

IN-PROGRESS AUDIT REPORT  
OF THE  
DETAILED CONTROL ROOM DESIGN REVIEW  
BEING CONDUCTED BY  
BALTIMORE GAS AND ELECTRIC COMPANY  
CALVERT CLIFFS NUCLEAR POWER PLANTS, UNITS 1 AND 2

James W. Moore  
Jack W. Savage

Lawrence Livermore National Laboratory

January 14, 1985

8503210281 850308  
PDR ADOCK 05000317  
F PDR

IN-PROGRESS AUDIT REPORT  
OF THE  
DETAILED CONTROL ROOM DESIGN REVIEW  
BEING CONDUCTED BY  
BALTIMORE GAS AND ELECTRIC COMPANY  
CALVERT CLIFFS NUCLEAR POWER PLANTS, UNITS 1 AND 2

BACKGROUND

Licenses and applicants for operating licenses shall conduct a Detailed Control Room Design Review (DCRDR). The objective is to "improve the ability of nuclear power plant control room operators to prevent accidents or cope with accidents if they occur by improving the information provided to them" NUREG-0660, Item I.D. (Ref. 1). The need to conduct a DCRDR was confirmed in NUREG-0737 (Ref. 2) and Supplement 1 to NUREG-0737 (Ref. 3). DCRDR requirements in Supplement 1 to NUREG-0737 replaced those in earlier documents. Supplement 1 to NUREG-0737 requires each applicant or licensee to conduct a DCRDR on a schedule negotiated with the Nuclear Regulatory Commission (NRC).

NUREG-0700 (Ref. 4) 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.

Criteria for evaluating DCRDRs are contained in Appendix A to Standard Review Plan (SRP), Section 18.1 of NUREG-0800 (Ref. 5).

A Program Plan is to be submitted within two months of the start of the DCRDR. Consistent with the requirements of Supplement 1 to NUREG-0737, the Program Plan shall describe how the following elements of the DCRDR will be accomplished:

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 HEDs 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 SPDS, operator training, Reg. Guide 1.97 instrumentation, and upgraded emergency operating procedures.

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 will evaluate the organization, process and results of the DCRDR. Evaluation will include review of required documentation (Program Plan and Summary Report), and may also include reviews of additional documentation, briefings, discussions, and on-site audits. In-progress audits may be conducted after submission of the Program Plan, but prior to submission of the Summary Report. Evaluation will be in accordance with the requirements of Supplement 1 to NUREG-0737. Additional guidance for the evaluation is provided by NUREG-0700 and Appendix A to SRP, Section 18.1. Results of the NRC evaluation of a DCRDR will be documented in a Safety Evaluation Report (SER) or SER Supplement.

Significant HEDs should be corrected. Improvements which can be accomplished with an enhancement program should be done promptly. Other control room improvements should be done on a schedule acceptable to the NRC.

#### DISCUSSION

The Baltimore Gas and Electric Company (BG&E) submitted a Detailed Control Room Design Review (DCRDR) Program Plan for its Calvert Cliffs Nuclear Power Plant, Units 1 and 2 (Calvert Cliffs 1 and 2) to the Nuclear Regulatory Commission on September 1, 1983 (Ref. 6). The first unit went into commercial operation in 1975 and the second in 1977. The DCRDR Program Plan was reviewed against the requirements of Supplement 1 to NUREG-0737 by the NRC Division of Human Factors Safety (DHFS), and comments were submitted to the NRC Division of Licensing in a memorandum dated December 19, 1983 (Ref. 7).

A human factors engineering in-progress audit of the Calvert Cliffs 1 and 2 Control Room Design Review (CRDR) was performed at the site on November 27-30, 1984. The purpose of the audit was to clarify certain aspects of the review process and to confirm that the review is being conducted appropriately.

The audit included observation of the Calvert Cliffs 1 and 2 control room and remote shutdown panel; briefings by and discussions with various members of the BG&E team and their human factors consultants (Essex Corporation); and examination of available documentation.

The audit was carried out by a team from the Human Factors Engineering Branch (HFEB), Division of Human Factors Safety, assisted by consultants from Lawrence Livermore National Laboratory, Livermore, California. This combined team is referred to in this report as the NRC audit team.

#### 1. Qualifications and Structure of the DCRDR Team

Supplement 1 to NUREG-0737 requires that the licensee establish a qualified multidisciplinary review team.

Several of the BG&E evaluation group members whose resumes appear in Appendix A of the Program Plan are still members of the present DCRDR team which meets weekly. A review of the resumes of team members indicated that the team had a mix of disciplines as recommended in NUREG-0800. Other individuals with appropriate supplementary expertise are requested to participate as needed.

The NRC audit team understood that Mr. M. Canova (Project Director) will remain in charge of the team membership until the DCRDR task ends. BG&E intends to include a human factors (HF) capability in all related departments to establish a continuing HF oriented participation in future design. This plan will obviate the existence of a separate HF department. The NRC audit team recommends that a HF person be present at

each committee team meeting, and that the membership and relative functions of the DCRDR teams and DCRDR committee be stated in the Summary Report or its supplements.

At the time of the audit, team assignments appeared to be adequate to conduct a satisfactory DCRDR.

## 2. Systems Function and Task Analysis

Supplement 1 to NUREG-0737 requires the applicant to perform systems function and task analyses to identify control room operator tasks and information and control needs during emergency operations. Furthermore, Supplement 1 to NUREG-0737 recommends the use of function and task analyses that had been used as the basis for developing emergency operating procedures technical guidelines and plant-specific emergency operating procedures to define these needs.

Operator information and control needs must be determined independently from existing CR design, and not be influenced by existing equipment.

The following steps for a top-down systems function and task analysis are identified in the NUREG-0700 guidelines.

1. Identification of Systems and Subsystems,
2. Identification of Operating Events for Analysis,
3. Function Identification,
4. Operator Task Identification and Analysis.

Calvert Cliffs will be using the Combustion Engineering CEN-152 Emergency Procedure Guidelines (EPG) as the basis for the DCRDR task analysis and to develop Calvert Cliffs plant-specific EOPs. The NRC audit team did not have an opportunity to examine or evaluate CEN-152 or related background material with respect to the Calvert Cliff DCRDR SFTA

effort. These EPGs were the topic of an August 29, 1984, meeting between the NRC and the CEQG Operations Subcommittee (Ref. 8).

The NRC staff conclusions are paraphrased below.

- (1) The basic parameters and control functions needed to satisfy the safety functions are identified in the EPGs.
- (2) The EPGs do not always explicitly identify the information and control needs in sufficient detail to determine the adequacy of existing plant-specific information and controls.
- (3) Further analysis and documentation is required to establish the required plant-specific information and control needs.
- (4) Each licensee/applicant must
  - describe the process used to identify parameters and other information and control needs which differ from or are not specified in the EPGs
  - describe how the characteristics of needed instruments and controls are determined
  - describe the processes for doing the above in either the procedures generation package or the DCRDR documentation with appropriate cross-referencing
  - identify and name for use in the EOPs the operator tasks and subtasks to the level of specific operator actions, so that all corresponding information and control needs can be identified and named for use in the EOPs.

- (5) Each licensee/applicant should establish an auditable record that defines the bases for determining, independently of existing equipment, the characteristics of each needed plant-specific instrument and control used to perform the EOPs.

In order for the licensee to enable the NRC to determine that BG&E has met the SFTA requirement of Supplement 1 to NUREG-0737, it must be demonstrated in discussions and/or reports that all of the NRC requirements are met. This means that the SFTA processes should be described in terms of

- what was done
- who performed them
- how they were done

In order to be acceptably accomplished for all emergency conditions, the systems function and task analyses should:

- Be independent of existing equipment.
- Identify and analyze the appropriate operating events, plant safety-related systems, and functions which must be exercised and analyzed.
- Identify the EOPs and tasks which must be executed and analyzed.
- Name the independent reference sources used, and describe who will use them and how they will be used to specify and document the transition from Combustion Engineering CEN-152 EPG to the plant-specific characteristics of information and controls needed by the operator to mitigate the effects of the emergency conditions.

- Completely cover all emergency operations included in the EPGs.

To enhance the acceptability of the description of the methodology, the applicant's documentation should include the following:

- Discussions of the approaches and information sources used (e.g., documents, guidelines, operations personnel, multiple approaches, plant-specific calculations, etc.).
- The rationale and methodology used in the selection of event sequences, along with a description of how it was verified that the selected sequences adequately cover the complete range of systems needed to mitigate abnormal plant conditions.
- The process used to identify the functions, systems, subsystems, and events selected for analysis. It should be made clear that the applicant is using an independent objective top-down approach rather than a bottom-up procedure-based approach.
- A discussion of who will perform the work and how the independent reference sources, the documented independently determined information and control needs and characteristics, and the inventory process were coordinated to ensure independence, completeness, and accuracy.

An essential part of the above is the method by which the independent reference sources were documented and used to ensure the independence of the identified characteristics of the information and control needs from the characteristics of existing equipment.

The NRC audit team believes that the interchange of information which occurred during the audit has clarified for BG&E what the NRC expects and how the SFTA should be conducted and reported to satisfy the requirement of Supplement 1 to NUREG-0737. The following comments restate certain key concerns which should be recognized and addressed in discussions and/or reports by BG&E.

- The degree of detail to which the task analyses were or will be carried should be made completely clear.
- How and to what extent the Combustion Engineering CEN-152 generic EPG guidelines and background material will be folded into and relate to the original Essex based analysis should be made completely clear.
- The methodology to ensure the independence of the determination of instrumentation and control needs from existing equipment should be explained.
- Descriptions of the independent reference sources and how used to determine I&C needs should be explained.
- The rationales of the following should be explained
  - events selected for analyses
  - how it was ensured that all necessary tasks for all emergency procedures were analyzed for all emergency conditions.
- The following paraphrased statement was made to the NRC audit team:

"If the EOPs/EPGs and the SFTA are found to be OK, then BG&E will not redo what was done in 1980-81."

The plant-specific ramifications of this statement are not fully understood in terms of the upgraded EOP requirements, and should be discussed/reported.

- It was stated that the task analyses will be made when the new EOPs are available. The NRC audit team requests that a definite time schedule be submitted.
- The format of the listing of the instrument and control needs and how it will mesh with the inventory should be described in detail.

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

Supplement 1 to NUREG-0737 requires the applicant to make a control room inventory and to compare the operator display and control requirements determined from the task analyses with the control room inventory to determine missing controls and displays.

The NRC audit team understands that a discrete inventory of I&C equipment will not be assembled for comparison with the I&C needs determined during the SFTA in order to identify equipment discrepancies. Instead, an auditable equivalent of an inventory which will use four other sources will be used, and will be described in the Summary Report. The four sources are:

- Photos
- An instrument index
- Instrument specifications
- The Human Engineering Evaluation Report (HEER) file

The inventory is critical to determining whether all of the required I&C equipment exists to satisfy operator needs in executing the EOPs.

Therefore, it is necessary that the Summary Report contain descriptions that will demonstrate to the NRC reviewers that the BG&E substitute for an inventory will be auditable and fulfill the intent of NUREG-0737. The descriptions shall cover, but not be limited to:

- Accurately depict the I&C equipment which exists on the control panels.
- Describe the I&C equipment characteristics (e.g., scales, ranges, accuracies, parameters, steps, control characteristics, etc.).
- Be complete and current.
- Serve as a proper basis for comparison with I&C needs to identify discrepancies eligible for corrective action.
- Be effectively used by competent DCRDR team members to accurately and completely identify existing HEDs and as a basis to initiate effective corrective actions.

#### 4. Control Room Survey

Supplement 1 to NUREG-0737 requires that a control room survey be conducted to identify deviations from accepted human factors principles. NUREG-0700 provides guidelines and criteria for conducting a control room survey.

The objective of the control room survey is to identify, for assessment and possible correction, characteristics of displays, controls, equipment, panel layout, annunciators and alarms, control room layout, and control room ambient conditions that do not conform to good human engineering practices.

BG&E cooperated with, but did not assist, Essex Corporation (Human Factors Consultant) in collecting the data for the original DCRDR in 1980/1981, which used NUREG/CR 1580 for guidance. Three portions of that review were revised after NUREG-0700 was released (e.g., illumination survey, noise survey, and operator-protective equipment survey). This combination of NUREG/CR 1580 and NUREG-0700 guidance is acceptable for these three items only.

For all other portions, the guidelines of NUREG/CR-1580 should be reviewed and compared with the guidelines of NUREG-0700. Special attention should be paid to those NUREG-0700 guidelines that specify additional criteria or more restrictive tolerances than those specified in NUREG/CR-1580, and supplemental checklists should be developed to address these differences. Additional HEDs which may result from this review and comparison should be reported to the NRC. Additional HEDs should be assessed, and corrective actions selected and scheduled for implementation on a schedule acceptable to the NRC.

At the present time, there have been approximately 740 candidate HEDs identified for assessment and selection of design improvements, as described in Sections 5 and 6 of this report. More may be added before the DCRDR is finished. Although not required, the NRC audit team recommended that BG&E include a survey of the remote shutdown panels in the present DCRDR.

The DCRDR survey teams included the operations staff from BG&E and consisted of at least two members. Team members used checklists to collect HF items for later resolution. The checklists were constructed by Essex using typical generic and specific HF problems collected from HEDs identified at several (e.g., eight or nine) other plants.

Each reviewer used the checklists to prepare for eventual assessment an HED report to describe the HED, potential operator errors, and suggestions for corrective actions for later resolution.

The NRC audit team reviewed selected BG&E checklists and HED reports to assess the quality, consistency, and auditability of the survey recorded. The following observations were made by the NRC audit team.

- Some HED reports contained incomplete and/or unclear descriptions and unexplained erasures or penciled reviewer comments.
- Some checklists contained check marks and/or question marks the meanings of which were eventually, but only after some difficulty, explained.
- The auditable records tracing the evolution of several selected potential HEDs from inception to ultimate disposition was found to exist, but was difficult to follow via a mixture of written and verbal pathways.
- Some reports appeared not to be used in the manner intended, or were marked incorrectly or inconsistently.

Discussions expressing NRC audit team concern whether the samples discussed above were typical or atypical resulted in a commitment that BG&E would review, resolve, and report for NRC review all similar items prior to a post-implementation audit.

BG&E stated that their design convention is to use mirror-imaged CR panel configurations, and that they do not intend to modify the CR to meet NUREG-0700 no mirror-image HF guidelines. However, it was also stated that BG&E does not always follow their convention and that some hybrid mirror-image configurations exist (e.g., KW, KVAR meters).

The NRC audit team requests that these hybrid HED cases be identified, assessed, and justified for NRC review.

BG&E performed an Operating Experience Review (OER) as part of the DCRDR in order to collect first-hand information and comments concerning the operator-system interfaces, functions and problems. All operators (35) filled out an Essex developed CR operator questionnaire which was subsequently evaluated by a HF person on an individual private-interview basis. About 135 HEDs were identified by this process. Since there was no requirement to do so, LERs were not reviewed at that time, and there are no HEDs recorded from LER sources. It should be made clear to the NRC whether it is intended to initiate an LER review during the present DCRDR.

The NRC audit team was told that BG&E will install a program for future continuing use to initiate and collect operating experience inputs for use by a Plant Operating Experience Assessment Committee (POEAC). The audit team recommends that this valuable activity be reported further for NRC information and review.

It was also stated that BG&E is working with Essex to produce a HF Engineering manual ("Man-machine Interface Design") for future continuing use by BG&E personnel during the review of changes and for new design work. This manual will use several HF source documents (e.g., NUREG/CR-1580, NUREG-0700, EPRI NP-1118, EPRI NP-2411, EPRI NP-3091, Mil Std 1472C). The NRC audit team recommends that more details and a time schedule for the completion of this effort be reported.

The NRC audit team performed a survey of the Engineering Safeguards Control Board Panels 2C8, 2C9, 2C10 for the purpose of auditing the quality and completeness of the BG&E DCRDR survey identification of HEDs. This review was based on Chapter 6 of NUREG-0700 and identified 25 potential HEDs which are described in detail in Appendix A of this report. These HEDs must be resolved to NRC's satisfaction.

Several of the potential HEDs were thought by BG&E not to qualify as HEDs, but post-audit telephone conversations with the NRC resulted in BG&E agreement to compare their findings with the findings of the NRC audit team, report any differences between the two, and write new HEDs as required to resolve the differences. New HEDs will go through the normal assessment process.

In addition, the NRC advised BG&E that it would be necessary for BG&E to compare the guidelines of NUREG/CR-1580 and NUREG-0700, identify differences which exist, and identify and process additional resulting HEDs which should be written, assessed, corrected, and reported, so that the results of the present DCRDR will satisfy the requirements of Supplement 1 to NUREG-0737.

#### 5. HED Assessment

Supplement 1 to NUREG-0737 requires that HEDs be assessed to determine which HEDs are significant and should be corrected.

BG&E states in their initial HED assessment concept that they had intended to fix all identified HEDs. However, as part of the DCRDR effort, an assessment committee was formed to evaluate HEDs. This committee assessed HEDs on the basis of whether or not the HED constituted a design deficiency having safety significance and of such a high potential for error occurrence that it required immediate attention. If the HED did not meet this criteria in the committee's opinion, no priority for implementation was assigned.

In order to more appropriately assign items to a formal implementation schedule, a new DCRDR Final Assessment Committee was formed. New prioritization documentation was initiated by reevaluating all of the original HEDs and assigning priorities to all items regardless of current implementation.

Under the assessment process, each HED was assigned a deficiency category and a scheduling priority. The following is a listing of the categories and priorities.

#### Scheduling Priority

Priority for scheduling of backfit purposes is per the followings:

Priority A - Prompt - First outage, given availability of materials and engineering lead time.

Priority B - Near Term - Second refueling outage given availability of parts and engineering lead time.

Priority C - Long Term - At any time.

#### Deficiency Category

HED categories are per the following:

Category I - HEDs for which there are documented errors or reported potential for errors with safety-related equipment or systems capable of creating unsafe operations or plant conditions and/or violation of the Operating License's Technical Specifications.

- These are Priority A HEDs.

Category II - HEDs for which there has been assessed to be a potential for errors with equipment or systems designated as safety-related or a capability for creating or contributing to effects which could cause unsafe operations, plant conditions, and/or

violations of the Operating License's Technical Specifications.

- These could be any priority depending on evaluated significance.

Category III - HEDs for which there has been assessed to be a potential for errors with equipment or systems which are NOT safety-related and would not contribute to unsafe operations or plant conditions in any manner. Nor would they contribute to a violation of the Technical Specifications.

- These HEDs must be reviewed at the end of the assessment phase to ensure that no cumulative affects could cause a category change - NO correction is required.

The NRC audit team requests that a time specific HED implementation schedule acceptable to the NRC be submitted for review and approval.

During discussions at the NRC in-progress audit, it was stated that the estimate for error potential, the basis for deficiency category assignment, was based upon expert judgment.

BG&E stated that justification will be provided for all Category I and II, "no action to be taken" items. However, they did not indicate that justification would be given for Category III, "no action" items. We recommend that a justification for the approximately 180 Category III items identified by BG&E be provided. The potential cumulative effect of these items should be evaluated.

BG&E indicated that all implementation of corrections would be dictated by resource availability. The NRC audit team is concerned that BG&E stated that a human factor consultant is not included in all phases of the HED assessment.

BG&E stated that a detailed description of concept and procedures for HED assessment would be included in the Summary Report.

The NRC audit team audited a random selection of about 15 HEDs in all categories which had been assessed by BG&E to be "no-action" items. Some were determined to have already been fixed, some had been resolved but not-fixed, and others were justified as not requiring corrective action for various reasons (e.g., infrequent operation, precision readings not required, meaning not easily confused in context, "as-supplied" by manufacturer, etc.). In some cases where no HED status was stated, BG&E committed to resolve the problems and report to the NRC prior to a post implementation audit.

#### 6. Selection of Design Improvements

Supplement 1 to NUREG-0737 requires the selection of control room design improvements that will correct significant HEDs. It also states that improvements that can be accomplished with an enhancement program should be done promptly.

BG&E stated that a committee will be responsible for informal selection of all design improvements. At the time of the NRC in-progress audit, the actual committee membership was indefinite. BG&E stated that they will define the committee membership in the Summary Report, and that the Project Manager from Essex will be a committee member. The NRC is concerned about the involvement level of human factors expertise and the use of subjective vs. objective choice in the selection of design improvements in the committee activities.

We recommend that the selection of the design committee, the degree of HF involvement, and the question of objective vs. subjective design improvement selection decision criteria be discussed in detail in the Summary Report. The relative influence of the cost of alternative design improvements should also be explained.

7. Verification That Design Improvements Provide the Necessary Correction and Will Not Introduce New HEDs into the Control Room

Supplement 1 to NUREG-0737 requires verification that selected design improvements will provide the necessary corrections of HEDs and will not introduce new HEDs into the control room.

BG&E explained a two-step verification process from a very cursory viewpoint. Basically, BG&E will conduct panel walk-downs which they state will identify each instrument and control covered in the EOPs. Essex will then be called in to reevaluate this process.

BG&E stated that they will provide a detailed summary of the validation/verification process, but did not state when. We are concerned as to when the verification process will be completed.

BG&E states the validation process will be performed on an on-going basis. They are working with Essex to establish a Human Factors Manual to be used by BG&E engineering personnel. BG&E will discuss the verification and validation process in detail at a yet undetermined date.

The NRC audit team is concerned with the statement (on page 35 of the Program Plan) that BG&E will conduct a post-implementation verification and validation review "where appropriate and acceptable." This statement is too indefinite and we recommend that a detailed explanation and definite time schedule for the verification and validation processes including a description of how they will be done and who will conduct them be included in the Summary Report.

## 8. Coordination of Control Room Improvements with Other Programs

Supplement 1 to NUREG-0737 requires that control room improvements be coordinated with changes from other programs; e.g., Safety Parameter Display System (SPDS), operator training, Regulatory Guide 1.97 (R.G. 1.97) instrumentation, and upgraded emergency operating procedures (EOPs).

NRC audit team discussions of the coordination efforts with BG&E resulted in the conclusion that BG&E recognized the need and has committed to the appointment of a senior engineer in the Licensing Department to act as corporate representative to coordinate the DCRDR. The details of how this will be done were not discussed. However, his duties will be described in the Summary Report.

The present status as presented by BG&E is as follows:

- The SPDS is being coordinated by passing the BG&E computer specifications to the SPDS vendor. Display mock-ups were made and tested and will be reviewed by BG&E for conformance with HF guidelines.
- RG 1.97 design efforts have not been completed but are identified in Facility Change Request (FCR) items and will be reviewed by BG&E for conformance with HF guidelines.
- BG&E considers the present task-oriented EOPs to be satisfactory and will be changed only as necessary. In consideration of the NRC preference for symptom-oriented procedures, the BG&E rationale for this philosophy should be explained and reported for NRC review and comment.

- The NRC audit team recommends that the BG&E commitment for coordinating design changes with operations personnel training be described for NRC review.
- BG&E will explain in detail in the report, how and by whom the coordination effort will be done.

### CONCLUSIONS

The NRC audit team concludes that BG&E is willing to respond to the concerns and comments expressed in the body of this report. However, BG&E does not appear to be convinced that the results will justify the time and expense involved.

The in-progress audit has clarified for BG&E the NRC DCRDR policy to require auditable compliance with Supplement 1 to NUREG-0737 and that this implies considering the guidelines of NUREG-0700 and the DCRDR evaluation criteria of Section 18.1, Rev. 0 and Appendix A to Section 18.1, Rev. 0 of the Standard Review Plan.

The scheduled end-of-December, 1984, due date for the Summary Report is in conflict with the status of a significant amount of work which still must be completed in order to satisfy the NRC acceptance criteria.

The most significant NRC audit team concern is a general one and is as follows:

BG&E DCRDR methodologies, processes, personnel responsibilities, and results should be reported in complete and unambiguous detail so that the NRC can unquestionably evaluate and determine auditable compliance with all elements of Supplement 1 to NUREG-0737 in the nine areas as listed on page 2 of this report.

## REFERENCES

1. NUREG-0660, "NRC Action Plan Developed as a Result of the TMI-2 Accident," May 1980; Revision 1, August 1980.
2. NUREG-0737, "Clarification of the TMI Action Plan Requirements," November 1980.
3. NUREG-0737, "Clarification of TMI Action Plan Requirements," Supplement 1, December 1982.
4. NUREG-0700, "Guidelines for Control Room Design Reviews," September 1981.
5. NUREG-0800, "Standard Review Plan," Section 18.1, "Control Room," and Appendix A "Evaluation Criteria for Detailed Room Design Reviews (DCRDR)," September 1984.
6. Program Plan Summary of the Calvert Cliffs Nuclear Power Plant Units 1 and 2 Control Room, in letter from A. E. Lundvall, Jr., (BG&E) to Director of Nuclear Reactor Regulations, September 1, 1983.
7. "Staff Comments on the Calvert Cliffs Nuclear Power Plant Units 1 and 2 Detailed Control Room Design Review Program Plan," memorandum from William T. Russell to Gus C. Lainas, December 19, 1983.
8. "Meeting Summary - Task Analysis Requirements of Supplement 1 to NUREG-0737, August 29 meeting with Combustion Engineering Group (CEOG) Operations Subcommittee," memorandum from H. Brent Clayton to Dennis L. Ziemann, September 7, 1984.

APPENDIX A

Part A - The following is a list of the HEDs which were identified by the NRC audit team. BG&E has committed to compare their findings with the findings of the NRC audit team, report any differences between the two, and write new HEDs as required to resolve the differences. New HEDs will go through the normal assessment process.

<u>HED #</u>	<u>Photo ID</u>	<u>Description</u>
B413	M2	Controls are mounted on panels more than 25 inches from the front edge of the panel.
B414	M3	There is no method of identifying individual annunciator lens assemblies to prevent interchangeability during lamp replacement.
B415	M3	Tiles on the annunciator panels do not use flashing illumination to indicate an alarm condition.
B416	M3	The axes of annunciator panels are not labeled. There is a designation present, however, it is located on the bottom of the panel rather than at the suggested top and left sides.
B417	M4	Annunciator tiles are not readable from the position at the work station where the annunciator controls are located.
B419	M6	There is excessive use of temporary labels.
B420	M6	Tag outs obscure labels on control boards.

<u>HED #</u>	<u>Photo ID</u>	<u>Description</u>
B421		There is a general lack of demarcation on panels.
B422	M7	Temporary scales are taped over permanent scales: type size is different from original, both scales are visible. There is inconsistent use of font styles, e.g., containment pressure has handwritten label.
B423		Displays do not indicate off scale upon failure.
M424	M8	There is inconsistent use of color in mimics. Some mimics have missing or temporary pieces, i.e., missing arrows to indicate flow path, temporary label on mimic, missing pieces on mimic on panel 2C09.
B425	M9	Not all mimic destinations are labeled or end at labeled components.
B426	M8, M9	Flow directions on mimics are not clearly indicated by distinctive arrowheads.
B427	M7, M8, M9	Labels use dark characters on a light background. This method does not ensure adequate contrast and prevention of loss of readability because of dirt build up.
B428	M7, M8, M9	No hierarchical labeling scheme is used on control panels.
B429		Many labels on panels are not placed above the elements they describe. Some are placed below elements they identify.

<u>HED #</u>	<u>Photo ID</u>	<u>Description</u>
B430	M10	Unusual use of an abbreviation for a technical term is used as a label. Label reads "HEAT CONTROL POTENT 10 METER" instead of "HEAT CONTROL POTENTIOMETER."
B431	M11	Use of uneven graduations between numerals the 22B Hi Pressure Safety Injection Header Flow display makes it difficult to determine the value at different points on the scale.
B432	M12	There is inconsistent use of abbreviations (i.e., in's or in for inches).
B434		Indicators do not use dual filament bulbs or bulb assemblies.
B444		The upper limit pointer for the Refueling Water Tank Level display is off scale. The lower limit pointer is less than one division below top of scale. The working range appears to be at the very top of the scale.

Part B - The following is a list of HEDs identified by the NRC audit team. These are HEDs to which BG&E has taken exception and, therefore, remain as open items which must be resolved to NRC satisfaction.

<u>HED #</u>	<u>Photo ID</u>	<u>Description</u>
B411		The shift supervisor's office is not within the primary operating area. There is no dedicated communication link between the shift supervisor's office and the primary operating area.

<u>HED #</u>	<u>Photo ID</u>	<u>Description</u>
B412	M1	Controls are placed less than 3 inches from the front edge of the control panel.
B418	M5	Key switches with single rows of teeth are not mounted with the teeth pointing up. Some controls have teeth pointing down, others teeth pointing up.
B433	M13	Spacing between groups of displays on panel 2C10 is not the width of a typical control or display within the group.