

APR 19 1983

ALL BOILING WATER REACTOR LICENSEES OF OPERATING REACTORS, APPLICANTS FOR AN OPERATING LICENSE AND HOLDERS OF CONSTRUCTION PERMITS

Gentlemen:

SUBJECT: NRC STAFF REVIEW OF THE BWR OWNERS' GROUP (BWROG) CONTROL ROOM SURVEY PROGRAM (Generic Letter 83-18)

The NRC staff has completed its review of the BWR Owners' Group (BWROG) Control Room Survey Program. The results of the staff's review are provided in the enclosed evaluation and letter to the Owners' Group Chairman. The BWR Owners' Group submittal addresses the planning and review phases of the Detailed Control Room Design Review (DCRDR) and provides valuable guidance to users utilities. However, the BWROG Survey Program should not be interpreted as fully responding to NUREG-0737 Task Action Plan Item I.D.1. Additional work is required.

The NRC review consists of a discussion of our concerns about the scope of the BWROG program and information or commitments that you should present in your program plan submittal. Since the BWROG survey program addresses only the planning and review phases of DCRDR, you are expected to complete the following tasks:

- a. Submit an individual program plan to the NRC referencing the BWROG Generic Program Plan. The plant-specific submittal should:
 - i. Document the qualifications of survey team members, and number and extent of plant personnel participation.
 - ii. Identify portions of the plant's DCRDR not performed in accordance with the methodology specified in the BWROG Program Plan.
 - iii. Discuss your program for prioritization of HEDs, reporting of DCRDR results, and implementation of control room enhancements.
- b. Complete the BWROG control room survey Checklist Supplement.

*IDR-5
INFO-HR
XRD-10-1
BWR*

8304200321

OFFICE	.....	.....	.....	.....	.....	.....	.....
SURNAME	.....	.....	.....	.....	.....	.....	.....
DATE	.....	.....	.....	.....	.....	.....	.....

- c. Prioritize HEDs, determine corrective actions, develop an implementation schedule, and report the results of the DCRDR to the NRC.
- d. Repeat portions of the task analysis using updated plant specific emergency operating procedures to account for differences in the new procedures.
- e. Update operating experience review.

This request for information was approved by OMB clearance number 3150-0065 which expires May 31, 1983.

Sincerely,

Darrell G. Eisenhut, Director
Division of Licensing
Office of Nuclear Reactor Regulation

Enclosure:
NRC Comments

*SEE PREVIOUS CONCURRENCES

OFFICE	*DL:ORB#5	*DL:ORB#5	*DL:ORB#5	*DL:AD-SA	DIR:DIR		
SURNAME	HSmith:cc	GDick	DCrutchfield	FMiraaglia	DEisenhut		
DATE	03/30/83	03/31/83	04/6/83	04/6/83	04/12/83		

- c. Prioritize HEDs, determine corrective actions, develop an implementation schedule, and report the results of the DCRDR to the NRC.
- d. Repeat portions of the task analysis using updated plant specific emergency operating procedures to account for differences in the new procedures.
- e. Update operating experience review.

This request for information was approved by OMB clearance number 3150-0065 which expires May 31, 1983. Comments on burden and duplication may be directed to the Office of Management and Budget, Reports and Management, Room 3208, New Executive Office Building, Washington, D. C.

Sincerely,

Division of Licensing
Office of Nuclear Reactor Regulation

Enclosure:
NRC Comments

DISTRIBUTION

Docket
ORB Reading
DEisenhut
FMiraglia
HThompson
JKramer
VMoore
SWeiss
MGreenberg
DCrutchfield
GDick

OFFICE	DL: ORB#5	DL: ORB#5	DL: ORB#5	DL: AD-5A	DL: DIR		
SURNAME	Hornich:cc	GDick	DCrutchfield	FMiraglia	DEisenhut		
DATE	03/30/83	03/31/83	05/16/83	04/6/83	03/ /83		

NRC REVIEW OF
BWR OWNERS' GROUP
CONTROL ROOM SURVEY PROGRAM

At the request of the BWR Owners' Group (BWROG), the Human Factors Engineering Branch (HFEB) of the Division of Human Factors Safety (DHFS) reviewed BWROG Control Room Survey Program. Several meetings between the NRC and the BWROG were held to resolve NRC concerns.

We conclude that the BWROG Control Room Survey Program as clarified in the September 16, 1982 meeting between the NRC and BWROG, is an acceptable approach to the planning phase and the review phase of the Detailed Control Room Design Review (DCRDR) called for in Supplement 1 to NUREG-0737 and described in NUREG-0700. A summary of the issues clarified in the September 16, 1982 meeting are included here.

The BWROG effort was initiated prior to the publication of NUREG-0700 and NUREG-0801. The submission of the BWROG program was accomplished in a number of stages and meetings with the NRC starting in July 1980. A working meeting was held with the NRC and BWROG on September 16, 1982 to review for completeness the material that had been submitted and to resolve and clarify some open issues that were either not resolved or not documented.

In order to prevent possible misuse of the BWROG Control Room Survey Program, it is necessary to emphasize that the BWROG Control Room Survey Program should not be interpreted as fully responding to Task Action Plan Item I.D.1. It only addresses the planning and review phases of the DCRDR.

A key area of NRC concern was what, specifically, was the scope of the BWROG program and at what point will a plant-specific program plan submittal be required from the licensees?

A program plan report that is submitted by a utility that is using the BWROG Control Room Survey Program should reference the BWROG program and include information that covers the remaining areas of a program plan as described in Supplement 1 to NUREG-0737. Utilities should address the availability of human factors engineering expertise in the other phases of the DCRDR as well as in any additional reviews or re-reviews and further surveys of additional operators. The BWROG should consider holding additional training workshops to supplement the number of reviewers who attended the initial workshop.

The BWROG Survey Program has already been utilized by a number of utilities. Some of the initial users have accumulated substantial amounts of additional operating experience since the survey was first performed. In addition, upgraded emergency operating procedures are currently being developed using function based technical guidelines. In order to insure a high degree of confidence and consistency in the survey program, program plan reports should contain the following commitments:

1. Utilities will update their operating experience review to incorporate recent operating history, if their survey was performed prior to June 30, 1982.
2. Utilities will use updated plant-specific emergency operating procedures to repeat portions of the task analysis to account for differences in the new procedures.

Since the NRC has not seen specific details on the BWROG Survey Program performed at each plant, utilities in their program plan submittals should provide the following information on the review phase: number and extent of plant personnel (especially operating personnel) participation during the review phase, attendance of plant personnel at BWROG Workshops and training courses, specific procedures walked through in the control room as part of the systems review, additional work performed by the utility to complete the systems review, and plans for reviewing the remote shutdown panel.

The BWROG program will provide each member utility with a list of plant-specific human engineering discrepancies and a preliminary attempt to prioritize them. Utilities will be responsible for presenting their plans and schedules for assessment, implementation, and reporting phases in their program plan. In addition, utilities should identify areas where they deviated from the BWROG program, as reviewed by the NRC. The utility's submittal should also provide the qualifications of the team members performing the DCRDR.

The NRC has not reviewed the preliminary prioritization methodology developed by the BWROG. Therefore, utilities should address the methodology used to determine discrepancy significance in their program plan report. Human factors engineering participation in the remaining phases of the DCRDR is considered to be very important. Therefore, it is necessary that a systematic documentation scheme be utilized to provide continuity in the event that other human factors consultants are involved in the remaining phases.

Following are a number of specific NRC comments and BWROG responses that were covered at the September 16, 1982 meeting:

1. Comment:

How does the review methodology used by the BWROG differ from that recommended in NUREG-0700?

BWROG Response:

NUREG-0700 includes four phases in the DCRDR:

- a. Planning
- b. Review

- c. Assessment and Implementation
- d. Reporting

The review phase is further divided into six processes:

- i. Review of operating experience
- ii. Analysis of system functions and operator tasks
- iii. Control room inventory
- iv. Control room survey
- v. Verification of task performance capabilities
- vi. Validation of control room functions.

The BWR program is designed to address only the first two phases of the control room design review (i.e., planning and review). The assessment and implementation and reporting phases are the responsibility of the individual utilities.

The BWROG review methodology includes analysis of plant LERs and scram reports, operator interviews, checklist evaluations, and task analysis and walkthroughs of emergency procedures. The LER and scram report analysis and operator interviews together correspond to Process i of NUREG-0700. The task analyses and walkthroughs satisfy the intent of Processes ii, iii, v, and vi. The checklist evaluations correspond to Process iv.

2. Comment:

Does the planning phase of the BWROG program meet NUREG-0700 recommendations?

BWROG Response:

The BWROG program was developed in advance of NRC requirements for control room reviews in a conscientious effort to improve BWR control

rooms. We believe the process used in developing the BWROG program satisfies the intent of NUREG-0700. A detailed description of the development process may be found in the BWROG program plan.

3. Comment:

What is the scope of the BWROG program plan?

BWROG Response:

The BWROG program plan covers the development and the methodology to be utilized for the detailed control room design review. The specified qualifications of the design team and survey team members will be submitted to the NRC at a later date.

4. Comment:

What is the role of human factors specialists in the BWROG DCRDR program?

BWROG Response:

The services of human factors specialists affiliated with the Massachusetts Institute of Technology and other academic institutions were extensively utilized in both the planning and review phases of the BWROG program. In the planning phase, the consultants performed an independent evaluation of the BWROG program, testing for completeness, adequacy, and validity. In the review phase, at least one human factors specialist participated full time on each survey team. In addition, the specialist performed an independent review of the control room, the results of which are available to each utility. Since the scope of the BWROG is limited to the planning and review phases, it is the responsibility of individual utilities to arrange for human factors consultation, if required, in the assessment and implementation and

reporting phases. Human factors input during these phases is recommended in plant-specific summary reports and in the description of BWROG methodology submitted in the program plan.

5. Comment:

Does the BWROG program determine, by analysis, what functions are necessary to mitigate an event and to verify that the systems to accomplish these functions do exist in the control room?

BWROG Response:

It is assumed, for the purposes of the control room design review, that the technical guidelines developed by the BWROG adequately and completely define operator functions and tasks. The technical guidelines are therefore used as a starting point for task analyses performed by the BWROG survey teams. The validity of the technical guidelines is to be evaluated separately by the NRC staff in response to Item I.C.1 of NUREG-0737.

6. Comment:

Describe the systems analysis used in the BWROG program.

BWROG Response:

The technical guidelines developed by the BWROG are used as the basis for task analysis and procedural walkthroughs. The following methodology is used:

- a. Operator tasks are defined.
- b. Control and instrumentation requirements are specified for each operator task.

- c. The completeness of control room inventory is verified through comparison with instrumentation requirements established in the task analysis.
- d. Task sequences are validated with walkthrough/talkthroughs. Traffic patterns, communication requirements and panel arrangements are considered.
- e. Each task is analyzed in terms of the following considerations:
 - i. Is the sequence valid and complete?
 - ii. Is sufficient information immediately available to the operator to complete the task?
 - iii. Do critical controls and displays identified for each task conform to checklist evaluation criteria?
 - iv. Do control/display relationships meet checklist criteria?
 - v. Is manpower adequate to perform the task?
 - vi. Are traffic patterns unobstructive?
 - vii. Is direct feedback used to verify control functions?

7. Comment:

Validation of the allocation of functions should be based upon performance criteria established as part of a reanalysis of operator functions.

BWROG Response:

Task analysis used in BWROG program assumes that allocation of operator functions and definition of operator tasks are adequately and completely defined by the BWROG technical guidelines. It is the technical guidelines which form the basis of the BWROG program.

8. Comment:

The technical guidelines available at the time individual plant surveys were performed had not been approved by the NRC. What further analysis, if any, will be performed when the final version of the technical guidelines is available.

BWROG Response:

Task analyses performed for each utility relied upon an early version of the technical guidelines available at that time. Although subsequent revisions to the technical guidelines do incorporate many changes, much valuable information was gained from the analyses performed. It is expected that individual utilities will supplement this work with further analysis as plant-specific procedures are developed.

9. Comment:

Discuss the methodology used in operator interviews. What precautions were taken to assure impartial questioning and data recording?

BWROG Response:

The BWROG program recommends that a minimum of one-third of the licensed operators at each plant participate in interviews, written

questionnaires were distributed, followed by interviews with a member of the survey team. An attempt was made to include a complete spectrum of operator experience, education, ability, and physical size. Topics included in the questionnaires were selected to allow for operator input on a wide variety of subjects and to address the concerns for which operating experience must serve as the primary source of information. The questions were structured to avoid leading the operator into specific answers or to limit his responses to specific areas. Each interviewer was trained in questioning techniques at a workshop held in October 1980. Additional written guidelines were provided in a workshop supplement distributed to survey team members.

10. Comment:

What method is used to prioritize and rate the safety significance of HEDs identified in BWROG control room reviews?

BWROG Response:

Assessment, prioritization, implementation, and reporting are not part of the BWROG program. However, a preliminary prioritization, based on potential for error and degree of compliance, is provided for the information of the utility as part of each Summary Report. Final corrective action recommendations will be determined in an item-by-item review of the HEDs, by each utility, addressing, in addition to potential for error and degree of compliance, the safety significance of the components and systems involved, frequency of use, the consequences of required operator retraining, and engineering and cost feasibility.

11. Comment:

How does the BWROG control room review checklist compare to the checklists found in Section 6 of NUREG-0700?

BWROG Response:

The BWROG checklists were developed prior to the issuance of NUREG-0700 but were derived from essentially the same human factors standards and have been reviewed in detail by a team of human factors specialists. While differences in presentation methods and areas of emphasis do exist, the BWROG checklists are comparable in scope to those contained in NUREG-0700. Each is considered to be a valid set of human factors criteria useful in the performance of control room design reviews. Credible results, with a high degree of similarity, can be expected using either document.

Following the issuance of NUREG-0700, the BWROG compiled a Checklist Supplement containing NUREG-0700 checklist items not directly addressed in the BWROG control room survey program. The desirability of including these items has been verified by the experiences of the BWROG survey teams. The Checklist Supplement is to be distributed for completion by individual utilities.

The level of detail provided by NUREG-0700 and the BWROG checklists differs in certain respects. NUREG-0700 addresses many topics on a detailed, quantitative basis, whereas the BWROG believes a more general, qualitative approach, coupled with survey team training, is more appropriate. Control dimensions and actuation torques, chair dimensions, ventilation system air velocity, luminance ratios, communications system frequency response, and label character

dimensions are examples. Where numerical values are specified in the BWROG checklists (anthropometrics and background noise levels for example) the values generally correspond closely to those in NUREG-0700 and in some cases are more restrictive.

A major difference between NUREG-0700 and the BWROG control room survey program may be found in the evaluation of computer systems. The BWROG does not believe that a detailed design evaluation of the process computer is appropriate at this time since most plants place minimal reliance on the process computer for operational support. It is recognized, however, that plants with advanced control rooms should address this area in more detail, and it is expected that human factors considerations will be addressed during any future development of computer-based operational aids.

Several review areas are addressed by the BWROG which are not covered in NUREG-0700. Among these are a comprehensive review of procedures and limited reviews of training, manning, shift change, and maintenance activities as they relate directly to control room operation.

12. Comment:

What tasks must utilities address on an individual basis beyond the work performed by the BWROG survey teams?

BWROG Response:

The BWROG survey program is designed to address only the planning and review phases of NUREG-0700. Individual utilities are expected to complete the following tasks:

- a. Submit an individual program plan to the NRC referencing the BWROG Generic Program Plan. The plant-specific submittal should:
 - i. Document the qualifications of survey team members.
 - ii. Identify portions of the plant's DCRDR not performed in accordance with the methodology specified in the BWROG Program Plan.
 - iii. Discuss the utility's program for prioritization of HEDs, reporting of DCRDR results, and implementation of control room enhancements.
- b. Complete the BWROG control room survey Checklist Supplement.
- c. Prioritize HEDs, determine corrective actions, develop an implementation schedule, and report the results of the DCRDR to the NRC.
- d. Consider the need for re-doing task analysis, based upon a comparison of final plant-specific emergency procedures (when available) with the version of the generic symptom-based technical guidelines used during the DCRDR.

These items will be emphasized in the BWROG control room survey Checklist Supplement.

13. Comment:

What are the relative strengths of the BWROG program?

BWROG Response:

The BWROG embarked upon the development of a DCRDR program in March 1980 in a responsive, conscientious effort to identify potential improvements to BWR control rooms. Considering its early genesis, the parallels to NUREG-0700 are striking. Over a period of 2 years, the program has been implemented with successful results at 17 plants. The BWROG considers the following points worthy of note:

- a. The program is generic in nature, a cooperative effort between BWR utilities, resulting in standardized review methodology.
- b. Extensive, multi-disciplinary design effort was involved in the development of the program. Reviews were performed by several independent agencies.
- c. Human factors specialists have been involved in each phase of the program.
- d. Impartial data gathering and standardized methodology were assured through use of inter-utility survey teams. Survey team members were trained in design review techniques during a 6-day workshop followed by on-site instruction.
- e. Operational experience was incorporated into both the development and review phases.
- f. Integration of the DCRDR with other control room enhancement programs was stressed from an early date.

- g. Task analyses, operator interviews, and operating experience reviews were included in the review methodology. Task analyses were based upon the new symptom based technical guidelines being developed by the BWROG. The checklist reviews and operator interviews are relatively comprehensive.
- h. A final generic report will be prepared, summarizing results of all BWR DCRDR to promote the exchange of experience, technology, and ideas between utilities.