IN-PROGRESS AUDIT

OF THE

DETAILED CONTROL ROOM DESIGN REVIEW

FOR

NIAGARA MOHAWK POWER CORPORATION'S

NINE MILE POINT NUCLEAR STATION, UNIT 1

January 30, 1985

Prepared by

Science Applications International Corporation
McLean, Virginia 22102

Under Contract to

The United States Nuclear Regulatory Commission

Contract NRC-03-82-096

FOREWORD

This report documents an in-progress audit of the Detailed Control Room Design Review (DCRDR) being conducted by Niagara Mohawk Power Corporation (NMPC) for its Nine Mile Point Nuclear Station, Unit 1. The audit was conducted by a team comprised of one representative of the U.S. Nuclear Regulatory Commission, one representative from Science Applications International Corporation (SAIC), and one representative from Comex Corporation (a subcontractor to SAIC). SAIC's participation was provided under Contract NRC-03-82-096, Technical Assistance in Support of Reactor Licensing Actions, Program III. SAIC had previously provided the NRC an evaluation of NMPC's Program Plan.

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BACKGROUND

Niagara Mohawk Power Corporation (NMPC) submitted a Detailed Control Room Design Review (DCRDR) Program Plan for Nine Mile Point Nuclear Station, Unit 1 (NMP-1) on September 30, 1983. Nuclear Regulatory Commission (NRC) staff comments on that Program Plan were forwarded to NMPC on January 25, 1984. In addition, the NRC Project Manager for NMP-1 arranged for NMPC to provide a DCRDR status briefing on August 17, 1984. NRC staff comments on information provided at that meeting were forwarded to NMPC on October 1, 1984.

Based on review of the Program Plan and information acquired at the August 17, 1984 briefing, the NRC staff planned an in-progress audit of the NMP-1 DCRDR. That audit was arranged through the NRC Project Manager for NMP-1 and was scheduled for November 27-30, 1984. The purpose of the audit was to compare the products of the NMP-1 DCRDR against the DCRDR requirements of Supplement 1 to NUREG-0737. The audit included review of DCRDR documentation; visits to the control room, remote shutdown panels, and simulator; and discussion of NMPC's plans to complete the DCRDR. Attachment A provides the audit agenda.

The audit team was comprised of the NRC team leader, a consultant from Science Applications International Corporation (SAIC), and a consultant from Comex Corporation. The disciplines of human factors engineering, systems engineering, and nuclear operations were represented on the team. Attachment B provides complete lists of attendees at the entrance and exit briefings.

This report documents the findings of the in-progress audit. It was compiled and integrated by SAIC with input from Comex Corporation and the NRC staff. The report represents the consolidated observations, conclusions, and recommendations of the audit team.

DISCUSSION

NUREG-0700 describes four phases of the DCRDR and provides applicants and licensees with guidelines for its conduct. The phases are:

1. Planning
2. Review
3. Assessment and implementation
4. Reporting

The requirements of Supplement 1 to NUREG-0737 indicate the need to include a number of elements in the DCRDR. They are:

1. Establishment of a qualified multidisciplinary review team

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

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

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

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

6. Selection of design improvements

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

8. Verification that improvements will not introduce new HEDs

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

Licensees are expected to complete Element 1 during the DCRDR's planning phase, Elements 2 through 4 during the DCRDR's review phase, and Elements 5 through 8 during the DCRDR's assessment and implementation phase. Completion of Element 9 is expected to cut across the planning, review, and assessment and implementation phases.

A Summary Report is to be submitted at the end of the DCRDR. As a minimum it shall:

1. Outline proposed control room changes

2. Outline proposed schedules for implementation

3. Provide summary justification for HEDs with safety significance to be left uncorrected or partially corrected.

The NRC staff evaluates the organization, process, and results of the DCRDR. Results of the evaluation are documented in a Safety Evaluation Report (SER) published within two months after receipt of the Summary Report.

The Summary Report for the NMP-1 DCRDR was scheduled to be submitted for NRC staff review by January 1, 1985. Due to the short time between the in-progress audit and the date for the submission of the Summary Report, the audit team concentrated its review on DCRDR results. The organization and process of the NMP-1 DCRDR were addressed in the NRC staff's Program Plan Comments and minutes of the August 17, 1984 meeting between NMPC and the NRC staff. In-progress audit findings, in terms of the DCRDR elements identified in Supplement 1 to NUREG-0737, are provided below.

<u>Establishment of a qualified multidisciplinary review team</u>. The establishment of a qualified multidisciplinary review team was not evaluated as a

separate element during the in-progress audit. The contribution of personnel from various disciplines to accomplishment of other DCRDR elements was, however, not ignored.

One concern raised during the audit is that the team performing the task analysis did not appear to have all of the necessary expertise demanded by the task. The persons preparing the task analysis were a human factors specialist (HFS) and licensed reactor operators going through requalification on the NMP-1 simulator. In the audit team's judgment the involvement of a nuclear systems engineer is necessary for the task analysis. This view is supported by the fact that incomplete results were found in the task analysis record. Participation of this needed expertise will increase the likelihood that the function and task analysis element will be successfully accomplished (Appendix A of Reference 2).

Function and task analyses to identify control room operator tasks and information and control requirements during emergency operations. This requirement as stated in Supplement 1 to NUREG-0737 calls for "... the use of function and task analysis (that had been used as the basis for developing emergency operating procedure technical guidelines and plant-specific emergency operating procedures) to identify control room operator tasks and information and control requirements during emergency operations" (Reference 1).

As a result of a meeting between NRC and the Boiling Water Reactor Owners Group (BWROG), Revision 3 of the Emergency Procedure Guidelines (EPGs) was found to provide a satisfactory starting point for the function and task analysis; however, further plant-specific analysis is necessary. The conclusions of that meeting are summarized below as documented in Reference 4.

1. "It appears that Revision 3 of the EPG provides a functional analysis that identifies, on a high level, generic information and control needs. However, these EPGs do not explicitly identify the plant-specific information and control needs, which are necessary for preparing emergency operating procedures and determining the adequacy of existing instrumentation and controls.

2. "Because detailed plant-specific information and control needs cannot be extracted directly from the EPGs, plant-specific analysis is required.

3. "Each licensee and applicant must describe the process used to identify plant-specific parameters and other plant-specific information and control capability needs and must describe how the characteristics of needed instruments and controls will be determined. These processes may be described in either the Procedure Generation Packages or the DCRDR Program Plan with appropriate cross-referencing.

4. "For each instrument and control used to implement the EOPs, there should be an auditable record that defines the necessary characteristics of the instrument or control and the bases for that determination. The necessary characteristics should be derived from analysis of the information and control needs identified in NRC-approved EPGs and from analysis of plant-specific information."

An adequate task analysis for the DCRDR should identify all tasks involved in the plant-specific upgraded EOPs and all the information and control capabilities necessary to perform those tasks. It should also identify the suitable characteristics of displays and controls that will support tasks specified in the EOPs.

During the November 27-30, 1984 in-progress audit, NMPC indicated that the starting point for the task analysis was the Revision 0 of the NMP-1 plant-specific EPGs. These EPGs were developed from the BWROG EPGs, Revision 3, supplemented by plant-specific information. The audit team reviewed the plant-specific EPGs which they found to contain plant parameters and values. This document also contains operator information and control needs; however, those needs are often documented on a high level and remained to be analyzed in detail. The NMP-1 EPGs include:

1. Reactor Pressure Vessel Control
2. Primary Containment Control
3. Secondary Containment Control

4. Radioactivity Release Control
5. Seven Contingencies

The audit team was also provided with two sets of documents produced during the task analysis. The first set, entitled "Task Description Forms," contains a brief statement of the operator task as derived from the NMP-1 EPGs. The second set, entitled "Task Analysis Instrumentation Requirement Form," contains data developed during the identification of needed instrumentation and controls.

The NMP-1 consultant (Advanced Resources Development Corporation - ARD), who conducted the task analysis, described the following process used to complete the forms. Task Description Forms were completed by the HFS by identifying tasks specified in the NMP-1 EPGs. Task Instrumentation Requirement Forms were completed by the HFS, partly by questioning operators. Task Analysis Instrumentation Requirement Forms were completed for later comparison with a control room inventory and include the following:

1. action step
2. operator identifier
3. verb (task descriptor)
4. control (equipment, position, identifier, type, other)
5. indicator/feedback (equipment, type, state, identifier, units, range, division, other)
6. other performance requirements
7. exit or comments

The audit team reviewed the records and forms made available by the DCRDR team. It appeared that the process used was capable of identifying and analyzing operator tasks and information and control requirements. However, the audit team believes the process should be applied in a more rigorous and systematic fashion. Also the process could be improved by the involvement of a nuclear systems engineer who is familiar with NMP-1 plant systems and can assist in the identification and description of operator tasks.

The following discussion illustrates the reasons for concluding that the task analysis product is incomplete and requires further effort.

A task originating from the Reactor Pressure Vessel Control EPG was described as follows: "Observe need for MSIV Isolation." This task should have been analyzed in further detail to describe the corresponding operator subtasks, decisions and information/parameters required for the task. This description is needed to determine the characteristics of controls and displays needed to conduct the task.

As the instance illustrates, the NMP-1 EPGs do not explicitly identify and describe all operator tasks to a detailed level. Further analysis is necessary to determine all task steps in the EPGs and the associated information and controls necessary to perform these tasks. When accomplished, the task analysis product can be fed back to the EOP project engineer to support the generation of complete and technically adequate procedures.

Incomplete documentation of operator tasks was also noted in the task analysis of the following NMP-1 EPGs.

1. Reactor Pressure Vessel Flooding
2. Emergency RPV Depressurization
3. Primary Containment Control
4. Secondary Containment Control

The audit team also found that as a result of insufficient task descriptions the determination of Instrumentation and Control Requirements had significant gaps. For example, the identification of needed confirmatory indications following an operator action had not been completely identified. In some cases the "task instrumentation requirements" forms contained simple indicator lights as the required feedback indication following an operator action. In the audit team's judgment, it should have contained feedback indications in the form of a meter. In other cases, the instrumentation required for operator feedback following operator action had not been filled in.

Finally, the audit team observed that the nomenclature used in the NMP EPGs and the task analysis documentation was inconsistent. For instance,

the terms "torus" and "suppression pool" were used interchangeably. Consistency and standardization between words used in procedures and those used on the control room panels are necessary to avoid operator confusion with procedures and delay in identifying needed controls and displays.

The audit team concludes that the task analysis reviewed during the audit was incomplete. Because the NMP-1 EPGs were of a high level and did not always contain detailed task descriptions, operator tasks were not fully identified and described. As a result, not all information and control needs or the characteristics of instrumentation appropriate for a given task could be identified. The licensee should upgrade the task analysis by addressing the concerns raised in the preceding paragraphs. Also, NMP-1 should assure that the control room will support EOP accomplishment by identifying and providing all control and display needs associated with the performance of the EOP tasks.

Comparison of display and control requirements with a control room inventory. According to the NRC requirement stated in NUREG-0737, Supplement 1, the DCRDR should include: "(iii) A comparison of the display and control requirements with a control room inventory to identify missing displays and controls" (Reference 1). The necessary input for the requirement is the product from the task analysis -- the needed instruments and controls and their characteristics, and the control room inventory. The intent of this requirement is to identify any missing controls and displays, and those that are unsuitable for the operator task needs. Only when a satisfactory task analysis is completed can the Instrumentation and Control (I&C) requirements be compared with a control room inventory and thereby satisfy the requirement. Moreover the control room inventory should include the characteristics of existing instruments and controls which will allow a meaningful comparison with the characteristics of needed information and control capabilities.

The NMP-1 control room inventory of existing instruments and controls was audited for its completeness and accuracy and for its capability to provide a comparison against needed control and displays as determined from the task analysis. The audit of NMP-1 process to compare the control room inventory with control and display requirements was based on several documents.

1. A printout from the computerized data base used to perform the comparison.

2. Task Analysis Instrumentation and Control Requirement Forms

3. Human Engineering Observations (HEOs) (approximately 15 resulted from the comparison of task requirements with the control room inventory).

The audit team observed several types of inadequacies with both the data collection/documentation and the comparison process itself. Due to these observations the team concludes that the requirement has not yet been satisfied.

The first observation concerns the inaccurate data transfer from the task analysis "I&C requirements" or source records to the computerized data base. One example is that tasks which originated from the "precautions section" of the EPGs, although entered on the forms, were not entered into the computer data base. Consequently, instrumentation and control needs associated with these tasks were not considered. It is the audit team's understanding that the omission was inadvertent.

A second observation was the omission of several pieces of control room equipment from the inventory including the core mapping, reactor vessel level indication, and annunciator alarms. Also, where dual meters existed in the control room, generally only a single meter was documented.

A third observation concerns the comparison process itself. Although the system (the computerized inventory and the program to provide a comparison with I&C requirements) could be made to function adequately, it did not appear to be doing so. For example, all "range mismatch" entries were wrong. It was suggested to the audit team that this was due to inaccurate data input from the "written" inventory to the computer; i.e., verification of data transferred from source records to the data base did not exist. Consequently, the computer processing output was not reliable. In the audit team's judgment both the control room inventory and the characteristics of needed controls and displays should be verified for completeness and accuracy before the comparison process is performed.

The audit team concludes that although the licensee has developed a process to compare control and display requirements with a control room inventory of information and control sources, the intent of this requirement has not been satisfied. This is due to the following reasons:

1. The task analysis has not been completed, and therefore all human factors characteristics of needed information and controls were not completely determined.

2. The control room inventory as found in the computer data base printout was incomplete and inaccurate; therefore, results of the comparison process were unreliable.

A control room survey to identify deviations from accepted human factors principles. This requirement as contained in Supplement 1 to NUREG-0737 calls for the conduct of a control room survey to identify deviations from accepted human factors principles. The NRC staff consider the control room survey to consist of a systematic comparison of control room design features with human engineering guidelines. Although the NRC staff has presented guidance contained in Section 6 of NUREG-0700 for this activity, other comparable references will be acceptable.

The NMP-1 survey has been completed and was performed during two separate efforts. In July, 1981 a human engineering review of the control room was conducted based on criteria and guidance in the "BWR Owners Group CRDR and Draft Evaluation Criteria." A second survey was performed during June 25 - July 20, 1984 using criteria and guidance from the BWR Owners Group "Supplemental Checklist." At this time the remote shutdown panel was also surveyed.

As a result of both surveys Human Engineering Observations (HEOs) were generated. HEOs were recorded on forms containing a description of the finding, components or panels affected, comments and assessment/resolution status. Findings were also documented in a photographic log.

The audit team conducted a minisurvey of their own to provide a basis for judging the adequacy of NMP-1 survey. HEOs documented by NMP were also reviewed to judge the completeness of the survey.

As a result of the minisurvey and audit of survey documentation, the audit team believes that the NMP-1 survey was generally adequate. However, some areas of the control room appear not to have been surveyed in a rigorous manner. Those areas are:

- Communications
- Annunciators
- Control Room and Remote Shutdown Panel Environment
- Emergency Equipment

NMPC has indicated in a follow-on schedule (Attachment C) that survey activity is to be conducted at the Fire Panel and on the Process Computer. Also indicated on the schedule is a need for studies of the control room environment, paging system, NRC issues, and a recorder refurbishment program. In the audit team's judgment the above areas should also be addressed in order to satisfy the requirement in Supplement 1 to NUREG-0737. Guidance in Section 6, NUREG-0700 may be useful in that effort.

Assessment of HEDs to determine which are significant and should be corrected. Supplement 1 to NUREG-0737 requires that HEDs be assessed for significance. In that assessment, the potential for operator error and the consequence of that error in terms of plant safety should be systematically considered. Both the individual and aggregate effects of HEDs should be considered. The result of the assessment process is a determination of which HEDs should be corrected because of their potential effect on plant safety. As noted in the NRC staff's comments on the August 17, 1984 meeting with NMPC, the decision about whether an HED requires correction should not be compromised by consideration of issues such as the means or potential cost of resolving that HED.

The HEO/HED Assessment/Resolution Process used in the NMP-1 DCRDR is diagrammed in Attachment C. As shown in the diagram, the process first sorted HEOs into categories. Those categories were:

1. Invalid
2. Resolved (change done or in progress)
3. Individual cosmetic enhancement
4. Systems/panel cosmetic enhancement

5. Uncategorized or further information needed
6. Normal Operation - functional
7. Emergency operation - functional

The audit team's understanding of the sorting process is that with the exception of categories 1, 2, and 5, HEOs were categorized in terms of general approaches to correction. Only following that categorization was a decision made about whether to correct an HEO. NMPC noted that some or all of the following factors were considered in making the decision about whether to correct an HEO:

1. Human Factors Value - Degree of human factors discrepancy

2. Interaction Impact - Degree of impact on specific aspect of operation

3. Risk vs Impact - Degree of overall risk reduction by incorporating fix compared to degree of difficulty in carrying out the fix

Based on NMPC comments during the in-progress audit, the audit team understands that potential for operator error and the safety consequences of such error were not considered independently of other factors to make a decision about whether in HEO <u>should</u> be corrected. Rather, the decision was whether an HEO <u>would</u> be corrected, and that decision was based on a number of factors. Additional factors appeared to include an initial decision about how the HEO would be corrected as well as the cost of that correction.

In the audit team's judgment, the assessment element of the NMP-1 DCRDR has not been satisfied. For any HEO, the potential for operator error and the consequence of that error may have been discussed, but, based on the auditable record, such discussions typically included other factors which may have biased the assessment. No assessment based on potential aggregate effects of HEOs appeared to have been made. Additional effort to assess HEOs is needed to satisfy the Supplement 1 to NUREG-0737 requirement. The result should be a decision about whether an HEO (or group of HEOs) should be corrected based on plant safety. Consideration of other factors, such as

various means for correction and the relative cost of those means, should be deferred until the selection of design improvements.

Several observations were made during the audit team minisurvey of the NMP-1 control room. Four of those observations which involved documented HEOs that NMPC decided not to correct were singled out by the audit team as warranting reconsideration. Those HEOs are as follows:

1. The control room GAITRONICS units are almost invariably mounted on the vertical panels, with the phone cord hanging down past the desk section. The cord could easily foul a control switch as the operator reaches for the phone unit to use it. Reconsideration of corrective action should be taken.

2. The six solenoid-controlled pilot-operated relief valves are monitored by temperature and acoustic sensors (one each) which alarm/read-out outside the control room, thus indicating possible flow. A single alarm in the control room indicates the presence of one or more of the 12 signals. Temperature can also be read from the computer printout in the control room. The HEO should be reconsidered and, if rejected, better documented.

3. The NMPC DCRDR team conducted a review of operating experience, including LERs, and originated two LER-based HEOs. One was based upon an NMP-1 LER concerning a mechanical pressure regulator control handle (one of approximately 20 such controls in the control room) which functions decrease/right, increase/left, opposite to U.S. convention. The team rejected this HEO, noting that this was NMP-1 convention. The condition exists in the simulator and the control room and is stated to exist in Unit 2 as well.

4. The DCRDR team rejected correction of an HEO concerning the single bulb installation in certain alarm indicators. As built, a failed bulb would result in an unrecognized alarm.

Selection of design improvements. The HEO/HED Assessment/Resolution process used in the NMP-1 DCRDR included a sorting of HEDs into categories. A number of those categories represented decisions as to general approaches for HEO correction. They were:

1. Individual cosmetic enhancement
2. Systems/panel cosmetic enhancement
3. Normal operation - functional
4. Emergency operation - functional

The initial categorization of HEOs was the only selection of design improvements activity complete at the time of the in-progress audit. Details as to how any HEO (or group of HEOs) will be corrected remain to be developed.

NMPC does have plans for continuing the selection of design improvements effort. A draft "follow-on" schedule, listing DCRDR events to be accomplished after January 1, 1985, was available during the in-progress audit (see Attachment D). That schedule indicates a Human Factors Manual will be completed by March 1, 1985, and an Integrated Cosmetics Package will be developed by July 1, 1985. The audit team understands that the Human Factors Manual will provide plant-specific guidance in the form of conventions and specifications to be applied to the operator-control room interface at NMP-1. The audit team further understands that the Integrated Cosmetics Package will be based on conventions and specifications in the Human Factors Manual. Finally, the audit team understands that the Human Factors Manual is intended to become part of the NMP-1 engineering procedures in order to affect future changes to the control room.

At the time of the in-progress audit, selection of design improvements had not progressed far enough to satisfy the DCRDR requirement of Supplement 1 to NUREG-0737. Based on the draft follow-on schedule, the audit team does not expect completion of the selection of design improvements by January 1, 1985. Thus, a summary report submitted on that date would be unlikely to provide sufficient detail to allow NRC staff evaluation of proposed control room changes. The audit team expects the selection of design improvements to remain an open item at least until the Integrated Cosmetics Package is finalized. A description of the Integrated Cosmetics Package and other

proposed control room changes should be provided in the Summary Report for NRC staff review.

The audit team recommends iteration of selection of design improvements with the verification processes discussed below. The audit team also recommends development of a means for revising the Human Factors Manual as necessary during the iterative process of selection and verification of design improvements.

Verification that selected improvements will provide the necessary correction, and verification that improvements will not introduce new HEDs. During the November 27-30, 1984 in-progress audit, NMPC indicated that verification that selected design improvements will provide the necessary correction and verification that improvements will not introduce new HEDs would not be accomplished prior to the January 1, 1985 date for the Summary Report. Verification was listed as an event in the draft follow-on schedule. Based on discussions with NMPC personnel, the audit team understands that the planned verification will be performed on the NMP-1 simulator. Mock-ups of planned control room improvements will be placed on the simulator for evaluation.

A key criterion of DCRDR success is a consistent, coherent, and effective interface between the operator and the control room. One good way to meet that criterion is through iteration of the processes of selection of design improvements, verification that selected design improvements will provide the necessary correction, and verification that improvements will not introduce new HEDs. In the audit team's judgment, evaluation of mock-ups on a simulator is one useful technique for satisfying the verification requirements of the DCRDR. Other techniques may prove necessary depending upon the nature of the HED and of the proposed correction. Those other techniques might include partial re-surveys on mocked-up panels, applied experiments, engineering analyses, environmental surveys, EOP walk-through/talk-throughs, and operator interviews. Each iteration of the selection and verification processes should reduce inconsistencies in the operator-control room interface while increasing the coherence and effectiveness of that interface. Note that the consistency, coherence and effectiveness of the entire operator-control room interface is important. Thus, evaluation of

both the changed and unchanged portions of the control room is necessary during the verification processes.

The audit team recommends active participation of NMP-1 operators in the verification (as well as selection) of design improvements. Participation of NMP-1 operators in those activities should result in a better operator-control room interface and in better acceptance of that interface by the operators. The audit team also recommends active participation of personnel with experience in human factors and engineering psychology during the verification of design improvements. Those personnel can be especially useful in identifying pockets of inconsistency or incoherency resulting from planned control room changes. Such inconsistencies and incoherencies can lead to future operator errors.

In the audit team's judgment, verification that selected improvements will provide the necessary correction and verification that improvements will not introduce new HEDs is essential to final determination of control room changes. Thus, those tasks should be completed prior to submission of the Summary Report. However, completion of the verification tasks by the date scheduled for submittal of the Summary Report (January 1, 1985) does not appear possible. The result may be that the DCRDR will remain an open item in the SER following receipt of a January 1, 1985 Summary Report. Supplements to the Summary Report and the SER may then be required to close the DCRDR.

<u>Coordination of control room improvements with changes from other programs such as the safety parameter display system (SPDS), operator training, Reg. Guide 1.97 instrumentation, and upgraded emergency operating procedures (EOPs)</u>. The coordination of control room improvements with changes from other programs was not evaluated as a separate element during the in-progress audit. However, coordination was discussed as it related to the function and task analysis element of the DCRDR.

NMP-1 EPGs have been developed and were used as a basis for the task analysis activity. Future integration of the task analysis product with the development of NMP-1 EOPs will help to assure that the control room will support operator task needs during emergency operation.

CONCLUSION

The DCRDR for NMP-1 is underway. The Program Plan has been reviewed and NRC staff comments provided. A meeting was held August 17, 1984 and the NRC provided a meeting summary October 1, 1984. An in-progress audit was conducted November 27-30, 1984. This report summarizes the audit team's findings.

Based on information available through the end of the in-progress audit, the following concerns have been raised:

1. The NMP-1 DCRDR team appeared to have the necessary qualifications and multidisciplinary structure to conduct the DCRDR. However, the audit team believes that the contributions of a nuclear systems engineer for the conduct of the task analysis is necessary to successfully accomplish that element.

2. The task analysis is incomplete. The methodology utilized did not sufficiently identify and describe operator tasks and information and control needs. Also, the determination of the human factors characteristics of needed controls and displays was found to be incomplete in places due to the high level description of operator tasks.

3. The control room inventory was incomplete; all information and control sources and their characteristics were not collected and thereby could not support a comparison with required controls and displays. The comparison process was computerized and appeared to be capable of functioning but, at the time of the audit, it was not functioning adequately.

4. The control room survey was complete for most control room features. Exceptions are noted in the section on the control room survey.

5. The assessment criteria and procedure used by NMP-1 has not satisfied the Supplement 1 to NUREG-0737 requirement.

6. The selection of design improvements had not progressed far enough at the time of the audit to satisfy the DCRDR requirement.

7. The activity to verify selected design improvements was being planned at the time of the audit. That activity was discussed at some length with NMP-1. The Supplement 1 to NUREG-0737 requirement has not been satisfied, and the audit team expressed concern that the activity would not be completed by the scheduled Summary Report date of January 1, 1985.

8. The coordination of the DCRDR with other improvement programs was not audited during the in-progress audit; however, the licensee did indicate that NMP-1 EPGs were being developed through the EOP program and were also used for the task analysis activity. Further integration of these two programs should be accomplished to assure that the control room supports plant-specific EOPs that are technically adequate and complete.

Evaluation of the NMP-1 DCRDR will continue through resolution of items in the SER which follows submission of the Summary Report. Current concerns with respect to the Summary Report are that insufficient time may have been allotted to complete some DCRDR activities prior to submission of the Summary Report. NMP-1 should also note that several information needs remain to be filled in order for the NRC to completely evaluate the NMP-1 DCRDR. They are:

1. An outline of proposed control room changes.

2. An outline of proposed schedules for implementation.

3. Justifications for leaving safety significant HEDs uncorrected or partially corrected.

4. Additional documentation of the systems function and task analyses.

Supplement 1 to NUREG-0737 requires that items 1 through 3 be reported in the Summary Report. Item 4 is the result of NRC meetings with the BWROG.

Provision of the above information will allow fullest possible close-out of the DCRDR in the SER which follows the Summary Report. Information needs which are not satisfied by the Summary Report may result in open items in the SER and the need for pre-implementation audits.

REFERENCES

1. NUREG-0737, "Clarification of TMI Action Plan Requirements," Supplement 1, December 1982.

2. NUREG-0800, "Standard Review Plan," Section 18.1, "Control Room," and Appendix A, "Evaluation Criteria for Detailed Control Room Design Reviews (DCRDR)," September, 1984.

3. NUREG-0700, "Guidelines for Control Room Design Reviews," September 1981.

4. Memorandum from S.H. Weiss, Division of Human Factors Safety, USNRC to V.A. Moore, Chief, Human Factors Engineering Branch. Subject: "Meeting Summary--Task Analysis Requirements of Supplement 1 to NUREG-0737--May 4, 1984 Meeting with BWR Owners Group Emergency Procedures Guidelines and Control Room Design Review Committees," May 14, 1984.

ATTACHMENTS

Attachment A

AGENDA FOR
NINE MILE POINT 1
DETAILED CONTROL ROOM DESIGN REVIEW
IN-PROGRESS AUDIT

Tuesday, 27 November 1984

Training and badging
NRC entry briefing (D. Serig)
Presentation on DCRDR status (NMPC)

Lunch

Audit of system, function, and task analysis documentation (C. Kain, G. Bryan)
Audit of HED assessment documentation (D. Serig)

Wednesday, 28 November 1984

Audit of system, function, and task analysis documentation (C. Kain, G. Bryan)
Audit of HED assessment documentation (D. Serig)
Visit to control room simulator

Lunch

Audit of comparison of control room inventory with control and display requirements documentation (C. Kain, G. Bryan)
Audit of selection of design improvement documentation (D. Serig)

Thursday, 29 November 1984

Audit of control room survey documentation (C. Kain, G. Bryan)
Audit of verification that improvements will provide the necessary correction and will not introduce new HEDs (D. Serig)

Lunch

Audit of control room survey documentation (C. Kain, G. Bryan)
NRC team meeting

Friday, 30 November 1984

Exit briefing (D. Serig, C. Kain)
Discussion

Attachment B

Attendees of the In-Progress Audit Entrance Briefing

November 27, 1984

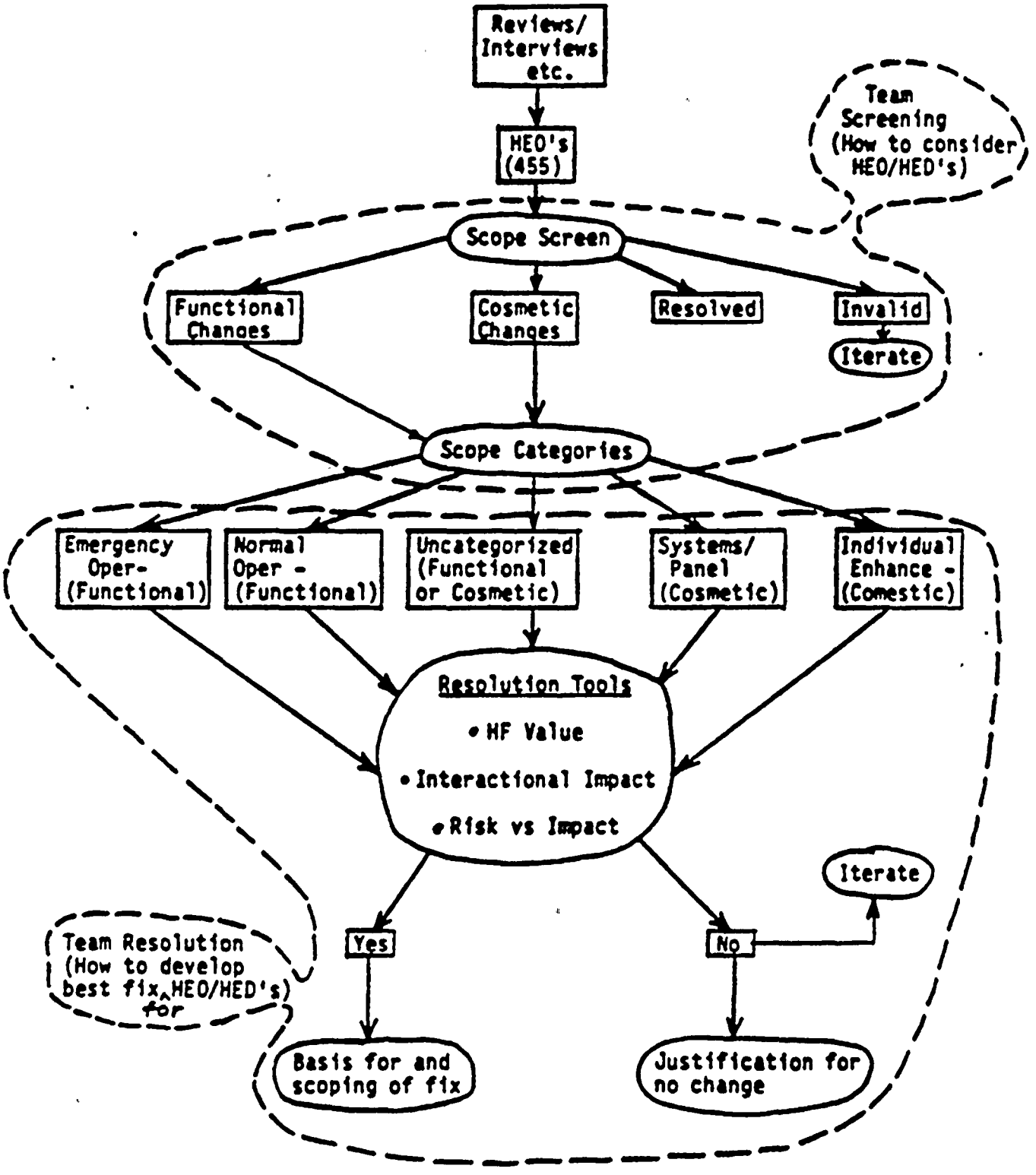
Name	Organization
D. Serig	NRC/DHFS/HFEB
C. Kain	SAIC (NRC Consultant)
G. Bryan	Comex (NRC Consultant)
T. Perkins	NMPC
J. Benson	NMPC
R. Randall	NMPC
B. Kershner	ARD (NMPC Consultant)
D. Taylor	ARD (NMPC Consultant)

Attendees of the In-Progress Audit Exit Briefing

November 30, 1984

R. Hermann	NRC/DL
D. Serig	NRC/DHFS/HFEB
C. Kain	SAIC (NRC Consultant)
T. Roman	NMPC
R. Pasternak	NMPC
J. Benson	NMPC
M. Goldych	NMPC
S. Wilczek, Jr.	NMPC
D. Matthews	NMPC
J. Aldrich	NMPC
R. Randall	NMPC
D. Taylor	ARD (NMPC Consultant)

E. Hierarchy and Flow of HEO/HED Assessment/Resolution Process



Attachment D

Follow-on Schedule	Date of Completion
Firepanel	
Review	1 February
HEO/HED Assessment	1 March
Process Computer	
Review	1 February
HEO/HED Assessment	1 March
HF Manual (need review team)	
Draft	1 March
Final	1 April
Revise Procedures	1 June
Integrated Cosmetics Package (need review team)	
Develop draft (integrate HED's)	1 April
Install on simulator	1 March
Final version ready	1 July
Other studies in progress or as needed	
CR environment	
NRC issues	
Paging System	
Recorder refurbishment program	
Implement Fixes	
Preliminary Management Review	
Initial package (report)	14 December
Follow-on items	1 July
Establish priorities/schedules	
Initial package	1 March
Follow-on package	1 May
Complete project paperwork	
Initial	1 April
Follow-on	1 June
Establish verification details	Included in project paper
Supplement to Summary	
Issue Report	1 August