toward the identification and resolution of HED corrections since the submittal ten months prior of the Summary Report. No systematic, rigorous process for identifying and selecting among alternative corrections to HEDs had been developed or employed. TED had developed corrective actions or justifications for not taking corrective actions for only 50% of the HEDs listed in the Summary Report. In the meeting, TED discussed its process for selecting HED corrections. TED needs to document this process and present flow diagrams illustrating this process to the NRC.

The NRC audit team found no integrated approach to the development of HED corrections. The approach taken by TED appeared to promote a piecemeal method of selecting and implementing HED corrections without adequate consideration of cumulative and interactive effects of HEDs. In the meeting, TED responded to this concern by stating that the HED database will enable cumulative and interactive effects of HEDs to be considered. The HEDs considered will include all HEDs, not just those associated with the special studies. As mentioned in the Assessment of HEDs section of this report, the HED database appears to be suitable for performing this function.

TED stated in the meeting that it upgraded and completed the HED documentation found during the pre-implementation audit to be incomplete, ambiguous, and inaccurate. TED stated that all components involved with each HED have been recorded for traceability through the HED correction process.

In order to document this effort, TED should provide several HED samples which demonstrate the upgrading of HED documentation.

A review of the Summary Report found many instances where the responses to HEDs were not finalized, and were ambiguous, uninformative, or otherwise unacceptable to the NRC. The NRC audit team stated in the pre-implementation audit report that in order to meet the requirements of Supplement 1 to NUREG-0737, TED should develop solutions to HEDs and implementation schedules that are approved by the NRC. TED stated in the meeting that it intends to do so. In order for NRC to complete its review and approval of HED resolutions, TED should propose HED corrections and implementation dates that are acceptable to the NRC. Until documentation of all HED resolutions is provided, the NRC's review is incomplete. HED documentation should be descriptive enough to allow an informed evaluation by the NRC to be made. The level of detail of the information necessary to allow an evaluation is presented in the Davis-Besse HED report.

In summary, TED needs to provide documentation of the following:

- The process for selecting HED corrections, including any supporting illustrations.

- The methodology for evaluating cumulative and interactive effects upon HED corrections and justifications for not taking corrective actions.

- An integrated approach to the development and implementation of HED corrections.

- Sample HEDs demonstrating the upgrading of HED documentation.

In addition, documentation of all HED resolutions for NRC review should be provided on a schedule agreeable to the NRC and TED.

7. Verification That Improvements Will Provide the Necessary Corrections Without Introducing New HEDs

The NRC audit team found that no systematic, rigorous process for verifying HED corrections was developed or employed. In addition, TED's design change process (via FCRs) did not include a human factors review in verifying design changes. The NRC audit team concluded in its report that a systematic, rigorous methodology for verifying design improvements should be performed and that this process should involve human factors specialists as active, integral members of the DCRDR team. TED stated in the meeting that expert judgment with the aid of the control room mock-up served as the process for verifying some of the "simple" HEDs. For "complex" HEDs, such as those involved in SFRCS, criteria were used as the basis of the verification. TED stated that a human factors specialist will be involved in the FCR process during the DCRDR. After the DCRDR, a human factors specialist will be involved in the FCR process on an as-needed basis. In order for this element of the DCRDR to be closed out, TED needs to provide documentation describing its methodology for verifying HED corrections and the involvement of human factors specialists.

8. Coordination of the DCRDR With Other Improvement Programs

The NRC audit team concluded from its findings that although Davis-Besse's organizational structure should enhance TED's ability to coordinate improvement programs, there was no evidence that any coordination had occurred other than the use of the EOPs as the basis of the SFTA. A systematic approach to integrate the improvement programs had not been established. In the meeting, TED cited its ability to coordinate the improvement programs through its organizational structure and the FCR process. However, the actual points of integration or interfaces and the iterative processes among the improvement programs appeared to be uncertain. TED should document not only the means by which it will coordinate the improvement programs, but also how these programs have and will be integrated. This documentation should include a description of those aspects of each of the improvement programs which will relate to or integrate with the others.

SUMMARY

TED has addressed all of the concerns identified in the pre-implementation audit report relative to DCRDR requirements. In addition, TED has updated operator comment forms, has ensured all HEDs identified in the operator forms are documented, and is establishing human factors standards and conventions for some aspects of the Davis-Besse control room design. Based on discussions with TED and its proposed schedule for completing the DCRDR, TED has committed to the following milestones:

- o Completed prior to restart:
  - Implementation of corrections to safety-significant HEDs associated with SFRCS, FW, and PAM.
- o Completed by the end of the fifth refueling outage (currently scheduled for spring of 1986):
  - Special studies
  - Implementation of corrections to all other safety-significant HEDs.
- o Completed by the end of the sixth refueling outage (currently scheduled for fall of 1987):
  - Implementation of the remaining HED corrections
  - Completion of the DCRDR.

In order for the NRC and TED to work toward the completion of the DCRDR, the following areas should be documented by TED:

- o Qualifications and Structure of the DCRDR Team
  - The human factors involvement in the remaining DCRDR activities.

- o Function and Task Analysis

  - The finalized approach for upgrading the SFTA.

  - The analysis performed for Steam Generator Tube Rupture.

  - The type of required characteristics identified for instruments and controls.

- o Comparison of Display and Control Requirements With a Control Room Inventory

  - The process for the comparison or verification of information and control availability and suitability and any resulting HEDs.

- o Control Room Survey

  - The results of the human factors review of new or added components to the control room, including any resultant HEDs.
  - The assessment and resolution of the HED associated with annunciator system flash patterns (which should be included in the documented results of the annunciator study).

- o Assessment of HEDs

  - The final methodology for evaluating and compensating for the cumulative and interactive effects of individual HEDs.

  - The finalized reassessment approach, prioritization, and scheduled implementation of corrections for the 29 HEDs.

- o Selection of Design Improvements

  - The process for selecting corrections to HEDs, including flow diagrams which illustrate this process.

  - The final methodology for evaluating the cumulative and interactive effects upon the resolution of HED corrections.

- An integrated approach to the development and implementation of HED corrections.

- Samples of upgraded HED documentation.

- A proposed schedule for the submittal of HEDs for NRC review.

o Verification That Improvements Will Provide the Necessary Corrections Without Introducing New HEDs

- The methodology for verifying HED corrections including the participation of human factors specialists.

o Coordination of the DCRDR With Other Improvement Programs

- The means by which the improvement programs will be coordinated.

- How the improvement programs have and will be integrated, including those aspects of each of the programs which will relate to and integrate with the others.

o Scheduling of the DCRDR

- Schedule for submittal of the documentation listed in this report.

- Completion schedule, including dates if possible, for the special studies.

- Schedule for the implementation of HED corrections.

- Completion of the DCRDR.

SYSTEM REVIEW AND TEST PROGRAM

In response to the June 9, 1985, event at Davis-Besse, TED has developed and is performing a System Review and Test Program. The objectives of this program are (1) to identify problems which may potentially impact the ability of those systems to perform the functions they must perform for safe operation of the plant; (2) to identify the corrective actions necessary to resolve these problems; and (3) to identify any special testing of the system that should be performed during restart power ascension. The program will also review the scope of surveillance testing conducted on these systems to ensure they are properly tested.

TED submitted documentation of its program to the NRC. The NRC's review of this document produced a number of questions which were documented in a September 27, 1985, NRC memorandum transmitted from W.H. Regan, Jr. to J. Stolz. Prior to the October 9 meeting, TED obtained a copy of the memorandum and had responses to the questions prepared for the meeting. Many of the responses were references to previous discussion in the meeting concerning the DCRDR. Some of TED's DCRDR upgrade actions are performed as part of the System Review and Test Program. In order to decrease the redundancy of discussion in these areas, many of TED's responses described below will reference previous discussion in the DCRDR section of this report. The discussion below is structured in an NRC question-TED response format. TED's responses are not quoted directly but reflect the NRC's interpretation or understanding of TED's responses.

SECTION II.C.5

1. As part of the "Systems Review and Test Program," Systems Review Groups will consider the significant HEDs identified by the DCRDR.

   NRC Question: Does Davis-Besse plan to reassess the priority and schedule for implementing corrective actions for all 29 HEDs reported on in its June 29, 1984, Summary Report?

TED Response: YES. Of the 29 HEDs involved, 14 were reassessed as part of the SR&TP and the others as part of the DCRDR. As previously mentioned, Essex human factors specialists will be involved in the reassessment.

2. This reassessment will be accomplished as part of the "Systems Review and Test Program" in Section II.C.7 of the Davis-Besse report.

NRC Question: What is the schedule for performing II.C.7?

TED Response: The SR&TP, or II.C.7, will be performed during the present outage prior to restart.

3. TED states, "All significant generic HEDs will be considered as well as the specific HEDs related to systems being reviewed under the program."

3.1 NRC Question: Describe the difference between generic and specific HEDs.

TED Response: Generic HEDs involve problems pervading the control room such as inadequate labeling. Specific HEDs relate to problems associated with specific components. The difference apparently is the degree of pervasiveness of the problem in the control room.

3.2 NRC Question: Will human factors specialists be included in these reviews and to what extent?

TED Response: YES. The project leader from Essex is dedicated to the completion of the remaining DCRDR activities and this area of the SR&TP. For further discussion, refer to the Qualifications and Structure of the DCRDR Team section of the DCRDR portion of this report.

4. TED - Each HED will be assessed to determine whether correction is required in the short term (prior to restart), and these will be resolved.

   NRC Question: Define "resolved."

   TED Response: "Resolved" and "dispositioned" mean the same thing as implementation.

5. Remaining HEDs will be addressed as part of the continuing implementation of the DCRDR program.

   NRC Question: Discuss what this means.

   TED Response: This means that HED corrections not needed for restart will be addressed after restart.

6. Regarding significant HEDs which affected the June 9 event, appropriate compensatory or corrective actions will be implemented prior to restart.

   NRC Question: Proposed actions should be submitted for NRC review and acceptance. Will they?

   TED Response: (None. NRC will need to discuss this.)

7. Actions described to correct SFRCS HEDs [II.C.5 (pg. 76, 2nd paragraph)] appear to be okay.

   TED states, "The new arrangement has been reviewed for human factors considerations."

   NRC Question: Were these reviewed by human factors specialists?

   TED Response: YES. Refer to the answer to question 3.2.

8. Other major control room design problem - Pushbutton arrangement for startup feedwater valves for aligning startup feedwater pump. TED no longer considers this problem relevant since the new motor-driven feedwater pump will be aligned differently and any operational considerations related to use of the new pump are being considered as part of the design process.

8.1 NRC Question: Does the "design process" include human factors engineering support for evaluating required controls and displays and integrating these into the existing control room panels for the new feedwater pump?

TED Response: YES. Refer to the answer to question 3.2.

8.2 NRC Question: Also, will an H.F. engineer participate in developing control and display arrangements for the different valve alignment for the new motor driven feed pump?

TED Response: YES. Refer to the answer to question 3.2.

9. A change (HED) not identified in the DCRDR involves PORV position indication now on the PAM panel which will be duplicated at the position adjacent to the PORV control switch.

NRC Question: Why didn't the DCRDR identify this HED? It should have been discovered during the panel layout and control/display relationship surveys. This raises the question of adequacy of process and personnel used for performing the surveys. Please discuss.

TED Response: This particular problem was missed in the DCRDR. However, this one instance is not indicative of the survey or personnel used.

SECTION II.C.7 System Review and Test Program (Pg. 81)

10. Introduction

Review is intended to identify problems which may potentially impact the ability of those systems to perform the functions they must perform for safe operation of the plant, to identify corrective actions necessary to resolve those problems, and to identify special testing of the system that should be performed during restart power ascension.

10.1 NRC Question: Explain what is meant by "...problems which may potentially impact the ability of those systems..."

TED Response: The problems referred to were not design problems related to human factors but to the system engineering.

10.2 NRC Question: Are human factors specialists involved in this review and test program, and to what extent will they participate?

TED Response: YES. Human factors specialist(s) will be involved in the review of documented equipment problems and backfits subsequent to the Systems Review Group's evaluation.

NRC Comments: TED should indicate that those systems included in the June 9 event have undergone a human factors review, and associated HEDs will be resolved to the satisfaction of the NRC.

10.3 NRC Question: Will new HEDs be identified and evaluated as part of the review and test program? If answer to question 10.2 is no, by whom will they be identified?

TED Response: The potential exists for new HEDs to be identified.

11. Background (Pg. 81)

TED concluded it was necessary to evaluate past equipment history to identify significant or recurring equipment problems to ensure that the root cause is identified and corrected.

NRC Question: Does this mean that only equipment problems will be evaluated or does it also include man-machine interface problems?

TED Response: It includes man-machine interface problems to the extent that HEDs identified from the DCRDR will be reviewed.

12. Program Objectives (Pg. 82)

The list of five objectives did not indicate whether human factors concerns would be addressed.

NRC Question: Will human factors considerations be addressed?

TED Response: YES, to the extent allowed in the review of HEDs identified from the DCRDR and by the role given to human factors specialists as reviewers, not participants of documented equipment problems and backfits determined by the engineering and operations-oriented Systems Review Groups.

13. Program Approach (Pg. 86)

Five System Review Groups (SRGs) will be established to conduct this program. Systems are assigned per groupings listed in Table II.C.7.1 (Pgs. 84 and 85). The groups consist of Toledo Edison engineering personnel and experienced support personnel from the nuclear industry. The support personnel are highly qualified industry representatives experienced in system design, operation, and testing.

13.1 NRC Question: Are human factors specialists included in the review groups?

TED Response: NO. Refer to the answer to question 12.

13.2 NRC Question: Provide detail as to the composition of each team with respect to individual areas of expertise.

TED Response: Refer to the answer to question 12.

13.3 NRC Question: Will these groups consider man-machine interface problems?

TED Response: Only through the review of DCRDR HEDs. There is no other activity in the SR&TP to review explicitly man-machine interface.

14. The results of the SRG efforts will be documented and then will be reviewed and approved by an Independent Process Review Group (IPRG). This group is composed of senior TED engineering personnel and other top level industry experts operating in accordance with a formal charter.

14.1 NRC Question: Describe areas of expertise of each member of the IPRG.

TED Response: The areas of expertise represented by the members of the IPRG do not include human factors.

14.2 NRC Question: Provide a copy of the "formal charter" for NRC review.

TED Response: The NRC has a copy of the formal charter.

15. System Performance Review (Pgs. 87-88)

A review of past equipment performance requires an examination of historical information on the system. Such information is available in many different formats. A list of types of historical information

being considered is provided. Included in the list is "Human Engineering Deficiencies (HEDs) which were developed as part of the DCRDR." The HEDs document deficiencies related to the man-machine interface between the operator and control room indications and controls.

15.1 NRC Question: Why are the reviews limited to only HEDs identified from the DCRDR?

TED Response: (None.)

15.2 NRC Question: Why doesn't the man-machine interface go beyond indicators and controls to include the equipment being controlled?

TED Response: TED stated that the approach is comprehensive of man-machine interface within the scope of the DCRDR.

SUMMARY

With several exceptions, TED responded to the NRC questions concerning the SR&TP. The exceptions refer to NRC questions numbered 6 and 15.1, to which TED did not respond. In reference to NRC question numbered 6, TED should submit documentation of its proposed actions for NRC review and approval. In reference to NRC question numbered 15.1, TED should document a response for NRC review.

NRC question numbered 15.2 reads, "Why doesn't the man-machine interface go beyond indicators and controls to include the equipment being controlled?" Stated in another way, the NRC question is, "Does the review of man-machine interface consider the plant equipment controlled from the control room for which the panels provide an operator interface?" TED should document a response to this question as restated for NRC review. In addition, TED should provide documentation of its responses to all the NRC questions.

ATTACHMENT 1

Attendees of the Meeting Held October 9, 1985
to Discuss the Davis-Besse DCRDR

TED Representatives

Jacque Lingenfelter	TED
Richard Morrison	Essex Corporation
Barbara Paramore	Essex Corporation
Robert Peters	TED

USNRC Representatives

Al DeAgazio	USNRC
Joe Moyer	SAIC
Timothy O'Donoghue	SAIC
William Regan	USNRC
Dominic Tondi	USNRC

Other

Marc Deflin	Duquesne Light Company

October 9, 1985

NRC/TED MEETING ON DCRDR

Summary of Preceding Events.

DCRDR Summary Report	6/84
Supplemental Information	1/85
NRC Audit	4/85
DB Event	6/9/85
NRC Letter on Audit	7/85
Organization/Administration Changes	7/85
Course of Action	9/85
NRC Questions on Course of Action	9/85

Purpose of Meeting.

1. Discuss Program Changes related to DCRDR.
   a. Address NRC concerns from 7/2/85 letter.
   b. Address System Review & Test Program and questions of 9/85 on Course of Action.
2. Schedule.
3. Future NRC/TED interaction.

DENISE B. McCAFFERTY

EDUCATION:

A.A., Edison Community College, 1975
B.A., Experimental Psychology, University of West Florida, 1977
M.A., Experimental Psychology, University of West Florida 1980. Major Area: Memory and Human Performance

AFFILIATIONS:

Human Factors Society, Member
Technical Interest Group: Industrial Ergonomics

PROFESSIONAL BRIEF:

Ms. McCafferty has participated in research and development projects for over eight years. The initial two years of her experience were in the area of educational psychology, organizing and conducting training effectiveness workshops; and participating in various research, design and data analysis projects. While working for the U.S. Navy, Ms. McCafferty was responsible for operation and maintenance of the Visual Detection Simulator. These duties included training other personnel as to use of the simulator, and the documentation categorization of data to be used in visual research studies. As a Research Psychologist, she designed and conducted repeated measures experiments dealing with human performance in unique environments.

For the last five years, Ms. McCafferty has been under contract to various electrical utilities, government agencies and oil refineries. Her projects have included the human factors engineering design, evaluation, and enhancement of human-machine interfaces of nuclear power plant and refinery control rooms in the United States and Spain. Ms. McCafferty has produced a variety of reports, guidelines, and manuals. In addition, she has participated in numerous procedure generation projects including emergency (symptom and event based), system operating, alarm response and general operating procedures. She has been involved with procedure evaluation projects on plant-specific simulators from various vendors (GE, CE, and Westinghouse).

EXPERIENCE:

ESSEX CORPORATION (1980 - Present)

Staff Scientist for a human factors review of Exxon U.S.A.'s Benicia Refinery Computer Replacement and Control Center Modification project. Assisted in the interview of over 80 refinery personnel in an effort to determine user needs of a proposed computer system. Produced a report which outlined the results of the interviews and gave human factors recommendations in the areas of control room workspace arrangement; console layout; lighting; traffic/congestion; noise/communications; and housekeeping and aesthetics.

Project Manager for Public Service Electric and Gas Hope Creek Generating Station symptom based emergency operating procedures verification and validation project.

Produced a work plan to guide the verification and validation process. Participated in verification and validation exercises with utility personnel. Observed Hope Creek operators perform procedures on a plant-specific simulator.

Project Manager for technical work for Nuclenor's Central Nuclear de Santa Maria de Garona (Spain) subcontract to conduct a control room design review. Work was performed under a subcontract to Operations Engineering, Inc. Directed on-site collection of data. Guided generation of human engineering discrepancies, assessment of probability of human error, and report production. Areas assessed on site included Annunciators, Anthropometrics, Workspace Design, Panel Design, Controls, Displays, Control-Display Integration, Communications, Emergency Equipment, Labeling, Noise levels and lighting.

Task Manager and Principal Investigator for the development of an annotated bibliography of human factors applications literature for the Department of Energy, Office of Nuclear Safety. Work was performed under subcontract to Lawrence Livermore National Laboratory (LLNL). Revised a document of Human Factors Guidelines for Maintenance also for LLNL.

Project Manager for Louisiana Power and Light Company's Steam Electrical Station safety function oriented emergency operating procedures (EOPs) project. Developed plant-specific Writer's Guide for Emergency Procedures including the verification and validation program for use by operation's personnel. Supported human factors portion of EOP generation, verification and validation efforts both onsite and at a non-specific plant simulator. Scheduled and coordinated production of EOPs, plant-specifc technical guidelines, and Procedures Generation Package materials (in accordance with NUREG-0899 and 0737 Supplement 1).

Project Manager for Baltimore Gas & Electric Company contract to prepare a program plan report summarizing the Calvert Cliffs Nuclear Power Plant control room design review process and the results of that review.

Project Manager for Baltimore Gas & Electric Company contract to perform an annunciator design validation study at the Calvert Cliffs Nuclear Power Plant.

Project Manager for finalizing the Human Factors Evaluation of the Calvert Cliffs Nuclear Power Station Units 1 & 2 Control Room Summary Report for Baltimore Gas & Electric Company.

Research Scientist for Hidraelectrica Espanola at Central Nuclear De Cofrentes (Spain) site to perform a preliminary human factors control room design review. Identified human engineering discrepancies (HEDs), assessed the probability of error, and the system or safety implications of such errors. Suggested possible backfits for HEDs.

Research Scientist for Florida Power & Light Corporation contract to review alarm system design for human factors concerns using criteria set forth in NUREG-0700 and NUREG/CR-1580. Also directed annunciator system redesign to correct deficiencies and improve information transfer to the operator.

Group Leader for Electric Power Research Institute's workshop for Human Factors Design in Nuclear Power Plants. Assisted nuclear power personnel in developing and applying human engineering tools to hardware design.

Research Scientist under contract to Duke Power Corporation produced Procedures Writer's Guide (in accordance with NUREG-0899) for Emergency and Abnormal Procedures for each of three multi-unit stations.

Research Associate for South Carolina Electric & Gas Corporation participated in rewriting/reformating effort of all emergency, off normal, system and general operating procedures for the Virgil C. Summer Nuclear Power Plant.

Research Associate on contract to Florida Power & Light Corporation performed initial design for demarcation and hierachical labeling scheme for control panel of St. Lucie Unit 2 Nuclear Power Plant.

Research Associate for Texas Utilties Generating Company contract designed a job performance aid to be used by nuclear power plant operators as an additional means of assessing plant conditions in the event of a Safety Parameter Display System failure.

Research Associate under contract to Baltimore Gas & Electric Company reviewed a power plant fire protection system panel layout, operability, and corresponding procedure manual.

Research Associate for Baltimore Gas & Electric Company Calvert Cliffs Nuclear Power Plant contract evaluated current and proposed design of the two unit shared control room annunciator system. In addition, documented alarm response procedure for each annunciator.

Research Associate for Consolidated Edison and Power Authority of the State of New York contracts using a plant specific simulator, assessed emergency procedure effectiveness, validated and verified operator action sequences. In addition, rewrote each of the two sets of plant emergency procedures for the Indian Point sites.

NAVAL BIODYNAMICS LABORATORY (1979 - 1980)

Research Psychologist. Designed conducted and analyzed results of repeated measures studies dealing with human performance in unusual environments. Assisted in writing of research reports submitted for publication.

NAVAL AEROSPACE MEDICAL RESEARCH LABORATORY (1978 - 1979)

Psychological Technician Was in charge of operation, maintenance and training of personnel on the Visual Detection Simulator (VDS). Minor duties included documenting target slides, editing the VDS manual, and drafting technical drawings.

DENISE B. McCAFFERTY (continued)

EDUCATIONAL RESEARCH AND DEVELOPMENT CENTER (1976 - 1978)

Graduate Research Assistant. Work included conducting literature surveys, assisting in the organization and development of workshops, and orienting personnel with the ERIC system. Analyzed and interpreted data on Escambia County's Residence for Youth Program, Children's Services Interagency Association, and Women's Infant's and Children's Supplemental Feeding Program. Reviewed available Computer Managed Instruction Systems.

PUBLICATIONS AND TECHNICAL REPORTS:

Human Factors Review of the Benicia Refinery Computer Replacement Project. Alexandria, VA: Essex Corporation, August 1985. (with B. Paramore)

Work Plan for EOP Verification and Validation at Hope Creek Generating Station. Alexandria, VA: Essex Corporation, July 1985. (with B. Paramore)

Human Factors Evaluation of the Santa Maria de Garona Nuclear Power Plant Control Room. Alexandria, VA: Essex Corporation, 1985. (with others)

Annotated Bibliography of Human Factors Applications Literature. Livermore, CA: Lawrence Livermore National Laboratory, September 1984. (with others)

Procedure Generation Package. Volume 1: Introduction. Killona, LA: Louisiana Power and Light Company, July, 1984. (with others)

Procedure Generation Package. Volume 2: Writer's Guide for Emergency Procedure (WG 001). Killona, LA: Louisiana Power and Light Company, July 1984. (with others)

Procedure Generation Package. Volume 3: Technical Guidelines, (TG-OP-902-000 through TG-OP-902-008). Killona, LA: Louisiana Power and Light Company, July 1984. (with others)

Procedure Generation Package. Volume 4: Validation and Verification Results. Killona, LA: Louisiana Power and Light Company, July 1984. (with others)

Procedure Generation Package. Volume 5: Emergency Procedures (OP-902-000 through OP-902-008). Killona, LA: Louisiana Power and Light Company, July 1984.

Human Factors Modifications to a Pre-Existing Alarm System. Proceedings of the Human Factors Society 27th Annual Meeting, 1983, 311. (with C. Baker)

Program Plan Summary of the Calvert Cliffs Nuclear Power Plants Units 1 and 2 Control Room. Alexandria, VA: Essex Corporation, September 1983. (with others)

Preliminary Human Factors Control Room Design Review of the Cofrentes Nuclear Power Plant. Alexandria, VA: Essex Corporation, July 1983. (with others)

Calvert Cliffs Annunciator Design Validation Study (DRAFT). Alexandria, VA: Essex Corporation, April 1983. (with C. Weiss)

HFE Assessment and Recommendations for Plant St. Lucie - Unit 2 Control Room Annunciator System. Alexandria, Va: Essex Corporation, December 6, 1982. (with others)

Operator Response to Problems in Process Control Systems. Paper presented at 8th Congress, International Ergonomics Association, Tokyo, Japan, August 23 - 27, 1982. (with others)

Summary Report for The Procedure Writer's Guide Project. Alexandria, Virginia: Essex Corporation, July 1, 1982. (with others)

Catawba Nuclear Station Writer's Guide for Emergency and Abnormal Procedures. Alexandria Virginia: Essex Corporation, July 1, 1982. (with others)

Oconee Nuclear Station Writer's Guide for Emergency and Abnormal Procedures. Alexandria, Virginia: Essex Corporation, July 1, 1982. (with others)

McGuire Nuclear Station Writer's Guide for Emergency and Abnormal Procedures. Alexandria, Virginia: Essex Corporation, July 1, 1982. (with others)

Issues in the Design of Annunciator Systems. Proceedings of the Human Factors Society 25th Annual Meeting, 1981, 122-126. (with others)

Performance Evaluation Tests for Environmental Research (PETER): Collected Papers (Report Number NBDL-80R008). New Orleans, Louisiana: Naval Biodynamics Laboratory, July 1981. (with others)

Human Factors Evaluation of the Calvert Cliffs Nuclear Power Station Units 1 & 2 Control Room (Draft) Volume 1: Summary Report. Volume 2: Task Analysis. Volume 3: Alarm Manual. Alexandria, Virginia: Essex Corporation, March 1981. (with others)

Performance Evaluation Tests for Environmental Research (PETER): Auditory Digit Span Task. Proceedings of the Human Factors Society 24th Annual Meeting, 1980, 340-343. (with others)

Evaluation of the Escambia County, Women's, Infant's and Children's Supplemental Feeding Program: 1976 - 1978 Data. Pensacola, Florida: University of West Florida. (with P. Taylor)

Behavioral Characteristics of Effective Teachers. National Teacher Corps Training Manual. Washington, D.C.: 1977.

Analysis of Clientele Data for Escambia County Residence for Youth Program (ECRY): 1976 - 1978 Data. Pensacola, Florida: Education Research and Development Center, 1977.

DENISE B. McCAFFERTY (continued)

Analysis of Clientele Data for Children's Services Interagency Association (CSIA): 1975 - 1977 Data. Pensacola, Florida: Educational Research and Development Center, 1977.

Computer Managed Instruction (CMI): An Investigation into Available Systems. Pensacola, Florida: Educational Research and Development Center.

Learning Transfer From Training Device to Ship-Mounted Cathode Ray Tube (CRT). Pensacola, Florida: Educational Research and Development Center, 1977 (Report prepared for Naval Training Station, Corry Field, Pensacola, Florida. (with B.R. Dunn)

Student Activities Entertainment Programming Survey. Pensacola, Florida: University of West Florida, Office of Student Activities, 1976. (with J. Prohn)

BARBARA PARAMORE

EDUCATION:

M.A., Education, The George Washington University, 1969

B.A., English Literature, The George Washington University, 1967

Special courses in system safety analysis, job analysis, and communications.

AFFILIATIONS:

Member, American Association for the Advancement of Science
Member, Human Factors Society

PROFESSIONAL BRIEF:

Ms. Paramore has 12 years of experience in human factors consulting for industry and government. She has worked in the fields of nuclear power operations, toxic and hazardous materials processing, commercial vessel operations, offshore drilling, and consumer product safety. Much of her work has involved work system operations and safety analysis, directed to identification of training program and procedural requirements and evaluation of human factors in work settings. Ms. Paramore has extensive experience in the development of designs and procedures for job-task analysis and human factors safety evaluation, and in directing implementation of those methods in the field.

EXPERIENCE:

ESSEX CORPORATION (1983 - Present)

Director, Systems Development Department. Ms. Paramore is responsible for management and technical direction of projects to improve personnel performance reliability and productivity in new and established work systems. Project examples include: (1) human factors support in the development of the human interface design, staffing, and training concepts for a new processing facility to demilitarize chemical munitions (client: U.S. Army Toxic and Hazardous Materials Agency); (2) support in the review and enhancement of the control room design for Hope Creek Nuclear Generating Station (client: Public Service Electric & Gas and Bechtel Power Corporation); (3) assistance in the verification and validation of emergency operating procedures for Louisiana Power and Light's Waterford-3 Generating Station; (4) development of procedures and aids for use by Department of Energy contractors to perform their own human factors evaluations of design, procedures, and communications (client: The Lawrence Livermore National Laboratory).

BIOTECHNOLOGY, INC. (1979 - 1983)

Senior Program Professional. Ms. Paramore served as principal investigator and project/task leader in the safety and personnel performance areas. Projects included: (1) task analysis of nuclear power plant control room operations conducted for the Nuclear Regulatory Commission's Office of Research, with the participation of eight utilities; (2) support to the NRC in the development of guidelines for a systems approach to human

factors engineering design reviews of nuclear power plant control rooms (NUREG-0700); (3) human factors engineering reviews of nuclear power plant control rooms prior to licensing; (4) methodology development for utility control room design reviews, human factors advisory support during design review activities, and participation in assessment of the safety significance of design discrepancies identified in reviews; (5) development of preliminary procedures, training requirements, and risk indicators for a proposed new facility at Rockwell International's Hanford site operated for the Department of Energy; and (6) studies of hazards associated with children's products and identification of factors affecting age suitability of such products, hazard analysis of thermal insulation products, and evaluation of the potential effectiveness of a new safety standard for architectural glazing for the U.S. Consumer Product Safety Commission.

• ORI, INC. (1970 - 1979)

Project Director and Associate Program Director. In these capacities, Ms. Paramore conducted and coordinated job-task analyses of commercial marine operations for the purpose of identifying training and licensing requirements. Analyses addressed commercial vessel control, liquefied natural gas (LNG) cargo handling, and mobile offshore drilling unit operations. She also conducted a program of accident data analysis for the Coast Guard in which behavioral factors in accidents were defined in terms of performance requirements identified through task analysis. Other projects involved identification of risk sources and assessment of the potential effectiveness of risk reduction measures in marine operations.

PUBLICATIONS:

McDermott, M. Paramore, B., & Callahan, W.T. Work in the Navy — A description of Navy officer and enlisted occupations. Technical report prepared for the Office of Naval Research, Psychological Sciences Division, under contract NR156-040-458 by ORI, Inc., June 1975.

Paramore, B. & Stoehr, L. Handbook for development of qualifications for personnel in new technology systems. U.S. Coast Guard Report No. CG-D-75-76, June 1976.

Paramore, B. et al. Functional job analysis of mobile offshore drilling unit operations (Technical Report No. 1242). Final report to the U.S. Coast Guard, prepared under contract DOT-CG-41903-A by ORI, Inc., April 1978.

Paramore, B., Gardenier, J.S., & Willis, R.M. Assessment of bridge-to-bridge radiotelephone in collision prevention. Paper presented at the 1978 Detroit/Windsor RCTM Assembly Meeting, April 17-21, 1978.

Paramore, B. & Jones, D.T. Personnel qualifications for mobile offshore drilling unit operations. Paper presented at the 1978 Annual Meeting of the Human Factors Society, Detroit, MI, October 16-19, 1978.

Paramore, B. et al. Study of task performance problems in reports of collisions, rammings, and groundings in harbors and entrances. Final report to the U.S. Coast Guard, prepared under contract DOT-CG-41903-A by ORI, Inc., November 1978.

Paramore, B. et al. Human and physical factors affecting collisions, rammings, and groundings on the western rivers and Gulf Intercoastal Waterway (Technical Report No. 1456). Final report to the U.S. Coast Guard, prepared under contract DOT-CG-41903-A by ORI, Inc., January 1979.

Simpson, W.E. & Paramore, B. Assessment of collision risk reduction factors for LNG shipping into Cove Point, Maryland (Technical Report No. 1609). Final report to the Johns Hopkins University Applied Physical Laboratory, prepared under contract 601075 by ORI, Inc., December 1979.

Paramore, B. Identification of emerging hazards in the children's and recreation program area. Final report to the U.S. Consumer Product Safety Commission, prepared under contract CPSC-79-1204 by BioTechnology, Inc., April 1980.

Paramore, B. An evolving system of hazard identification and analysis for consumer product safety. Paper presented at Symposium on Human Factors and Industrial Design in Consumer Products, sponsored by the Human Factors Society and the Industrial Designers Society of America, Tufts University, Medford, Massachusetts, May 28-30, 1980.

Paramore, B. Analysis of architectural glazing injuries, 1978. Final report to the U.S. Consumer Product Safety Commission, prepared under contract CPSC-C-79-1204 by BioTechnology, Inc., September 1980.

Paramore, B. & Burgy, D. Innovations in task analysis of nuclear power plant control room crews. Paper presented at the 1982 Winter Meeting of the American Nuclear Society, Washington, D.C., November 14-19, 1982.

Paramore, B. & Banks, W.W., et al. A pilot task analysis of the Rockwell Size Reduction Facility, 234-5Z Plutonium Finishing Plant. Richland, WA: Hanford Environmental Health Foundation, November 1983.

Paramore, B. & Peterson, L.R., Editors. Human Factors review plan. Livermore CA: The Lawrence Livermore National Laboratory, September 1984.

JOHN E. FARBRY, JR.

EDUCATION:

Bachelor of Architecture, Washington University, 1965.
M.A. Experimental Psychology, University of Missouri-Columbia, 1973
Ph.D. Experimental Psychology, University of Missouri-Columbia, 1978; Major Area: Human Memory and Cognition

AFFILIATIONS:

American Psychological Association (Member)
Division 21: Society of Engineering Psychologists
Human Factors Society (Member)
Technical Interest Group: Computer Systems
Potomac Chapter of the Human Factors Society (Member)

PROFESSIONAL BRIEF:

Dr. Farbry's activity in psychology has been concerned with basic research in human performance, teaching, and the application of psychological knowledge to complex systems in industrial settings. His research activity involves the investigation of stress effects interacting with individual differences and the analysis of human memory and learning. In the first area, stress effects were examined with regard to coping responses in a VA hospital environment. Also, the effects of stress on problem-solving behavior were studied in a laboratory setting. The second area includes the study of qualitative changes in memory over an extended period of time and the observation of error behavior in rote learning. The undergraduate courses taught include experimental method, physiological psychology, introductory psychology and the psychology of language. During his three years at Essex, his work has been primarily concerned with the analysis and evaluation of the operator-machine interface in nuclear power plant control rooms. This work has been directed primarily to the evaluation of conventional PWR and BWR main control rooms in the U.S. and a BWR radwaste control room in Japan. He has conducted design studies of control panel component arrangement in both cases. The two most recent projects have focused on the evaluation of CRT display systems in advanced control rooms for BWR and PWR facilities in Japan.

EXPERIENCE:

ESSEX CORPORATION (1980 - Present)

Project Manager. Directed evaluation of CRT display system for advanced control room of Chubu Electric Power Company. This work included the updating and reorganization of CRT specifications; analysis of population stereotype data from client operations personnel and application of the results to CRT evaluation. Conducted review of functional allocation between control room operator vs. CRT system and an information availability analysis. Evaluation of CRT display system including features of CRT format organization, color/symbol schemes, alarm system, CRT information access and labeling.

Research Scientist. Developed general guidelines and criteria to support design of main control room in a nuclear power plant. The guidelines were directed to the

arrangement and grouping of components and component systems on the main control panel, the determination of the profile and floor plan configuration of the control panel and the planning of the control room facility.

Research Scientist. Developed population stereotype questionnaire for control panel elements with results applied to stereotype specification for an advanced control room (ACR) of a pressurized water reactor unit for Mitsubishi Heavy Industries. Also evaluated CRT pages for ACR and studied operator movement among CRTs. Developed voice-computer communication guidelines to support interactive computer systems.

Project Engineer. Evaluation of proposed and existing control panels for radwaste control room of boiling water reactor plant for Japan Atomic Power Company. Short- and long-term recommendations were made regarding the arrangement of panel components, proposed component types and annunciator system. The recommendations included a design proposal for the component arrangement of two radwaste control subpanels.

Research Associate. Performed human factors evaluation and a design study for main control panel arrangement of new pressurized water reactor power plant for Carolina Power and Light. Also participated in on-site evaluation of individual components and panel arrangement for main control panel of existing boiling water reactor plant and prepared label backfit supplement.

HELLMUTH, OBATA, AND KASSABAUM, INC. (1978 - 1980)
Saint Louis, Missouri

Architectural Draftsman/Research. Commercial structures: preparation of construction documents, statistical research on firms distribution of manpower across different building types. Client contact, coordination with structural and mechanical engineers, building code analysis.

CHINN AND ASSOCIATES (1977 - 1978)
Columbia, Missouri

Architectural Draftsman. Commercial and residential structures. Coordination with structural and mechanical engineers, preparation of construction documents such as site plans, floor plans, elevations, construction details and perspectives.

STEPHENS COLLEGE (1976 - 1977)
Columbia, Missouri

Instructor. Department of Psychology. Full responsibility for six courses in Basic Psychology and courses in Psychobiology and the Psychology of Language. Also, student advising and staff seminar participation.

MID-MISSOURI MENTAL HEALTH CENTER (1974 - 1976)
Columbia, Missouri

Research Assistant - Coordinated medical, research, and technical staff for psychological research on stress in hospital patients receiving a difficult examination (endoscopy). Also recording of polygraph data before and during examination, pre- and post-patient interviews, data reduction/preliminary analysis, library research, and assistance with the preparation of a variety of journal articles.

CHINN, DARROUGH, AND COMPANY (1973 - 1974)
Columbia, Missouri

Architectural Draftsman. Commercial and residential structures: preparation of construction documents, coordination with structural and mechanical engineers.

UNIVERSITY OF MISSOURI (1973)
Columbia, Missouri

Teaching Assistant. Department of Home Economics. Architectural Design II: Taught design process, planning, and development of drafting skills. Delineation course: Emphasis on color media applied to interior perspective drawing.

UNIVERSITY OF MISSOURI (1969 - 1973)
Columbia, Missouri

Teaching Assistant. Department of Psychology. General Experimental Psychology (Laboratory Instructor); General Psychology (Course Coordinator, Discussion Leader); and Research Methods, The Senses, Applied Psychology (Assistant).

UNIVERSITY OF MISSOURI (1969 - 1971)
Columbia, Missouri

Research Assistant. Department of Psychology. Design of graphic stimuli (face components) for automated display in a human learning study, data collection, and assistance with the writing of journal articles.

HELLMUTH, OBATA, AND KASSABAUM, INC. (1966 - 1968)
Saint Louis, Missouri

Architectural Draftsman. Commercial structures: preparation of construction documents.

A.L. AYDELOTT AND ASSOCIATES (1965)
Memphis, Tennessee

Architectural Draftsman. Commercial structures: preparation of construction documents.

JOHN E. FARBRY, JR. (Continued)

TECHNICAL REPORTS:

Summary Report: A Human Engineering Review of an Advanced Control Room CRT Display System for the Chubu Electric Power Company. Technical Report for Chubu Electric Power Company, Inc. in Nagoya, Japan, in press. (with D. Eike)

Human Engineering Specifications for an Advanced Control Room CRT Display System for the Chubu Electric Power Company. Technical Report for Chubu Electric Power Company, Inc. in Nagoya, Japan, in press. (with R. Kane, S. Fleger, and T. O'Donoghue)

A Functional Allocation Review of an Advanced Control Room CRT Display System for the Chubu Electric Power Company. Technical Report for Chubu Electric Power Company, Inc. in Nagoya, Japan, in press, (with T. Harding).

A Human Engineering Evaluation of an Advanced Control Room CRT Display System for the Chubu Electric Power Company. Technical Report for Chubu Electric Power Company, Inc. in Nagoya, Japan, in press. (with S. Fleger, R. Kane, T. Harding, and D. Pisitz).

Response Sterotypes of Japanese Control Room Operators to Elements of CRT Display Systems. Technical Report for Chubu Electric Power Company, Inc. in Nagoya, Japan, October, 1982.

A Human Engineering Evaluation of CRT Formats, CRTs, and Keyboards for the Mitsubishi Heavy Industries Advanced Control Room. Technical Report for Mitsubisi Heavy Industries, Japan, July 1982. (with R. Kane, S. Fleger, T. Harding and F. Piccione)

Extracontractual Studies on: Stress, Method for Design Criteria Evaluation, and PCC Configuration Study. Technical Report for Mitsubishi Heavy Industries, Japan, July, 1982. (with R. Kane, D. Metcalf, R. Benel, S. Fleger)

Response stereotypes of Japanese nuclear power plant control room operators. Study for Mitsubishi Heavy Industries, December 1981. (with R. Kane and S. Fleger)

System-Specific Specifications, Basic Console Evaluation, and Human Engineering Library Bibliography for Advanced Control Room. Technical Report for Mitsubishi Heavy Industries, Japan, July 1982. (with R. Kane, H. Manning, S. Fleger, T. O'Donoghue, N. Tulloh, and L. Grealis)

Human factors evaluation report on the Tsuruga Number One New Radwaste Control Room. Final report prepared for the Japan Atomic Power Company, September 1981. (with A. Strong)

Label backfit supplement BSEP 1 and BSEP 2. Prepared for Carolina Power and Light, September 1981.

Human factors evaluation report for the Brunswick Unit 1 and Unit 2 Control Room. Final Report prepared for Carolina Power and Light, September 1981. (with W. Talley, D. Beith, E. Talley, and T. Justice)

Human factors design evaluation report for the Shearon Harris Unit 1 control room. Final report prepared for Carolina Power and Light, September 1981. (with W. Talley, J. Haher, T. Amerson, D. Beith, and T. Justice)

JOURNAL ARTICLES:

Control-display integration on large, multi-system control panels. Proceedings of the Human Factors Society 25th Annual Meeting. Rochester, New York 1981. (with T. Harding and K. Mallory)

Evaluative persistence: Salt from the evaporative forgetting process. Dissertation Abstracts International, 1979, 39 (No. 8), 4068 B.

Greater repetition of errors under performance compared to observation in multiple-choice human learning. Perceptual and Motor Skills, 1973, 37, 949-950. (with M.H. Marx and D. Witter)

Psychological preparation for endoscopy. Gastrointestinal Endoscopy, 1977, 24, 9-13. (with R.H. Shipley, J.H. Butt, and B. Horwitz)

Preparation for a stressful medical procedure: Effect of amount of stimulus preexposure and coping style. Journal of Consulting and Clinical Psychology, 1978, 46, 499-507. (with R.H. Shipley, J.H. Butt, and B. Horwitz)

Long-term persistence of response-repetition tendencies based on performance or observation. Bulletin of the Psychonomic Society, 1978, 8, 65-67. (with D.W. Witter and M.H. Marx)

PRESENTATIONS:

Evaluative persistence: A long term memory for first impressions. Paper presented at the convention of the American Psychological Association, Montreal, September 1980.

Videotape preparation for a stressful medical procedure: Effects of number of exposures. Paper presented at the meeting of the Association for Advancement of Behavior Therapy, New York City, December 1976. (with R.H. Shipley, J.H. Butt, and B. Horwitz)

JENNIFER T. GOODSON

EDUCATION: M.A., Psychology,
George Mason University, 1984
B.A., Psychology,
Western Maryland College, 1981

AFFILIATIONS: Human Factors Society, National and Potomac Chapter
Psi Chi (Psychology Honor Society)

PROFESSIONAL BRIEF:

Ms. Goodson's experience has focused on applied research and quantitative analysis in the area of human factors engineering. As a scientist in Essex Corporation's Alexandria office, Ms. Goodson is involved in assessing nuclear power plant control room designs and identifying human engineering discrepancies, and in performing research in the area of organizational communication. Her professional experience also includes two years of work with the Human Factors Engineering research and development programs under the Naval Air Systems Command.

EXPERIENCE:

ESSEX CORPORATION (September 1984 - Present)
Alexandria, Virginia

Scientist - Assesses nuclear power plant control room designs and identifies human engineering discrepancies. Performs research in the area of organizational communications.

GEORGE MASON UNIVERSITY (1983 - 1984)
Fairfax, Virginia

Graduate Teaching Assistant - Taught experimental psychology and statistics undergraduate lab sections. Designed and directed student-performed experiments. Instructed students in statistical techniques, analysis of data, and reporting and interpreting results.

E-TECH, INC. (1981 - 1983)
Arlington, Virginia

Analyst - Prepared and maintained data base information in exploratory and advanced development Human Factors Engineering programs under the Naval Air Systems Command. Prepared support documentation and researched technical information for data required in response to specific requests. Wrote technology base presentations for management and budget reviews.

Programs included: Computer Assisted Methods (CAM), HFE Technology Integration and Application (TIA), HFE Technology for Ships, Voice Interactive Systems Technology, HFE Technology for Test and Evaluation (T&E), and Air Combat Performance.

JENNIFER T. GOODSON (Continued)

Applied methods included: Crewstation Assessment of Reach (CAR), Crewstation Geometry Evaluator (CGE), Computerized Accomodation Percentage Evaluator (CAPE), Workload Assessment Model (WAM), Human Operator Simulator (HOS), Field of View Evaluation Apparatus (FOVEA), Naval Flight Officer Function Analysis, and Mission Operability Assessment Techniques (MOAT).

Systems impacted included: A-7E, F-4, F-14, F-18, P-3C, Light Airborne Multi-Purpose System (LAMPS), VFA/VSTOL, Long Range Airborne Anti-Submarine System (LRAAS), LINEBACKER, PROTEUS, TRIDENT, Bearcat LSO Control Station, Mark 13 Catapult, Mark 14 Arresting Gear System, SEAFIRE/MK B6, Visual Target Acquisition System (VTAS), and Tactical Aircrew Combat Training System (TACTS).

Also worked for the Assistant for Training and Personnel Systems Technology, Office of the Undersecretary of Defense. Prepared and maintained data base information for Manpower, Personnel and Training research and development programs. Prepared comprehensive report of all ongoing research efforts performed by the four branches of service in Human Factors, Manpower and Personnel, Simulation and Training Devices, and Education and Training. Report was used for congressional review and as a foundation for the Manpower and Training Research Information System (MATRIS) data base.

SECURITY CLEARANCE: SECRET, granted by DISCO (1981).

Rich

PROPOSED WORK PLAN FOR
DEVELOPMENT OF THE DAVIS-BESSE SFRCS PANEL

Prepared For:

Davis-Besse Nuclear Power Station

Prepared By:

Essex Corporation
333 North Fairfax Street
Alexandria, Virginia 22314
703/548-4500

September 30, 1985

PROPOSED WORK PLAN FOR DEVELOPMENT OF THE DAVIS-BESSE SFRCS PANEL

This document describes a work plan methodology for the design of a new panel to serve functions of the Steam Feed Rupture and Control System (SFRCS). The work plan is composed of nine tasks which include a requirements analysis (Tasks 1 & 2), the design and evaluation process (Tasks 3-7), and a final review of the completed product and documentation of the panel development (Task 8 & 9).

TASK 1: ANALYZE DOCUMENTED PROBLEMS WITH SFRCS COMPONENTS

Objective

- To determine which features of SFRCS related components have documented problems which may need correction.

Steps

1. Review all HEDs concerned with SFRCS and group HEDs according to schedule for correction.
2. Review relevant information resulting from the plant trip on June 9, 1985 (e.g., NUREG 1154, Davis-Besse reports,...) and determine which issues need to be addressed for possible SFRCS corrections.

Products (Task 1)

- List of issues which should be addressed during any corrections of SFRCS in the main control room.

Support Needed from Davis-Besse Personnel (Task 1)

- Operations and I&C personnel available to provide information regarding the operator requirements and hardware requirements of SFRCS.
- Project management review of identified problems.

TASK 2: IDENTIFICATION OF SFRCS INFORMATION AND CONTROL REQUIREMENTS

Objective

- Davis-Besse is in the process of developing a new panel in order to centralize SFRCS functions. The objective of this task is to identify information and control requirements for the SFRCS functions.

Steps

1. Review Task 1 results for SFRCS instrumentation and control requirements. Determine if any SFRCS related components are recommended for addition, deletion or relocation.

2. Review DCRDR task analysis to identify which information and control requirements are required for SFRCS functions in the emergency procedure.

3. Through interview and joint analysis with system engineers, I&C and operations, determine which other I&C requirements, if any, should be addressed for the proposed panel to support SFRCS functions. This analysis may review portions of selected normal procedures.

4. Determine criteria regarding installation on control panel considering:

    - Seismic.
    - Fire separation.
    - Consideration of space required behind panel face and on top of panel (e.g., space for maintenance, for operation,...)
    - Availability of new controls and displays from manufacturer.
    - Other criteria.

Products (Task 2)

- List of information and control requirements for SFRCS functions. This list should flag requirements for new components vs. relocated components. Requirements for relocated components should identify existing panel location.

Support Needed from Davis-Besse Personnel (Task 2)

- Availability of Operations, I&C, and/or Systems Engineering for requirements analysis (determination of Tech Spec values, set points, ...)
- Review by project management of component requirement list.

TASK 3: IDENTIFY HARDWARE FOR SFRCS FUNCTIONS

Objective

- To identify specific components to provide required instrumentation and control functions for the SFRCS function.

Steps

1. Determine which existing components will satisfy information and control requirements and other practical requirements such as size. Refer to relevant HEDs from DCRDR.

2. For new component requirements compare possible components from different manufacturers on the basis of relevant criteria from 0700 and Davis-Besse experience.

Products (Task 3)

- List of displays and controls proposed for new panel.

Support Needed from Davis-Besse Personnel (Task 3)

- Availability of Operations and I&C personnel to provide Davis-Besse experience as input into selection.

- To be determined: Will CRT/SPDS be involved here? Or are only hardwired components to be used?

TASK 4: ASSESS GROUPING OF SFRCS RELATED COMPONENTS

Objectives

- Assess proposed system grouping of SFRCS related components relative to other system groupings to ensure that operator traffic patterns are effective. This task does not address arrangement of specific components within a group.

- To identify and address any human factors problems which could arise from relocating components (e.g., is it possible that important existing control-display relations will be disturbed? Will component grouping be degraded?

Steps

1. Prepare traffic patterns for proposed grouping of components. The traffic patterns should be based on procedures which use the new SFRCS components and relocated SFRCS components.

2. Compare the traffic patterns for the proposed arrangements to those developed for the DCRDR. The primary criteria used in this comparison will include:

   - Distance walked.

   - Number of shifts between system groupings.

   - Number of shifts between different panels (console, vertical panel, back panels).

   - Interference among operators.

These comparisons will focus on the SFRCS function and other functions which use components proposed for relocation to the SFRCS panel.

3. Verify problem components with operator(s).

4. Resolve locations of problem components.

Products (Task 4)

- List of problems identified in traffic pattern analysis. These items would identify which components, if any, were not in an appropriate system grouping, or those components which are strongly associated with more than one system grouping.

- Final list of components to be placed on new panel.

Support Needed from Davis-Besse Personnel (Task 4)

- Project management review of components in poor locations.

TASK 5: PRELIMINARY SFRCS COMPONENT ARRANGEMENT

Davis-Besse has developed preliminary diagrams showing different alternatives for a panicked component arrangement. Davis-Besse has also developed a full-scale mock-up of the new panel based on one of the preliminary diagrams.

Objective

- Complete a preliminary component arrangement in sufficient detail to allow an evaluation of component arrangement.

Steps

1. Compare the list of components and component requirements developed in this work plan to the set of components used for the mock-up.

2. Review criteria for component layout. These criteria include practical considerations such as panel structural limitations and fire separation; and NUREG-0700 criteria (e.g., panel layout, location aids, ...).

3. Revise the preliminary scheme to accommodate changes in list of requirements.

4. Consider alternative mimic arrangement, if useful.

Products (Task 5)

- Description of list of criteria.

- Revised mock-up and/or drawing to reflect incorporation of updated criteria and requirements. This scheme to include sufficient labeling for component location and identification during evaluation.

Support Needed from Davis-Besse Personnel (Task 5)

- I&C personnel to provide information regarding panel structure and component area constraints.
- Review of revised layout by Project Manager.

TASK 6: EVALUATION OF PRELIMINARY COMPONENT ARRANGEMENT

Objective

- Determine to what extent the preliminary component arrangement satisfies operational needs defined by (1) a walkthrough on the mock-up and (2) review of relevant SFRCS HEDs from DCRDR.

Steps

1. Develop scenarios for SFRCS operation for emergency procedure walkthroughs.
2. Ensure that all relevant portions of mock-up are prepared for a walkthrough to evaluate only component arrangement (relationships among individual components within a grouping) and labeling.
3. Observe operators as they walkthrough the prepared scenarios to identify possible human factors concerns with the panel layout.
4. Interview operators participating in walkthrough for comments, criticisms, and suggestions.
5. Assess operator comments.
6. Review the HEDs which are relevant to the component arrangement and determine if the layout corrects the problems.

Products (Task 6)

- Scenarios and procedural steps used in the evaluation.
- Record of walkthrough comments by observors and operators.
- Record of assessment of comments.
- Record evaluation of HED correction.

Support Needs from Davis-Besse Personnel (Task 6)

- Operators to assist in development of scenarios.
- Operator to ensure relevant portions of mock-up are prepared for walkthough.
- Operators to participate in walkthrough and interview.
- Operators and Systems Engineer to assist in evaluating SFRCS HED correction.

TASK 7: REFINE AND FINALIZE DESIGN

Objective

- To complete the design process and prepare final documents suitable for panel construction.

Steps

1. Incorporate comments on preliminary design into drawing of new panel. (This process may be somewhat iterative due to evaluations of new changes and trade-off analyses).
2. Evaluate modified design as required. Examine all HEDs identified in Task 1.
3. Prepare final drawing and necessary notes for panel manufacture. The final design drawing should include proposed label content.

Products (Task 7)

- Record results of HED correction assessment.
- See No. 3 above.

Support Needed from Davis-Besse Personnel (Task 7)

- Operations and Project Management to review changes and final document.

TASK 8: REVIEW MANUFACTURED PRODUCT

Objective

- To determine if manufactured panel satisfies specifications.

Steps

(This item could change depending on who manufactures the panel and the number of participants in the process.)

1. Check physical layout features of panel such as dimensions, color, application of mimic lines, and components characteristics against the requirements established in earlier tasks.

Product (Task 8)

- Statement of any problems identified in above evaluation.

Support Needed from Davis-Besse Personnel (Task 8)

- Review by Project Manager, Operations, and I&C.

TASK 9: DOCUMENTATION OF DESIGN PROCESS

Objective

- To provide description of important steps in the design process, to record the level of preparation for the design process and the rationale for key decisions in the process.

Steps

1. Prepare summary of each task in the design process and combine into a final report.

Product (Task 9)

- Final report for SFRCS panel design.

Support Needed from Davis-Besse Personnel (Task 9)

- Review of report by Project Manager.

METHOD FOR UPDATING SFTA AND I&C REQUIREMENTS VERIFICATION

The following additional function and task analysis will be performed to document and further verify required instrumentation and control requirements as recommended in the NRC's DCRDR audit report of July 2, 1985:

1. Complete function and task analysis of radioactivity release response (not previously analyzed)

2. Reanalysis of operator actions for steam generator tube rupture to ensure comprehensive identification of information and control needs (parameters and control action capabilities)

3. Analysis and documentation of required characteristics of instrumentation and controls to meet information and control needs for all emergency operator tasks.

4. Verification of I&C availability and suitability by comparison of requirements data from steps 1 - 3 above to existing instrumentation and controls.

ANALYSIS TEAM

The analysis team will consist of a human factors specialist with experience in DCRDR task analysis and a nuclear operations specialist (SRO license), and a systems/ I&C engineer.

INPUTS TO THE ANALYSIS

- Abnormal Transient Operating Guidelines (ATOG)
- Safety sequence diagrams developed in analysis leading to ATOG
- System Function Review Tables developed in previous function and task analysis for the Davis-Besse DCRDR
- Documentation of system changes recommended by Davis-Besse's System Review Group.

ANALYSIS APPROACH

The analysis approach is divided into four parts, corresponding to the four needs identified in the DCRDR audit report.

1. Radioactivity Release Analysis

a. Review system documentation and technical specifications pertinent to radioactivity release detection and control system.

b. Review administrative procedures concerning personnel responsibilities for radioactivity release control.

c. Prepare safety sequence diagrams identifying system and operator functions for radioactivity release response.

d. List tasks required to accomplish operator functions.

e. Analyze each task and specify task action requirements, and the necessary instrumentation and controls and their characteristics, based on what the operator is expected to accomplish and plant system characteristics and operating and safety limits.

f. Synthesize instrument and control requirements specified for each component and parameter, by system.

2. Steam Generator Tube Rupture Analysis

a. Compare existing Task Data Forms to applicable portions of the ATOG and safety sequence diagrams. Add any operator actions and associated information and control needs that may have been omitted from Task Data Forms.

b. Compare Task Data Forms as amended in step (a) to applicable parts of the symptom-based EOP and technical specifications to identify any additional action, information, and control needs that may be called for by those documents.

c. Analyze all information and control needs on updated Task Data Forms to specify implications for I&C characteristics as in step 1(e) above.

d. Synthesize I&C requirements as in step 1(f) above.

3. Analysis and Documentation of Required I&C Characteristics for All Remaining Emergency Operating Sequences

This will be done as described for steps 1(e) and 1(f).

4. Verification of Availability and Characteristics of Existing Instrumentation and Controls

The synthesized set of requirements for each emergency response sequence will be compared to existing components in a walk-through exercise involving one to two operators to assist the analysis team. This will be done in the mockup. Before these exercises the mockup will be verified and updated as necessary to ensure that it is fully accurate with respect to the current control room.

DAVIS-BESSE HED REASSESSMENT METHODOLGY: DETERMINATION OF CUMMULATIVE AND INTERACTIVE EFFECTS

The procedure employed to determine cummulative and interactive effects between HEDs initially requires the identification of all HEDs related to a specific component. This will be done using the on-line tracking system which can cross-reference HEDs using specific component ID numbers.

A team of human factors specialists and operations personnel will evaluate the specific relationships between HEDs to determine those which will interact to increase the error potential and/or decrease the potential for recovery. Because the consequence of the error is a constant, and only the potential for that effort is impacted by interaction effects, the consequence of error will remain as determined during normal assessment.

The factors to be considered by the evaluation team are as follow:

I. Potential for Error

- A. Situational factors
  - 1. Time criticality for task completion
  - 2. Frequency of use of component
- B. Specific factors
  - 1. Operator function/involvement
    - a. Maintained control of dynamic system parameter
    - b. Discrete control of plant systems
    - c. Monitoring systems/responding to alarm information
  - 2. Human engineering considerations
    - a. Determination of general location of component in control room
    - b. Identification of specific location of component in control room
    - c. Usability of component

II. Potential for Recovery

- A. Detectability of error-contingent on verfication of control action (feedback)
  - 1. Nature of verification information (direct vs. inferred)
  - 2. Accessibility of verification information
- B. Restoration of error dependent on dynamics of system(s) involved

DAVIS-BESSE COMPUTERIZED MED TRACKING SYSTEM
(Prototype)

Sample MED Data and Sample MED Status Summary

DAVIS-BESSE
HUMAN ENGINEERING DISCREPANCY (HED) REPORT

TITLE: Accidental activation of Pushbutton Controls

HED NO: P.4.1.3
CATEGORY: III
STATUS: COMP
CORR CODE: N/A

ITEMS INVOLVED:
PANEL ID: C-15
COMPNT ID: HIS-6227, HIS-6236, HIS-6237, HIS-6240, HIS-6242, HIS-6243, HIS-6244, HIS-6246, HIS-6248, HIS-6250, HIS-6251, HIS-6254, HIS-6626

PROBLEM DESCRIPTION:
Pushbuttons mounted low on the Electrical Distribution Panel are subject to accidental activation by personnel leaning or bumping against them.

0700 PARA: 6.4.1.2g

DATA SOURCE: 01.3

SPECIFIC ERROR:
Inadvertent activation of controls.

BACKFIT:
Change the pushbuttons to rotary switches to prevent inadvertent activation

DISPOSITION:
Changing the controls would violate the current shape coding conventions in the control room. A foot-guard extends 4.5 inches from the base of the panel to prevent operators from leaning or bumping the panel.

SCHEDULE: N/A

ORIGINATOR: D.Beith DATE: 07/19/83

APPROVED: DATE:

HUMAN ENGINEERING DISCREPANCY (HED) REPORT

TITLE: Indicator Lights are Dim

HED NO: P.5.1.1
CATEGORY: IIC
STATUS: COMP
CORR CODE: CL5

ITEMS INVOLVED:
PANEL ID: C-22
COMPNT ID: SI-60098

PANEL ID: C-6
COMPNT ID: ZI-3000

PANEL ID: C-7
COMPNT ID: TI-RCT

PROBLEM DESCRIPTION:
Lights on the above panels are difficult to read clearly and have litt le contrast in ambient lighting. Operators must shield the lights wit h their hands to read the displays clearly.

0700 PARA: 6.5.3.1b

DATA SOURCE: S.5.1.B3(4),S.5.1.B6(1),Q4.3

SPECIFIC ERROR:
Misinterpretation of equipment status

BACKFIT:
Increase brightness of LED lights.

DISPOSITION:
Add a hood to all LED displays to eliminate glare and increase the bri ghtness contrast.

SCHEDULE: 6th Refuel

ORIGINATOR: D.Beith DATE: 07/26/83

APPROVED: DATE:

HUMAN ENGINEERING DISCREPANCY (HED) REPORT

TITLE: Label Cleanliness

HED NO: P.6.1.2
CATEGORY: III
STATUS: COMP
CORR CODE: CL5

ITEMS INVOLVED:
PANEL ID: ALL
COMPNT ID: ALL

PROBLEM DESCRIPTION:
No procedure exists for the periodic cleaning of control panel labels. Labels are not cleaned on a regular basis

0700 PARA: 6.6.2.4d

DATA SOURCE: S6.1.B6(9),S6.1.B4(1),D6.7

SPECIFIC ERROR:
Misreading component labels

BACKFIT:
Establish a maintenance or administrative procedure for periodic cleaning of labels.

DISPOSITION:
Same as above. In addition labels will be standardized black on white to reduce reading problems.

SCHEDULE: 7th Refuel

ORIGINATOR: D.Beith DATE: 07/25/83

APPROVED: DATE:

HUMAN ENGINEERING DISCREPANCY (HED) REPORT

TITLE: Computer Display Titles are Un
clear in Describing Display Co

HED NO: P.7.1.1
CATEGORY: III
STATUS: COMP
CORR CODE: ENH

ITEMS INVOLVED:
PANEL ID: CRT'S
COMPNT ID: DISPLAYS

PROBLEM DESCRIPTION:
Titles used for individual CRT displays do not accurately describe the actual contents of the display

0700 PARA: 6.7.1.2a(2)

DATA SOURCE: S7.1.B2(6),B3(7),B3(B3)

SPECIFIC ERROR:
Delay in obtaining appropriate data.

BACKFIT:
Modify display titles to give a clearer indication of display contents using standard acronyms and abbreviations developed for control room labels.

DISPOSITION:
Same as above.

SCHEDULE: 7th Refuel

ORIGINATOR: D.Beith DATE: 12/14/83

APPROVED: DATE:

DAVIS-BESSE

HUMAN ENGINEERING DISCREPANCY (HED) REPORT

TITLE: Inconsistent Use of Color in t
he Control Room

HED NO: P.8.1.1
CATEGORY: III
STATUS: OPEN
CORR CODE:

ITEMS INVOLVED:
PANEL ID: ALL
COMPNT ID: ALL

PROBLEM DESCRIPTION:
There is no consistent meaning assigned to the colors used for compone
nt and mimic coding across the control room.

0700 PARA: 6.5.1.1d(1) 6.5.1.6d(2) 6.5.3.2a(2)
6.4.2.2f(1)

DATA SOURCE: SB.1.B7(1,7,8,9)

SPECIFIC ERROR:
Delay in locating/identifying controls and display.

BACKFIT:
Development and implement a standard system of color coding to the con
trol room.

DISPOSITION:
To be reviewed further under the labeling study.

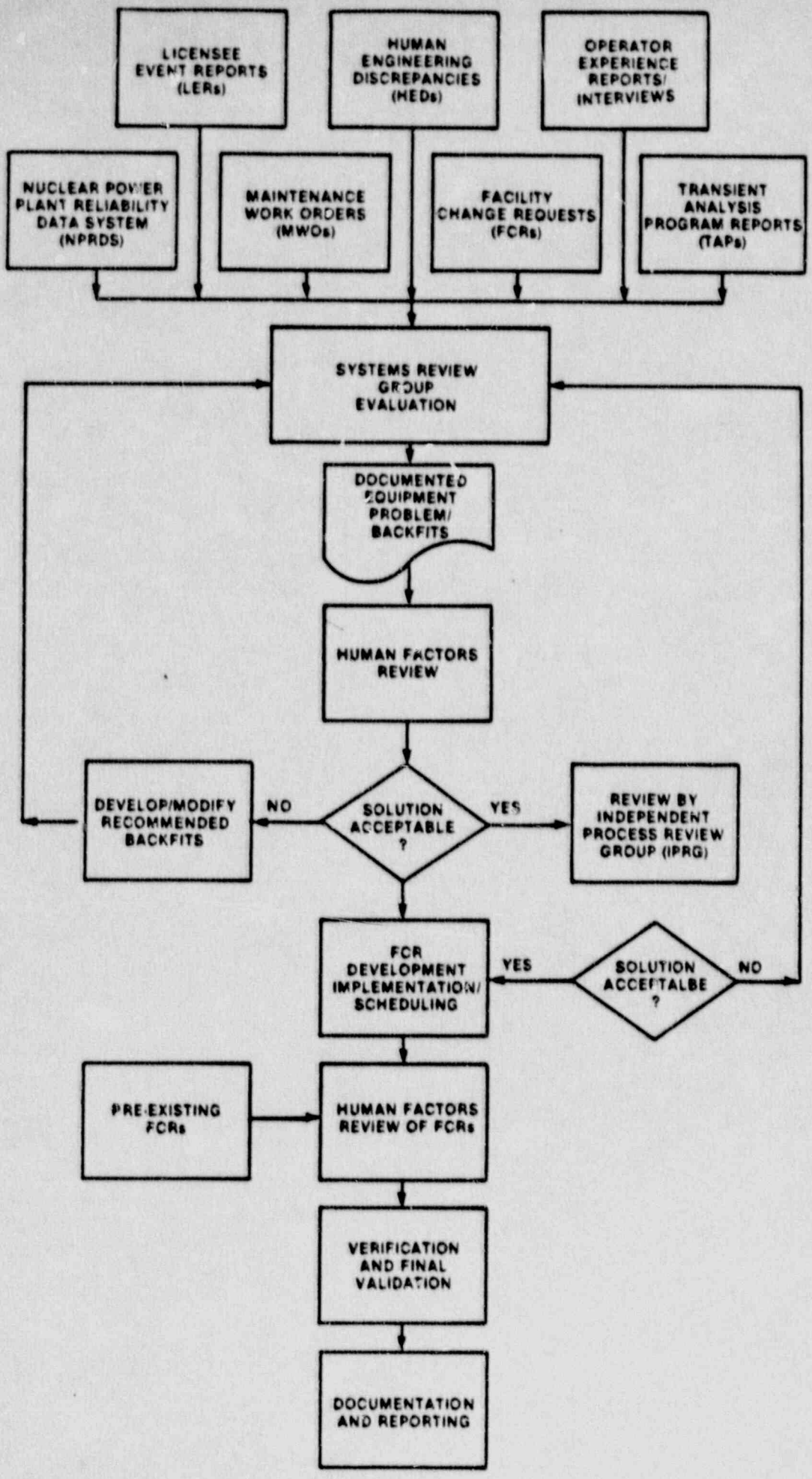
SCHEDULE:

ORIGINATOR: D.Beith DATE: 01/17/84

APPROVED: DATE:

DAVIS-BESSE HED STATUS SUMMARY

HED NO.	TITLE	PNL	CMPNT	0700	CAT	STAT	COR	SCHED
P4.1.3	Accidental Control Activation	C15	HIS6227 HIS6242 HIS6248 HIS6626 HIS6236 HIS6243 HIS6250 HIS6237 HIS6244 HIS6251 HIS6240 HIS6246 HIS6254	6412g	III	Comp	N/A	N/A
P5.1.1	Dim Indicator Lights	C06 C07 C22	Z13000 TI-RCT S16009B	6531b	IIC	Comp	CLS	Ref-6
P6.1.2	Label Cleanliness	ALL	ALL	6624d	III	Comp	CLS	Ref-7
P7.1.1	CRT Display Title Clarity	CRT	ALL	6712a	III	Comp	ENH	Ref-7
P8.1.1	Inconsistent Color Codes	ALL	ALL	6411f1 6511d1 6516d2 6532a2	III	Open	-	-


LICENSEE EVENT REPORTS (LERs)
HUMAN ENGINEERING DISCREPANCIES (HEDs)
OPERATOR EXPERIENCE REPORTS/ INTERVIEWS
NUCLEAR POWER PLANT RELIABILITY DATA SYSTEM (NPRDS)
MAINTENANCE WORK ORDERS (MWOs)
FACILITY CHANGE REQUESTS (FCRs)
TRANSIENT ANALYSIS PROGRAM REPORTS (TAPs)
SYSTEMS REVIEW GROUP EVALUATION
DOCUMENTED EQUIPMENT PROBLEM/ BACKFITS
HUMAN FACTORS REVIEW
SOLUTION ACCEPTABLE ?
NO
YES
DEVELOP/MODIFY RECOMMENDED BACKFITS
REVIEW BY INDEPENDENT PROCESS REVIEW GROUP (IPRG)
FCR DEVELOPMENT IMPLEMENTATION/ SCHEDULING
YES
SOLUTION ACCEPTALBE ?
NO
PRE-EXISTING FCRs
HUMAN FACTORS REVIEW OF FCRs
VERIFICATION AND FINAL VALIDATION
DOCUMENTATION AND REPORTING

DAVIS-BESSE SYSTEMS REVIEW GROUP
DISCREPANCY INDEX

HED NO.	TITLE	CATEG	SRG NO.
P1.7.10	LAMP TEST/DUAL BULB CAPABILITY	IA	
P1.7.11	INDICATOR BULBS SHORT OUT DURING REPLACEMENT	IA	
P3.1.37	ANNUNCIATORS WITH MULTI-PARAMETER INPUTS	IIA	
P4.1.4	CONTROLS CO-LOCATED EXCESSIVELY CLOSE TOGETHER	IA	MU & P-NRR-22
P5.1.2	UNLIT INDICATOR LIGHTS PROVIDE SYSTEM STATUS	IIA	MU & P-NRR-26
P5.1.6	SCALE RANGE INSUFFICIENT FOR MAXIMUM SYSTEM VALUE	IIA	MU & P-RR-03 IMS-NRR-03
P5.1.7	METERS DO NOT HAVE AN OBVIOUS FAILURE MODE(OFF-SCALE LOW)	IIB	
P5.1.9	MULTISCALE METERS DIFFICULT TO READ	IIA	
P5.1.29	METERS SUFFER PARALLAX PROBLEMS	IIA	IMS-NRR-03
P6.1.12	LABELS NOT LOCATED ABOVE THE ELEMENTS DESCRIBED	IIA	ARTS-NRR-02
P6.1.15	TEMPORARY LABELS OBSCURE LABELS AND COMPONENTS	IIA	
P9.2.1	SFRCS DISPLAY ARRANGEMENT INCORRECT	IIA	-SFRCS FCR-
P9.2.4	RELATED CONTROLS/DISPLAYS NOT PROPERLY GROUPED	IIB	
P9.2.5	ICS PANEL ARRANGEMENT MISLEADING	IIB	
P9.2.6	CONTROL VIOLATES OPERATOR EXPECTANCY	IIA	SFAS-NRR-04
P9.2.7	AFW DISPLAY ACCURACY INSUFFICIENT	IIA	AF-NRR-06
P9.2.18	SFRCS INFORMATION AVAILABILITY INCONSISTENT	IIA	SG-NRR-01
P9.2.20	SFAS ISOLATION GROUPS UNCLEAR	IIA	SFAS-NRR-[illegible] MU & P-NRR-09

P9.2.28	FEEDWATER FLOW INDICATION MISLEADING	IIB	
P9.2.30	CRITICAL DISPLAYS NOT VISIBLE	IIA	
P9.2.33	AFW SYSTEM LACKS APPROPRIATE MIMICS	IIA	
P9.2.42	STEAM GENERATOR LOGIC INPUTS VARY (ICS AND SFRCS)	IIA	SG-NRR-02 MFW-RR-04
P9.2.43	SFRCS BLOCK CONTROL NOT LOCATED IN CONTROL ROOM	IIA	-SFRCS FCR-
P9.2.47	DECAY HEAT MIMIC RELATIONSHIPS UNCLEAR	IIA	HPI-RR-11
P9.2.54	CONTROLS NOT ARRANGED TO SUPPORT OPERATIONS (SFRCS)	IIA	-SFRCS FCR-
P9.2.65	MAIN TURBINE INFORMATION INADAQUATE	IIB	
P9.2.83	ICS TRACK MODE INFORMATION INADAQUATE	IIB	
P9.2.84	DEAERATOR LEVEL CONTROL VALVE INFORMATION INADAQUATE	IIB	
P9.8.7	INACCURATE DISPLAYS (PAM) (CR)	IIA/ IIC	RCS-RR-04

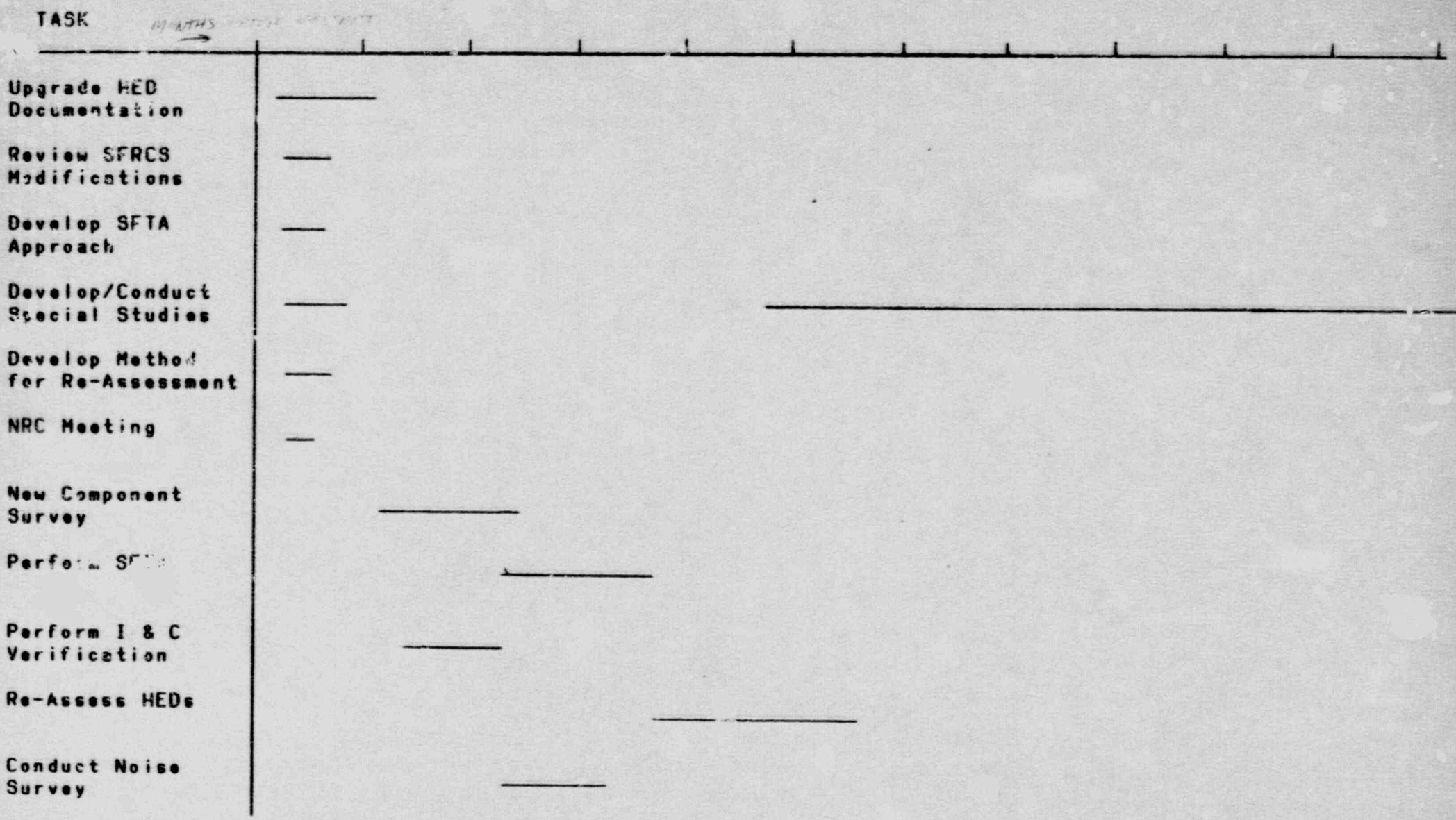
DAVIS-BESSE HED/SYSTEMS REVIEW GROUP
PROBLEM ID CROSS-INDEX

PROBLEM ID. NO.	PROBLEM DESCRIPTION	RELATED HED NO.
ARTS-NRR-02	CONTROLS TOO CLOSE TOGETHER - ACTUAL PROBLEM IS LABELING AS THE ARTS OUTPUT TRIP AND LAMP TEST CONTROLS ARE LABELED "CH 1, 2, 3, 4" AND "BKR A, B, C, D" WHILE THE ACTUAL RELATIONSHIP IS 1 TO B, 2 TO A, 3 TO D, AND 4 TO C.	P6.1.12
SIA-NRR-09	STATION AIR COMPRESSOR CANNOT BE STARTED FROM THE CONTROL ROOM - NO CONTROL SWITCH	
SIA-NRR-14	NO INSTRUMENT AIR FLOW METER IN THE CONTROL ROOM	
AF-NRR-06	NO FLOW INDICATION EXISTS ON THE AFW PUMP MINIMUM FLOW LINE	P9.2.7
CCW-NRR-09	NO CCW LETDOWN FLOW METER IN THE CONTROL ROOM	
EVS-RR-01	CONTROLLERS NOT PROTECTED AGAINST ACCIDENTAL ACTIVATION (PDC 5000, PDC 5014)	
CS-NRR-03	NO CONTAINMENT SUMP LEVEL INDICATION - ONLY TWO INDICATOR LIGHTS THAT OPERATORS ARE UNSURE OF TO INDICATE LOW LEVEL	
CS-NRR-04	NO PUMP DISCHARGE PRESSURE INDICATION IN THE CONTROL ROOM FOR MONITORING CAVITATION WHEN IN THE RECIRC. MODE	
CRD-NRR-04	DIAMOND CONTROL PANEL LIGHTS ARE NOT COLOR CODED TO MATCH THOSE USED ON THE SIMULATOR	
CRD-NRR-09	CRD MOTOR POWER ANNUNCIATOR IS A NUISANCE ALARM	
CF-NRR-02	CORE FLOOD TANK LEVEL INDICATION READS IN CUBIC FEET, TECH. SPECS. READ IN GALLONS	
13.8KV-NRR-02	MIMIC BUSSES ARE CONFUSING TO FOLLOW	
13.8KV-NRR-03	METERS ON ELECTRICAL PANEL ARE DIFFICULT TO READ CLEARLY	
HPI-RR-11	HPI AND DECAY HEAT PUMP CONTROL SWITCHES ARE NOT CLEARLY GROUPED	P9.2.47
IMS-NRR-03	INCORE TEMPERATURE METER RANGE ON PAM PANEL IS NOT LARGE ENOUGH FOR SYSTEM CAPABILITIES	P5.1.6 P5.1.29

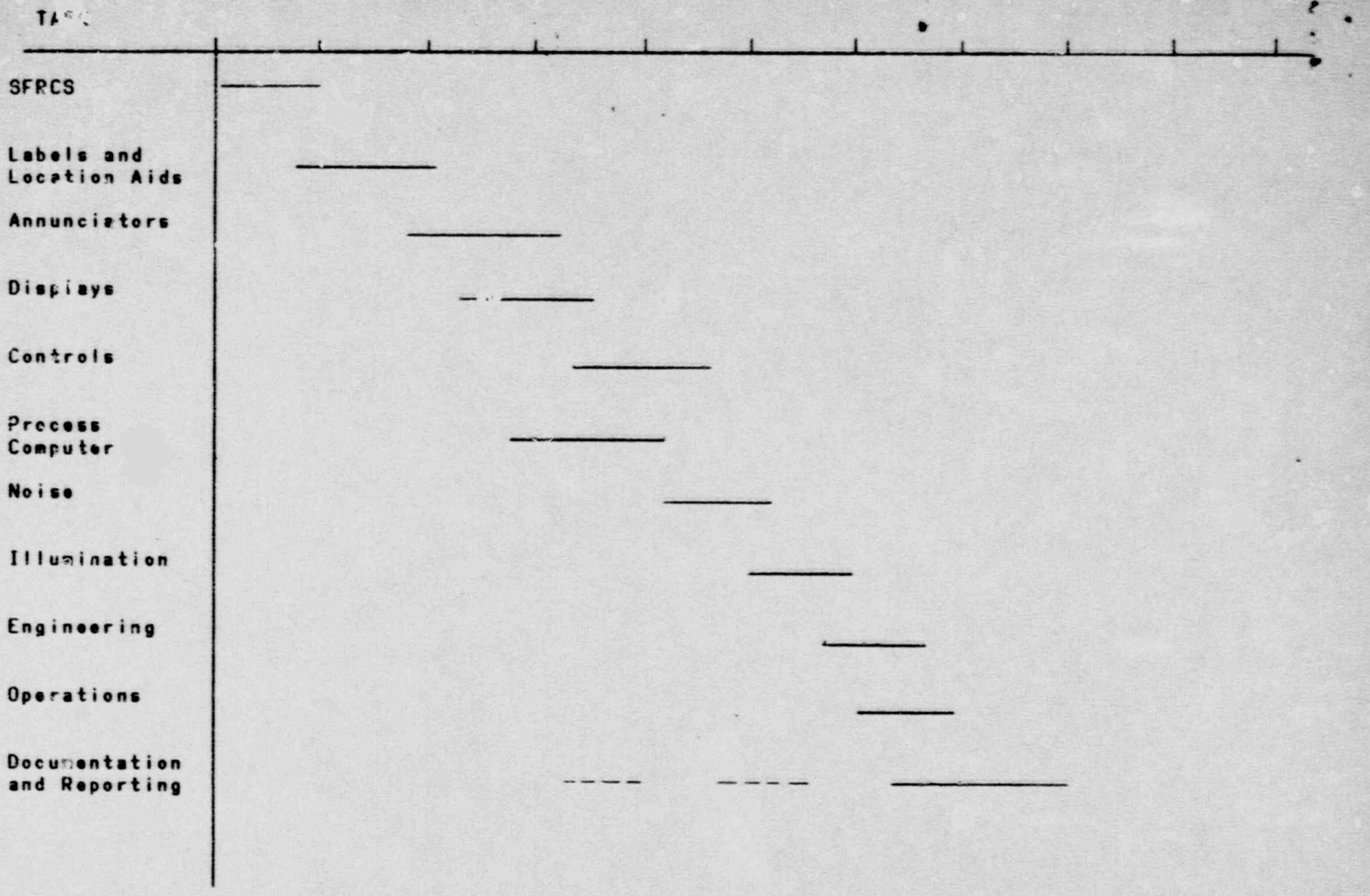
IMS-NRR-04	TWO BACKUP INCORE MULTIPOINT DETECTORS ARE AVAILABLE - ONLY NEED ONE	
ICS-NRR-03	NO ALARM TO INDICATE SATURATION OF Tavg INTEGRAL	
ICS-NRR-07	NON-NUCLEAR INSTRUMENTATION SYSTEM SELECTOR SWITCHES CAN BE POSITIONED BETWEEN DETENTS - THIS COULD CAUSE AN ICS TRANSIENT	
ICS-NRR-08	THE SYSTEMS REVIEW GROUP FEELS A CONTROL ROOM DESIGN REVIEW IS NEEDED	
MFW-RR-04	ELIMINATE UN-NECESSARY INTERLOCKS IN THE MFW SYSTEM TO ELIMINATE VARYING INDICATIONS OF MFW LEVEL AND THE UN-NECESSARY LEVEL CONTROLS	P9.2.28 P9.2.43 P9.2.85
MFW-NRR-05	HI PRESSURE FEEDWATER HEATER SIGHTGLASS LEVEL INDICATIONS ARE UNRELIABLE/OUT OF SERVICE - REPLACE THEM WITH BETTER COMPONENTS	
MFW-NRR-09	MFW STARTUP CONTROL VALVE POSITION INDICATION INDICATES THE DEMAND PLACED ON THE VALVE, NOT THE ACTUAL STATUS	
RCS-RR-03	BENTLEY-NEVADA PROXIMITY PROBES USED TO DETECT RC PUMP VIBRATION ARE CONFUSING TO READ - OPS PERSONNEL RELY ON THE ANNUNCIATOR AS SOLE INDICATION OF HIGH VIBRATION. NEW METERS ARE BEING ADDED TO THE CONTROL ROOM	
RCS-RR-04	INCORE TEMP. INDICATIONS ARE AVAILABLE ON THE PAM PANEL BUT THREE OPERATORS ARE REQUIRED IN ORDER TO READ THEM. SPDS DOES PROVIDE THIS INFORMATION	P9.8.7
RCS-NRR-09	INOPERATIVE DISPLAYS - RC Tave DIGITAL DISPLAY IS BROKEN	
RCS-NRR-16	CCW SYSTEM WATER LOSS LEADS TO AN RCP TRIP AFTER A CERTAIN AMOUNT OF TIME. NO DEVICES IN THE CR TO MEASURE ELAPSED TIME AND DETERMINE WHEN A MANUAL TRIP SHOULD OCCUR - A TIME DELAY IS BEING ADDED TO THE CCW ANNUNCIATORS	
RPS-NRR-04	RPS CHANNELS ARE LABELED 1,2,3,4 - TRIP BKRS ARE RELATED B,A,D,C NOT A,B,C,D AS WOULD BE EXPECTED. SEE ARTS-NRR-02 AS WELL	P6.1.12
SFAS-NRR-01	SFAS ACTUATES MSIV'S LOCATED OUTSIDE CONTAINMENT - THESE VALVES ARE UNNECESSARY AND ARE BEING REMOVED (SFRCS ACTUATES THE SAME VALVES)	
SFAS-NRR-04	SFAS MANUAL TRIPS ARE NOT GROUPED WITH THE ASSOCIATED RESET CONTROLS, AND RESET INVOLVES TWO ACTIONS - PRESS "OFF" ON THE TRIP CONTROL AND THEN PRESS RESET	P9.2.6

SFAS-NRR-05	RCP SEAL INJECTION ISOLATION VALVES AND RCP SEAL RETURN VALVE CONTROL SWITCHES ARE GROUPED UNDER LEVEL TWO ACTUATION WHEN THEY SHOULD BE UNDER LEVEL THREE	P9.2.20
SW-RR-02	EMERGENCY CONDENSER OUTLET VALVES HAVE NO AUTO-INITIATION FEFATURE - THE SYSTEM TEMP. INDICATION IS INACCURATE AS WELL	
SW-NRR-02	SW FLOW INDICATOR INACCURATE - CHANGE SENSOR LOCATION	
SW-NRR-08	NO TEMP. INDICATOR FOR THE SWING CCW HEAT EXCHANGER - AN FCR IS IN PLACE TO ADD ONE	
SW-NRR-09	NO ALARM IN THE CONTROL ROOM TO INDICATE A LOSS OF TPCCW FROM SERVICE WATER.	
SG-NRR-01	NO SFRCS LEVEL INDICATION IN THE CONTROL ROOM AN FCR IS IN PLACE TO ADD ONE (SEE SG-NRR-02)	P9.2.18 P9.2.42
SG-NRR-02	STEAM GENERATOR LEVEL INDICATION IS INACCURATE AND UNRELIABLE - DOESN'T ALWAYS MATCH ACTUAL SFRCS LEVEL - INSTALL SFRCS LEVEL INDICATION	P9.2.18 P9.2.42
MU & P-RR-03	FLOW INDICATOR RANGE IS INSUFFICIENT FOR THE POTENTIAL LIMIT OF THE SYSTEM (FI MU31)	P5.1.6
MU & P-NRR-09	LEVEL THREE ACTUATION COMPONENTS LOCATED IN THE LEVEL TWO ACTUATION GROUP (SEE SFAS-NRR-05)	P9.2.20
MU & P-NRR-11	LOCATION OF G4977A AND G4978A MAKE IT DIFFICULT TO OPERATE THE SYSTEM TO SUPPLY HYDROGEN TO THE MAKEUP TANK	
MU & P-NRR-16	RCP SEAL LEAKAGE INDICATORS ARE INACCURATE AND UNRELIABLE (FI-4137A,4237A,4337A,4437A)	
MU & P-NRR-22	CONTROL SWITCHES MU-54 AND MU-3971 ARE LOCATED EXCESSIVELY CLOSE TOGETHER, HAVE SIMILAR LABELS, AND LOOK THE SAME - THIS COULD CAUSE CONFUSION DURING OPERATIONS	P4.1.4
MU & P-NRR-26	BORATION PERMIT INDICATOR LIGHT IS UNLIT TO INDICATE SYSTEM NORMAL STATUS - NO OBVIOUS FAILURE MODE	P5.1.2
EDG-NRR-23	EDG FUEL OIL STORAGE AND DAY TANKS HAVE NO LEVEL INDICATORS ON THEM - OVERFILLING OF THE TANKS OFTEN RESULTS AND CAUSES SPURIOUS HIGH LEVEL ALARMS IN THE CONTROL ROOM	

TASK TIME-PHASE SCHEDULE



SPECIAL STUDY TIME-PHASE SCHEDULE



MEETING SUMMARY DISTRIBUTION

Licensee: Toledo Edison Company

*Copies also sent to those people on service (cc) list for subject plant(s).

Docket File
NRC PDR
L PDR
ORB#4 Rdg
Project Manager - ADe Agazio
JStolz
BGrimes (Emerg. Preparedness only)
OELD
EJordan, IE
ACRS-10
RRamirez
NRC Meeting Participants:
WRegan
DTondi