OCT 11 1984

Docket No. 50-458

Mr. William J. Cahill, Jr.
Senior Vice President
River Bend Nuclear Group
Gulf States Utilities Company
Post Office Box 2951
Beaumont, Texas 77704
ATTN: Mr. J. E. Booker

Dear Mr. Cahill:

SUBJECT: RESULTS OF IN-PROGRESS AUDIT OF RIVER BEND STATION (RBS) DETAILED CONTROL ROOM DESIGN REVIEW (DCRDR)

The staff conducted an in-progress audit of the RBS DCRDR July 24-27, 1984. The enclosed report presents the results of this audit. Final evaluation of the DCRDR will be completed subsequent to receipt of the RBS Summary Report which the staff understands is scheduled for submittal on October 31, 1984.

If you have any questions or desire clarification or further discussion on this subject, contact NRC Project Manager Edward Weinkam.

Sincerely,

Original signed by:

A. Schwencer, Chief
Licensing Branch No. 2
Division of Licensing

Enclosure: As stated

cc: See next page

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

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River Bend Station

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NUCLEAR REGULATORY COMMISSION

IN-PROGRESS AUDIT OF THE

DETAILED CONTROL ROOM DESIGN REVIEW

OF RIVER BEND STATION UNIT 1

INTRODUCTION AND BACKGROUND

This report documents the findings of the NRC staff and its consultant, Lawrence Livermore National Laboratory (LLNL), during an in-progress audit of the detailed Control Room Design Review (DCRDR) of Gulf States Utilities (GSU) River Bend Station, Unit 1 (RBS). The DCRDR audit was conducted July 24 through July 27, 1984 at the GSU training facility and River Bend site. The purpose of the audit was to clarify certain aspects of the review process, confirm that the review is being conducted properly and evaluate the results of the review to date. The audit team consisted of two NRC staff members from the Human Factors Engineering Branch and consultants from LLNL. This report reflects NRC staff conclusions and recommendations regarding the River Bend Station Unit 1 DCRDR as of the time of the audit.

Applicants for operating licenses are required to conduct a Detailed Control Room Design Review. 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). Supplement 1 to NUREG-0737 (Ref. 2) requires each applicant or licensee to conduct a DCRDR on a schedule negotiated with the NRC.

NUREG-0700 (Ref. 3) 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 each phase are contained in draft NUREG-0801 (Ref. 4).

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, Regulatory Guide 1.97 instrumentation, and upgraded emergency operating procedures

GSU submitted a DCRDR program plan for River Bend Station, Unit 1 to the NRC January 31, 1984 (Ref. 5). NRC staff comments on the program plan were transmitted to GSU April 25, 1984 (Ref. 6).

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 review of additional documentation, briefings, discussions, and on-site audits. This report documents one such audit. Pre-implementation audits may be conducted after 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 draft NUREG-0801. Results of the NRC evaluation of the DCRDR will be documented in a Safety Evaluation Report Supplement.

The DCRDR in-progress audit began with an entrance briefing conducted by the NRC audit team and an overview of the River Bend DCRDR and orientation to the River Bend Unit 1 Control Room conducted by GSU. Attendees at the entrance and exit briefings are shown in Exhibits 1 and 2. These initial briefings were followed by in-depth discussions about specific DCRDR program elements, review of selected portions of DCRDR documentation, and audit of some GSU findings in the River Bend Control Room. Both GSU staff and their contractors, General Physics Corporation, participated in the audit. In addition to the DCRDR documentation, GSU provided several documents to support the NRC audit during the site visit. These include as yet undocketed draft materials proposed by GSU as DCRDR Program Plan revisions or supplements.

The following section summarizes the findings of the NRC audit team regarding the various elements of the River Bend DCRDR.

AUDIT FINDINGS

QUALIFICATIONS AND STRUCTURE OF RBS DCRDR TEAM

Supplement 1 to NUREG-0737 requires the establishment of a qualified multidisciplinary review team to perform the DCRDR. Guidelines for team selection are found in NUREG-0700 and draft NUREG-0801.

The RBS program plan stated that the review team would be a multidisciplined team with the wide range of skills necessary to perform the DCRDR. The information gathered by the NRC audit team during the RBS in-progress audit supported that statement. Before the in-progress audit, there was a question as to extent of participation in the day-to-day review activities by the team members and supporting personnel. The audit provided evidence that an appropriate level of expertise is being provided in the necessary technical areas.

Based on this audit of the RBS review team's organization and qualifications, we conclude that GSU management has made a clear commitment to support the DCRDR process and that the review team members have suitable expertise for the job. The audit team concludes that the requirement of Supplement 1 to NUREG-0737 to establish a multidisciplinary review team to conduct the DCRDR is being met by the RBS DCRDR team.

FUNCTION AND TASK ANALYSIS

Supplement 1 to NUREG-0737 requires the applicant to perform function and task analyses to identify control room operator tasks and information and control capability requirements during emergency operation. NUREG-0700 recommends the following steps be performed in conducting a top-down review of system functions and analysis of operator tasks:

1. Identification of systems and subsystems

2. Identification of event sequences for analysis

3. Function identification

4. Operator task identification and analysis

GSU is using Boiling Water Reactor Owners Group (BWROG) emergency procedure guidelines (EPG) as the basis for the DCRDR task analysis and to develop River Bend specific EOPs. These EPGs were the topic of a May 4, 1984 meeting between the NRC and the BWROG (Ref. 7). Based on that meeting, the staff has concluded that:

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.

The major concern identified by the NRC staff in reviewing the RBS Program Plan was that the methodology used to conduct the task analysis may not result in appropriate identification of operator information and control needs. Specifically, it was not clear to the staff if the analyses would ascertain, independently from the existing displays and controls, the characteristics of the information required by operators to perform discrete emergency tasks. Therefore, a major emphasis of the in-progress audit was on the GSU task analysis.

Based on detailed discussion with GSU personnel and their contractors, audit of task analysis documentation to date, and review of drafts of proposed DCRDR Program Plan revisions provided by GSU , it appears that an approach to performing the analysis which will be sufficient to meet the requirements of Supplement 1 to NUREG-0737 is being pursued. This conclusion is contingent upon the successful completion of the following analysis steps that GSU has indicated it is pursuing:

1. Plant systems and subsystems with which control room operators must interface during emergency operations have been identified.

2. Description of the functions of each of the above systems have been prepared.

3. A set of scenarios has been developed which, with the residual tasks defined below, incorporate all of the operator actions necessary to implement Rev. 3 of BWROG EPGs.

4. Residual tasks, i.e., operation actions identified in the EPGs that are not incorporated in the emergency scenarios, have been identified and analyzed to determine information and control requirements.

5. All operator actions encompassed by 3 and 4 above have been analyzed to identify discrete tasks operators must perform.

6. Operator decisions and actions associated with each task have been defined.

7. Information and control requirements for successful task performance have been identified for each task. These include, but are not limited to, identification of parameters which need to be monitored and identification of relevant information and control capability characteristics such as ranges, setpoints, need for trending, need for continuous or discrete control, etc.

The analysis steps noted above will be accomplished using sources of information which are independent from the specific displays and controls in the RBS control room. These sources include the RBS FSAR, basis documents for emergency operating procedures, technical specifications, BWROG EPGs and subject matter experts. If these steps are performed and documented, the staff believes the requirement for conducting function and task analysis as part of the DCRDR will be met.

CONTROL ROOM INVENTORY

Supplement 1 to NUREG-0737 requires the applicant to compare the display and control requirements identified by the task analysis with a control room inventory to identify missing displays and controls.

GSU intends to accomplish the inventory function as part of the task analysis and related verification and validation efforts. GSU has indicated that the specific displays, controls or other interfaces available to " (1) initiate, maintain or remove a system from service, (2) confirm that an appropriate system response has or has not occurred, i.e., feedback, or (3) make a decision regarding plant or system status" will be documented. The specific displays and controls available in the control room and their characteristics will be noted on an "Equipment Characteristics Form." Input to this inventory form is derived primarily from walk-through of emergency operating scenarios. GSU's approach does not conform with the recommended approach of developing a complete control room inventory. It should, however, be sufficient to provide information which, when compared with the information and control requirements identified during the task analysis, will enable GSU to identify missing displays and controls. Care must be taken in developing the inventory information to assure that it accurately reflects the final as-built control room because of the currently incomplete status of the control room, differences between the control room and the RBS simulator and the evolving nature of the RBS EOPs.

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 practice.

GSU/General Physics performed a complete control room survey (CRS) in February 1984. The 1981 BWROG CRS Checklist and the 1983 Supplemental CRS Checklist were used for this survey. The NRC audit team endorses the GSU decision to do the CRS over again, rather than use the survey that was done by the BWROG in San Jose in 1981. By doing a complete new survey, a more up-to-date and integrated evaluation of control room interfaces will be provided.

The NRC audit team reviewed Panels 680 and 870 by comparing the CRS checklists filled out by the RBS reviewers with the corresponding HED sheets. An HED sheet was found on file for all checklist item deviations with an evaluation product (EP) equal to or greater than 6. The HED sheet deviation descriptions include the BWROG checklist category item identification number and the panel location.

During the in-progress audit, the NRC audit team was told by the RBS review team that all deviations from the guidelines with an EP equal to or greater than 4 would be considered HEDs. The audit team was further told that, based on BWROG guidelines, checklist items with EP=0 to 3 required no corrective

action and would be dropped. It is the NRC audit team's position that all checklist deviations with a judged compliance factor of 2 and 3 and a potential for error of 1 should also be listed as HEDs and evaluated. During post-audit telephone discussions between the NRC and RBS, it was agreed that all checklist deviations with a compliance factor greater than 1 would be evaluated as HEDs regardless of their potential for error rating.

The NRC audit team compared the BWROG checklists that were filled out by the GSU/General Physics CRS working groups with the actual control panels. Control room panels 601, 680, 870, and remote shutdown panels for Division 1 and Division 2 were audited. It was found that the BWROG checklist were applied objectively and consistently by the two RBS working groups that performed the survey of the control panels.

The NRC audit team agrees with most findings of observed deviations from guidelines that were written up as HEDs. There was minor disagreement with a few GSU/GP findings that control layouts and control/display relationships conform to guidelines. GSU should ensure that panel layout and control/display relationships are assessed using well defined review criteria.

Care must be taken to assure that a clear, auditable trail is provided for the evaluation and resolution of HEDs that are duplicated. Duplication includes HEDs that are duplicated on different panels and HEDs designated to be panel generic or control room generic HEDs. Some generic discrepancies need detailed review throughout the control room. These generic discrepancies include labels, annunciators, and glare on instruments and controls.

Any open (i.e. as yet not completed) CRS items should be resolved and the results reported in the Summary Report or, if necessary due to schedular constraints, a supplement to the Summary Report. Items that are considered open include the following:

- Lighting
- Heating, ventilation, air conditioning
- Communications
- Noise levels
- Availability of procedures in the control room and remote shutdown panels
- Availability of protective clothing and gear

We conclude that the RBS CRS appears to have been executed with reasonable diligence and adequately documented. With the completion of the open items

above and the addition of HEDs defined by any deviation from the guidelines, the RBS CRS is expected to meet the requirement of NUREG-0737, Supplement 1 to conduct a control room survey which identifies deviations from accepted human factors principles.

ASSESSMENT OF HEDs

Supplement 1 to NUREG-0737 requires that HEDs be assessed to determine which HEDs are significant and should be corrected. NUREG-0700 and draft NUREG-0801 contain guidelines for the assessment process.

As stated in the RBS Program Plan, the assessment phase will analyze, evaluate, and prioritize all HEDs found, and recommend means of correcting those which will impact safety or plant/operator performance. The stated emphasis on the likelihood of operator error and resulting safety consequences is appropriate. Human factors personnel will assist GSU personnel in assessing the HEDs for documented errors, potential for operator errors, and impacts on plant safety.

During the in-progress audit, the NRC audit team reviewed a proposed supplement to the Program Plan entitled "HED Assessment and Resolution." This document describes a formal HED assessment and resolution methodology to be used by the RBS review team similar to the guidance of draft NUREG-0801. The methodology is thorough and complete. It directs team members in both independent and collective assessment actions. Information from the operating experience review will be used to help assess whether an HED resulted in a documented operator error or provides the potential for operator error. HEDs that may affect operator performance are subjected to a series of twenty statements or questions which will aid the reviewers in their assessment and judgment of the HEDs. HEDs will also be assessed for their impact on plant safety by subjecting them to a list of five statements or questions that address the plant impact of errors that could be associated with the HEDs.

As an aid to prioritizing them for selection of corrective actions, the RBS review team will categorize the HEDs into levels of significance as determined by safety status and error potential.

We expect that the applicant's HED assessment method, if conscientiously executed as described at the audit and in the proposed Program Plan supplement, will meet the intent of the guidelines of NUREG-0700 and NUREG-0801, and should meet the requirements of Supplement 1 to NUREG-0737 to assess HEDs to determine which HEDs are significant.

SELECTION OF DESIGN IMPROVEMENTS

Supplement 1 to NUREG-0737 requires the selection of control room design improvements that will correct the significant HEDs. It also states that

improvements that can be accomplished with an enhancement program should be done promptly.

The proposed Program Plan supplement noted in the previous section describes a formal process by which the DCRDR review team will reach a consensus in selecting the optimal design improvement for each HED. When a consensus is reached, the proposed corrective actions and cost estimates will be forwarded to GSU management for review and approval.

HEDs in Categories I, II, or III which are not corrected or only partially corrected, will be justified and submitted to the NRC in the Summary Report. Category IV HEDs (nonsafety-related with low error potential) will not be justified.

The human factors consultants will work in conjunction with other DCRDR team members in appropriate combinations of expertise to determine and recommend a corrective action or alternate solutions for each HED, and to assure that no new HEDs are created.

A feasibility and scope review and evaluation of each recommendation will be performed by engineering representatives. This evaluation will employ a line of questions similar to that used in generating the recommended design changes and will also address the feasibility of the proposed modifications by taking into account characteristics specific to River Bend. The results of the review will be made available to all DCRDR team members. The DCRDR team members are free to seek additional inputs from their respective departments, suggest alternative resolutions as appropriate, and submit their suggestions for consideration.

Several meetings may be scheduled to discuss the resolutions and obtain a consensus before submittal of proposed resolutions to management for review and approval. Since management has veto power over implementation, it is important that any such actions be justified.

We conclude that the applicant's methodology for selection of design improvements, when executed as described and acceptably reported, should demonstrate that the requirement of Supplement 1 to NUREG-0737 to select design improvements that will correct the HEDs has been met.

VERIFICATION THAT MODIFICATIONS PROVIDE THE NECESSARY CORRECTIONS AND DO NOT INTRODUCE NEW HEDs

Supplement 1 to NUREG-0737 requires that applicants verify that design improvements provide the necessary corrections and do not introduce new problems.

The staff's comments on the GSU Program Plan recommended that mock-ups or some other means of verifying design improvements be used before the changes are installed in the control room. The staff understands that major changes

may be mocked-up prior to implementation to aid in determining and/or verifying the effectiveness of proposed corrective actions.

COORDINATION OF THE DCRDR WITH OTHER PROGRAMS

Supplement 1 to NUREG-0737 requires that the control room improvements be coordinated with changes from other initiatives such as the SPDS, operator training, Regulatory Guide 1.97 instrumentation, and upgraded EOPs.

The coordination and integration of the DCRDR with the other NUREG-0737, Supplement 1 activities stems largely from the fact that the DCRDR team leader also functions as coordinator of all Supplement 1 tasks. Although the coordination effort was not reviewed in depth during the audit, it appears that GSU is adequately integrating the DCRDR with the other NUREG-0737, Supplement 1 actions.

CONCLUSIONS

Based on the in-progress audit, the staff believes that GSU is conducting a control room review which, if completed in a manner consistent with that described to the NRC audit team and if adequately documented in a Summary Report, should meet the requirements of NUREG-0737, Supplement 1. A final evaluation and decision on the adequacy of the DCRDR will be made after submittal of the GSU Summary Report scheduled for October 31, 1984. GSU will be informed within approximately two weeks of receipt of the Summary Report by the reviewing branch if a pre-implementation audit will be conducted.

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 TMI Action Plan Requirements," November 1980; Supplement 1, December 1982 (Generic Letter No. 82-33)

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

4. NUREG-0801, "Evaluation Criteria for Detailed Control Room Design Reviews," October 1981, draft report.

5. Letter from J. E. Booker, GSU, to H. R. Denton, submitting the River Bend Station Detailed Control Room Design Review Program Plan, January 31, 1984.

6. Letter from A. Schwencer, NRC, to W. Cahill, Jr. transmitting staff comments on River Bend Station Control Room Design Review Program Plan, April 25, 1984.

7. Memorandum for Voss A. Moore, From S. H. Weiss, "Meeting Summary - Task Analysis Requirements of Supplement 1 to NUREG-0737 - May 4, 1984 Meeting with BWR Owners' Group Emergency Procedure Guidelines and Control Room Design Review Committees," May 1984.

EXHIBIT I

RIVER BEND DCRDR IN-PROGRESS AUDIT

ENTRANCE BRIEFING ATTENDEES

JULY 24, 1984

GSU

D. Chase, System Engineer
R. King, Licensing Engineer
R. Taylor, QA Engineer
T. Fredieu, Asst. Ops. Supervisor
R. Stafford, Dir. Quality Services
T. Croure, Mgr. QA
P. Graham, Asst. Plant Mgr.
M. Bishop, Shift Supervisor
R. West, PGCC Supervisor

LLNL

R. Peterson, Nuclear Engr.
J. Savage, Elec. Engr.
K. Harmon, Engineering Associate

STONE & WEBSTER

N. Borreggine, Elec. Engineer

General Physics

D. Burgy, Director, H.F. Sr. Engr.
R. Stamm, Sr. Engineer
R. Price, Dir. St. Francesville Training Services

NRC

J. Hoyt, Engr. Psychologist
V. Pezoldt, Engr. Psychologist

EXHIBIT II

RIVER BEND DCRDR IN-PROGRESS AUDIT

EXIT BRIEFING ATTENDEES

JULY 27, 1984

GSU

D. Chase, Systems Engr.
R. Kirg, Licensing Engr.
T. Fredieu, Asst. Ops. Supervisor
P. Graham, Asst. Plant Mgr.
M. Bishop, Shift Supervisor
E. Grant, Supervisor Nuclear Licensing
W. Odell, Director Nuclear Training

NRC

J. Hoyt, Engr. Psychologist
E. Weinkam, III, Licensing Project Manager
J. Minns, Health Physicist
V. Pezoldt, Engr. Psychologist

GENERAL PHYSICS

D. Burgy, Director, Human Factors
R. Stamm, Sr. Engineer
R. Byrd, Mgr, BWR Training Program
R. Price, Dir. St. Francisville Training Services

LLNL

R. Peterson, Nuclear Engineer
J. Savage, Electrical Engineer
K. Harmon, Engineering Associate