

~~4.2.4~~ 1,600 Unresolved Human Engineering Concerns (WBN)

As discussed in Section 4.2.2, 1,600 HECs were identified during the first two stages of the WBN DCRDR. As of February 17, 1987, 1,846 HECs had been identified. These HECs have been assessed to HED status, where applicable. Corrective action plans have been proposed for about three-fourths of the HEDs. The remaining HEDs have no corrective action planned; justification has been prepared. The proposed HED corrective actions and the schedule for implementing them are to be included in the DCRDR Summary Report, which was submitted to the NRC on October 2, 1987. Thus, all outstanding HECs have been resolved.

4.2.5 Too Many Poor Engineering Practices (All Plants)

In the second part of Employee Concern (EC) WI-85-100-107 (and identical ECs XX-85-122-020, -021, and -022), the CI states, "There are too many poor engineering practices in this area."

Resolution of Past Poor Human Engineering Practices. Because this concern is broadly stated, its validity with respect to the existing control room designs can only be determined by a detailed review of the control room design. The assessment of the control room design by the DCRDR team provides the basis for resolving this EC.

The DCRDR teams have recommended corrective actions for the safety-significant HEDs as part of their assessments. The resolution of past poor engineering practices are included in that activity. (Some work remains to be done at BLN; see Section 4.2.8).

TVA Procedures for Future Control Room Design Changes. There are several TVA procedures in place to guide the engineering aspects of any control room modifications which result from corrective actions generated in the DCRDR and future modifications.

Engineering Procedures. EEB-EP 22.32 (Ref. 11) describes:

". . . human factors engineering (HFE) principle compliance review of design and design changes. This HFE design review is mandatory for any change to a nuclear power plant which:

- a. Affects the operation or environment of the main control room (MCR), auxiliary (backup) control room (ACR), or local control stations, and
- b. Involves issuing new or revised Division of Nuclear Engineering (DNE) design input or design output documents [Nuclear Engineering Procedures (NEPs) -3.2 and -5.1].

The review will ensure that the designs or design changes have been done in accordance with TVA DNE design guides, standards, procedures, and applicable industry standards in regard to HFE. . ."

"An HFE review will be accomplished by review of information on any design or design change which can affect:

- a. An operator's environment, or
- b. An operator's workspace, or
- c. Controls and displays in the MCR, ACR, or local control stations, or
- d. Operational procedures.

This review will be done according to NEP-6.1 and any design input or design output document which affects any of the above items. . ."

"To ensure effective coordination with the CRDR activities and results, each design or design change will be coordinated with the CRDR team leader for the plant affected; or if the CRDR is completed, the design or design change will be reviewed against the CRDR documents.

New changes will be evaluated for impact on CRDR commitments and deviations will be documented by the HFE review."

Division of Nuclear Engineering Procedure NEP-6.1, "Change Control" (Ref. 17), defines the process by which plant changes are identified, scoped, coordinated, reviewed, and approved before implementation. Processing of engineering change notices (ECNs) (the documentation that provides a concise scope of a design change) is described in Section 4.0 of NEP-6.1.

A checklist for the lead engineer is provided in the procedure to ensure that a human factors review is performed, if required. All future changes to TVA nuclear plant control room/control boards will be handled by this procedure.

Design Guides. According to Section 3.0 of EEB-EP 22.32, the Electrical Engineering Branch has the responsibility for human factor engineering reviews in TVA. For control room/control board changes a number of engineering design guides are used. The principal ones are noted below:

- o Design Guide E-18.1.11

This design guide presents principles and techniques of human factors engineering (HFE) pertinent to designing operator work stations in power generating plants.

o Design Guide E18.1.12

This guide describes methods and techniques of HFE in control console and cabinet design and panel layout. It provides a means for measuring the HFE adequacy of new designs and of modifications to existing designs.

o Design Guide E18.1.13

This document defines and documents accepted HFE principles and standards to be employed for the design of annunciators and alarm systems.

o Design Guide E18.1.14

This design guide details the human factors requirements for controls and displays that are integrated into a functional panel design. Criteria that will help the operator identify and operate the controls and displays quickly and efficiently are presented.

o Design Guide E18.1.15

This design guide contains general HFE requirements for operator interface with computers and computer driven devices.

A review of these design guides by the evaluation team indicates that the necessary features to provide proper human factors designs are addressed and that these procedures are adequate to assist in modifications that may be required in the control room (Ref. 52).

These procedures and design guides should ensure good engineering practices in the human factors area.

4.2.6 Compliance with NUREG-0700 (All Plants)

Employee Concerns WI-85-100-007 and XX-85-122-020, -021, and -022 question compliance with NUREG-0700. NUREG-0700 provides guidelines for licensees and applicants in conducting a DCRDR to ensure consideration of human factors in completed nuclear power plant control room designs. The requirement to conduct a DCRDR is contained in NUREG-0737, Supplement 1 (Generic Letter 82-33). The purpose of NUREG-0700, then, is to lead utilities to appropriate levels of compliance. TVA's generic program plan, which describes TVA's approach to following the guidelines of NUREG-0700, has been reviewed by the NRC and has subsequently been revised by TVA in response to the NRC's comments. TVA has conducted three DCRDRs (at SQN, BFN, and WBN) utilizing the

guidance of NUREG-0700. The BLN DCRDR has been temporarily suspended. NUREG-0700 allows alternative approaches as long as they are identified and justified. Final compliance is achieved upon TVA's completion of the DCRDR by submittal of the Summary Reports, followed by NRC review of the Summary Reports, as documented in safety evaluations. The status of the DCRDRs for each site is described further in Section 4.2.2.

4.2.7 Possible Material False Statement Related to Appendix D of the Safety Evaluation Report (WBN)

Employee Concern IN-85-102-001 states:

"Control Room modifications have not been made. There are 1600 outstanding unanswered concerns. Reference Appendix D to the Safety Evaluation Report.

Individual considers this a material false statement."

This section of the report addresses the portion of the EC dealing with the alleged material false statement.

The material false statement to which the concerned individual refers cannot be ascertained from the quotation itself. However, the evaluators believe that the EC must be related to a series of submittals made by TVA to the NRC between November 1983 and October 1984 which inaccurately reported the status of WBN unit 1 control room design modifications called for in Appendix D to the Watts Bar SER (NUREG-0847) resulting from TVA's preliminary assessment of the WBN control room (see Section 4.3.1). The reasons behind this conclusion are as follows:

- o Under section 186 of the Atomic Energy Act, as amended, the term "material false statement" essentially refers to statements made by applicants or licensees to the NRC. The last sentence in Employee Concern IN-85-102-001 could be read to mean that the material false statement was made in Appendix D to the Safety Evaluation Report since Appendix D is the immediate antecedent to "this." However, the SER is written by the NRC staff, not by TVA. Thus, the SER is not a "statement" within the meaning of the regulation.
- o Control room modifications not having been made does not constitute a "statement."
- o It may be thought that having "1600 outstanding unanswered concerns" constitutes a material false statement; however, as discussed elsewhere in this report, these 1,600 concerns can only refer to the

human engineering concerns (HECs) identified by the DCRDR team during the initial review phases (see Section 4.2.2) which have been assessed and converted to human engineering discrepancies where appropriate. Corrective actions for these HEDs are being planned and implemented in accordance with the governing procedures. The entire process is to be documented in a Summary Report to the NRC. The WBN DCRDR Summary Report is to be submitted on October 1, 1987; therefore, no "statement" had been made to the NRC related to the 1,600 HECs at the time EC IN-85-102-001 was expressed.

- o On August 29, 1985, NRC Region II issued a Notice of Violation and Proposed Imposition of Civil Penalty to TVA (Ref. 30) for a material false statement contained in a series of status reports submitted by TVA to the NRC between November 1983 and October 1984. These status reports purported to indicate the completion of corrective actions related to Watts Bar Unit 1 control room design modifications called for by Appendix D to the SER. The NRC stated that there was apparently no attempt by TVA to deliberately mislead NRC personnel. TVA admitted the violation.

A more thorough discussion of these material false statements related to WBN SER Appendix D is contained in Subcategory Report 24500 (Ref. 61), element 201.5 for Watts Bar, on TVA's commitment tracking program. That element evaluation affords a complete treatment of the portion of EC IN-85-102-001 related to the alleged material false statement. The factors which contributed to the inaccuracies in the status reports have been determined to be programmatic, that is, due to procedural deficiencies related to tracking of commitments, rather than to substantive inadequacies in the human factors/control room design review program. Therefore, the evaluation of Subcategory Report 24500, WBN element 201.5 is adequate to address this portion of EC IN-85-102-001.

4.2.8 Review of HECs (BLN)

Employee Concern BLN-ONP-EC-001 asserts that HECs identified might not be properly reviewed due to a delay in startup and a reduction in manpower at BLN.

The BLN DCRDR preliminary Action Plan lists all human engineering concerns (HECs) identified at BLN before May 12, 1983. These HECs have been assessed for possible redesignation as human engineering discrepancies (HEDs). Nineteen additional HECs were identified after the preliminary Action Plan was issued and before the DCRDR was temporarily suspended, but have not been assessed for possible redesignation as HEDs. The computerized Tracking and Reporting of Open Items (TROI) system shows 15 BLN DCRDR tasks yet to be

completed. Review of the 19 HECs is not included on the TROI system. The DCRDR is scheduled to be under suspension for approximately 3 to 4 years. Since the DCRDR will be suspended for such a long time and the outstanding 19 HECs are not being tracked by TROI, TVA could overlook the HECs when the DCRDR resumes.

4.3 Control Room Design Review by NRC - Element 208.2

4.3.1 NRC Review of WBN Control Room Preliminary Assessment (WBN)

Employee Concern IN-85-102-002 asserts, in part, that the NRC review of the Watts Bar control room, as reported in its Safety Evaluation Report (SER), Chapter 18 and Appendix D, June 1982, was inadequate. According to the concern, that inadequacy is attested to by the fact that over 1,700 human engineering concerns had been identified during the first two phases of the TVA Detailed Control Room Design Review (DCRDR) completed on February 1, 1985: (a) review of operating experience, including a personnel survey, and (b) an onsite control room survey.

NRC Guidelines. According to NUREG-0737 (Ref. 6), WBN could have obtained an operating license in advance of completion of the detailed control room design review. However, completion of a preliminary control room assessment by TVA to identify significant human factors and instrumentation problems, followed by evaluation of this assessment and an onsite review/audit by the NRC, is required before the issuance of an operating license. Further, WBN was required by a condition of the draft operating license to complete its DCRDR and submit a Summary Report before April 1, 1987 (Ref. 29; Att. 2 item 1[a]). This schedule date has been extended twice. The Summary Report was actually submitted on October 2, 1987. Since the operating license for WBN has not yet been granted, the detailed DCRDR was actually completed before issuance of an operating license.

NUREG-0737 describes the scope of the onsite review/audit, as follows:

"The NRR onsite review/audit will be on a schedule consistent with licensing needs and will emphasize the following aspects of the control room:

- (1) The adequacy of information presented to the operator to reflect plant status for normal operation, anticipated operational occurrences, and accident conditions;
- (2) The groupings of displays and the layout of panels;

- (3) Improvements in the safety monitoring and human factors enhancement of controls and control displays;
- (4) The communications from the control room to points outside the control room, such as the onsite technical support center, remote shutdown panel, offsite telephone lines, and to other areas within the plant for normal and emergency operation.
- (5) The use of direct rather than derived signals for the presentation of process and safety information to the operator;
- (6) The operability of the plant from the control room with multiple failures of nonsafety-grade and nonseismic systems;
- (7) The adequacy of operating procedures and operator training with respect to limitations of instrumentation displays in the control room;
- (8) The categorization of alarms, with unique definition of safety alarms.
- (9) The physical location of the shift supervisor's office either adjacent to or within the control-room complex.

"Prior to the onsite review/audit, NRR will require a copy of the applicant's preliminary assessment and additional information, which will be used in formulating the details of the onsite review/audit."

WBN Preliminary Design Assessment. The preliminary assessment of the WBN control room to identify significant human factors problems started on January 21, 1980. TVA sent a report to the NRC on January 13, 1981, listing items TVA had identified in the WBN preliminary assessment and the action to be taken (Ref. 22). The report states:

"During the week of February 4, 1980, a preliminary control room review was accomplished on the Sequoyah Nuclear Plant (SQN) unit 1 control room prior to criticality. SQN unit 1 is similar (basically identical) to SQN unit 2 and WBN units 1 and 2. A preliminary assessment conducted for either unit is appropriate for the other units.

"This assessment was conducted by the Essex Corporation (under contract to the Nuclear Regulatory Commission, NRC) with a team of NRC and TVA personnel actively involved. Essex Corporation issued a report . . . summarizing their findings. NRC identified from the report the significant items requiring immediate attention.

"TVA provided corrections to these items, and they were documented in the Sequoyah Safety Evaluation Report dated September 4, 1980. These changes are also needed on WBN. They will be completed prior to each unit's fuel loading."

Subsequent to the SQN preliminary assessment, TVA

". . . continued the preliminary review of the WBN main control room by proceeding with internal design studies and task analyses of the control boards and by making five trips to the plantsites [sic] and the plant simulators to identify human factor problems. These trips involved walk throughs of the operating instructions at both the Watts Bar plant and simulator. Detail [sic] interviews were conducted with the operators at the plants and at the simulator with the instructors.

"The control rooms were also examined to identify any significant human engineering deficiencies. The information obtained from these sources was reviewed with engineering design groups to determine the significant items and identify possible ways to implement the desired changes. These changes were then reviewed and coordinated with the plant personnel to finalize the changes to be incorporated" (Ref. 22).

Adequacy of the NRC Evaluation of TVA's Preliminary Assessment. As a preliminary step in its operating license review process, the NRC issued the WBN Safety Evaluation Report (SER), NUREG-0847, in June 1982 (Ref. 9).

Appendix D to the June 1982 SER contained the results of the NRC's evaluation of the preliminary control room assessment noted above. According to SER Section 18.1, an NRC staff team, assisted by human factors consultants from the University of California's Lawrence Livermore National Laboratory, BioTechnology, Inc., and the National Bureau of Standards, conducted an onsite control room design review from October 6, 1980 to October 10, 1980.

"Human engineering discrepancies, identified as a result of the onsite control room review and the applicant's preliminary design assessment, were contained in the staff's draft control room design report and were transmitted to the applicant. The report ranked the discrepancies according to their importance. Observed discrepancies were given a priority rating of one, two, or three (high, moderate, or low), based on the increased potential for operator error and the possible consequences of that error. The staff requires the applicant to implement corrective measures for all [79] priority 1 and 2 deficiencies before an operating license is issued because the correction of these items will significantly reduce the potential for operator error. . . No immediate actions are specified [in Appendix D] for correcting priority 3 items

because they will not significantly affect the safe operation of the plant. However, the staff does require the applicant to report on all priority 3 items as part of his detailed control room design review and to determine the best solution."

In Section 18.2 of the SER, the NRC concluded:

"The applicant's proposed corrections of the discrepancies documented in Appendix D to this report are acceptable to the staff.

"The staff will perform a confirmatory audit to verify that actions have been implemented to correct control room deficiencies and report the results in a supplement to this report.

"Based on its review of the applicant's submittals, the control room review, and other clarifying information, the staff concludes that with the implementation of the corrective actions specified in Appendix D (before an operating license is issued) the potential for operator error leading to serious consequences as a result of human factors considerations in the control room will be sufficiently low to permit safe startup and power operation of the Watts Bar nuclear plant.

"The applicant must address all priority 3 items, as well as other deficiencies that may be identified, in his detailed control room design review which will be performed using NUREG-0700 for guidance, and final resolution of all deficiencies must be on a schedule consistent with NUREG-0737."

A requirement substantially the same as the latter is also contained in the draft license (Ref. 29; Attachment 2, item 1[b]). The WBN DCRDR team has verified that, as of March 12, 1985, all but one of the Appendix D items had been completed (Ref. 44).

As noted above, the NRC onsite review/audit was conducted from October 6, 1980 to October 10, 1980, approximately a month before publication of NUREG-0737 (Ref. 6). Therefore, the NRC/consultant review team apparently did not have the benefit of knowing the aspects of a control room that NUREG-0737 specified should be "emphasized" in the review/audit. Consequently, the NRC/consultant review team used a draft of the NUREG-0700 guidelines to organize its review/audit report (Ref. 23).

Nevertheless, to assess the completeness of the NRC's review, the evaluation team compared the human factors engineering concerns raised in the review/audit report and in the SER (Ref. 9) with the nine areas of emphasis for onsite control room review/audits listed in NUREG-0737. Six of the nine

areas of emphasis were found to have been addressed. The evaluation team could not verify whether the following three of the nine areas of emphasis had been reviewed:

- (5) The use of direct rather than derived signals for the presentation of process and safety information to the operator;
- (6) The operability of the plant from the control room with multiple failures of nonsafety-grade and nonseismic systems;
- (9) The physical location of the shift supervisor's office either adjacent to or within the control room complex.

With respect to item (9), although the NRC's review/audit report did not specifically address the shift supervisor's office, the onsite team almost certainly observed its location. In any event, the shift supervisor's office location is covered by Guideline 6.1.1.6 of NUREG-0700 and Appendix A of TVA's generic program plan. Therefore, this item is to be addressed in the DCRDR and in the NRC's review of the summary report.

Similarly, the use of direct rather than derived signals, item (5), should be verified during the function and task analysis phase of the DCRDR.

Multiple failure analysis, item (6), is not part of the DCRDR program specified in Supplement 1 to NUREG-0737. A thorough assessment of the operability of the plant from the control room with multiple failures of nonsafety-grade and nonseismic systems would require a major systems engineering effort. Such a study is not a human factors engineering consideration as the evaluation team understands it. Bearing in mind that the onsite review/audit called for in NUREG-0737, item I.D.1, is a preliminary evaluation, and that the nine items listed are aspects of the control room to be "emphasized" in the review/audit, item (6) should not be interpreted to imply such a detailed study.

At the time of the NRC's site visit, the control room at Watts Bar was considered to be a couple of months away from completion. Many of the systems and subsystems were either not yet operational or not completely installed, thus limiting the NRC audit team's capability to assess the full human-machine interface (Ref. 23).

At the time the employee concern was expressed, none of TVA's nuclear plants had completed their DCRDRs. The DCRDR for SQN was completed in November 1986, and the DCRDR for WBN was completed on October 2, 1987. Thus, the preliminary assessments of the control room for both SQN and WBN and NRC's evaluation of the preliminary assessments, including onsite review/audits, were not intended to constitute the final review of human factors engineering at these plants.

Regardless of the adequacy of the NRC's October 1980 onsite control room review/audit and evaluation of the WBN preliminary design assessment, the NRC's evaluation of the WBN DCRDR Summary Report, including a preimplementation audit, if any, will provide reasonable assurance that "the operator-machine interfaces of the control room and remote shutdown areas are adequate to support safe operation of the plant" (Ref. 7).

4.3.2 Implications of NRC's Review at WBN to SQN Licensing (WBN)

Employee Concern IN-85-102-002 implies that, had the NRC conducted a more thorough review of TVA's preliminary assessment of the Watts Bar control room design (which could have identified concerns similar to the HECs identified by TVA in the later DCRDR for WBN), the NRC would have been placed in an embarrassing situation having previously authorized operating licenses to Sequoyah units 1 and 2 (which have control rooms basically identical to Watts Bar's) in September 1980 and September 1981, respectively.

The NRC's onsite control room review/audit was never intended to constitute its final review of human factors engineering at WBN. Regardless of the thoroughness of the NRC's onsite control room review, the NRC will review the WBN DCRDR Summary Report and document this review in a supplement to the Watts Bar SER. Further, the prior licensing of Sequoyah is irrelevant. Generic Letter 82-33 requires that all (i.e., both operating plants and plants under construction) nuclear power plant control rooms undergo a DCRDR. As noted elsewhere, the Sequoyah DCRDR program was conducted subsequent to the expression of EC IN-85-102-002, having been completed in November 1986 with the NRC's evaluation issued in August 1987.

4.3.3 Reevaluation of NRC's Onsite Control Room Review (WBN)

The last part of IN-85-102-002 concludes that the NRC will not, as of early 1985, reevaluate its original Watts Bar control room review and revise its SER in which it approved the control room design fully aware of TVA's subsequent findings.

The NRC is on record (WBN SER 18.2) that it will conduct confirmatory audits to verify that actions have been implemented to correct control room deficiencies noted in the Safety Evaluation Report. Results will be reported in a supplement to the SER prior to the issuance of an operating license. Similarly, the NRC is also committed (Ref. 26) to document the results of its evaluation of TVA's DCRDR, including a new onsite (preimplementation) audit (Ref. 38) in an SER or SER supplement. The NRC has made completion of the DCRDR and submittal of a summary report a condition of TVA's receiving an operating license for WBN. Therefore, human engineering discrepancies identified after the NRC's October 1980 onsite review/audit will be subjected to NRC scrutiny.

4.4 Tabulation of Findings

A summary of the classified findings is provided in Table 1. Class A and B findings indicate that there is no problem and that corrective action is not required. Class C, D, and E findings require corrective action. The finding/corrective action class, defined in the Glossary Supplement, is identified in the table by a letter (for finding) combined with a numeral (for corrective action). For example, the designation C6 in Table 1 indicates that the evaluated issue was found to be valid and that a corrective action involving evaluation was initiated before ECTG evaluation.

The summary of findings by classification is given in Table 2. Of the 25 findings identified by a classification in Table 1, 9 were not valid and required no corrective action. Two corrective actions for 15 valid findings had been initiated before the ECTG evaluation. One finding will require corrective action as a result of the investigation.

5. CORRECTIVE ACTIONS

Table 2 identifies 16 findings that require corrective action. Since some of the corrective actions apply to more than a single plant, only three different types of corrective actions are required to address the 16 negative findings. The detailed corrective actions are described in Attachment B. A condensation of this information by element, with the applicable plant identified in parentheses, follows:

- o 208.1, Human Factors Review Program, NUREG-0700
 - Complete the in-progress detailed control room design reviews (WBN and BLN). SQN and BFN DCRDRs have been completed. According to the corrective action plan, the WBN DCRDR was to have been completed by August 1, 1987; however, this target date has changed. The WBN DCRDR Summary Report was submitted on October 2, 1987. BLN's DCRDR is scheduled to be completed approximately one year before the anticipated fuel load date.
 - Correct human engineering discrepancies identified in the detailed control room design review (all TVA nuclear plants).
 - Place review of 19 HECs onto the computerized Tracking and Reporting of Open Items (TROI) system list (BLN).
- o 208.2, Control Room Design
 - There are no corrective actions for this element.

To avoid making false statements to the NRC in the future, TVA has implemented a Corporate Commitment Tracking System (CCTS) as committed in the Corporate Nuclear Performance Plan. This computerized database now tracks all TVA commitments to the NRC. In addition, the DCRDR team will verify completion of modifications required by Appendix D of the June 1982 Safety Evaluation Report (SER). This corrective action is not listed separately in Table 3 because it is addressed in Finding "a" of element 201.5 in Subcategory Report 24500.

The corrective actions above also appear on Table 3, along with their corresponding finding/corrective action classifications. The table indicates the plant or plants to which a corrective action is applicable by the Corrective Action Tracking Document (CATD) column where the applicable plant is identified by the CATD number. If a CATD was not issued, the applicable plant is listed in parentheses. A CATD was not issued for correcting human engineering discrepancies (HEDs) because the schedules for this corrective action will be negotiated with the NRC. TVA's Corporate Commitment Tracking System, audited by TVA Quality Assurance and the NRC, will ensure completion of the HED correction effort. The table shows that one corrective action is applicable to all plants, one is applicable to WBN and BLN, and one is applicable to BLN. With respect to corrective actions, Table 3 shows that, of the two elements in this subcategory, one required no corrective action (208.2). In all cases, the evaluation team found the corrective action plans (CAPs) to be acceptable to resolve the findings.

6. CAUSES

Table 3 also identifies one or more causes for each problem requiring corrective action. For each corrective action, the most important cause is identified; however, in one instance it was felt that the problem was the result of two causes, each of which should be identified.

For the two corrective action descriptions listed in Table 3, four causes have been identified. They are shown in the table and totaled at the bottom. The four causes are: "Untimely Resolution of Issues," "Inadequate Design Bases," "Failure to Document Engineering Judgments," and "Engineering Error."

"Untimely Resolution of Issues" was chosen because, although the completion of the DCRDRs at WBN and BLN has not impeded licensing, the reviews could reasonably have been completed earlier. "Inadequate Design Bases," was selected because, during the initial design stage, TVA lacked bases for evaluating human factors in the design of main control rooms and remote shutdown stations. "Failure to Document Engineering Judgments" was selected because, in suspending DCRDR activity at Bellefonte, TVA failed to document work in progress in a fashion that would ensure that such work would be

completed upon resumption of the DCRDR program. "Engineering Error" was selected because human factors errors or oversights were made in the initial control panel or workstation design process. "Standards Not Followed" was not selected because, at the time of initial design, guidelines for assessing human factors for the control room were not available.

Using the three larger groups of causes identified by the headings in Table 3, the totals show that one cause is in the management effectiveness category, two are in the design process effectiveness category, and one is in the technical adequacy category.

7. COLLECTIVE SIGNIFICANCE

As shown in Table 3, two causes were identified related to correction of the HEDs identified in the DCRDR. It is judged from the number of HEDs and their safety significance that TVA lacked an effective design process in the area of control room human factors. By its very nature as a summary of causes, the table does not place the subject of this report in the context of the more general subject of human factors, as applied to the nuclear industry.

As an engineering science, human factors was first applied to control room design by the U.S. space program in the middle 1960s. Attempts to apply these practices in the nuclear industry were limited, however, by a continuing evolution of design criteria (e.g., redundancy, separation); a reluctance to use state-of-the-art and therefore untried techniques (computer-based controls/displays, miniaturized control elements, etc.); and an expansion of required safety systems, each demanding limited control/display space set by the dimensions of the physical plant early in the design phase. Further, this application of space program human factors technology to nuclear power plant control room designs was, in some cases, inappropriate. The net effect of these factors did not become evident until the assessment of the Three Mile Island accident. Following that assessment, a program of design reviews was initiated to correct, as much as possible, the accumulated impact of those outside factors on the final as-built control rooms existing today.

With these thoughts in mind, it is improper to draw any more general negative findings or establish any broader concerns as to TVA's overall effectiveness in this area. The latter-day application of human factors technology to nuclear power control room design is an industrywide problem and not indigenous solely to TVA.

The evaluation team's judgment as to the significance of the corrective actions is shown in the last three columns of Table 3. The term "significance" as used here is rated in accordance with the type or types of

changes that may be expected to result from the corrective action. As can be seen from the significance columns, only one of the three corrective actions for this subcategory is judged to be "significant." Correction of human engineering discrepancies is a "significant corrective action" because it could result in changes that will affect the overall performance of the safety-related instrumentation and control systems in the control room. Documentation or control room hardware modifications are labeled as potential in Table 3 because modifications have not been finalized yet.

Completion of the in-progress DCRDRs merely constitutes a licensee's action in response to a regulatory requirement (NUREG-0737). This corrective action itself is not judged to be significant because, in general, control room modifications will occur after the NRC reviews the DCRDR summary report. Adding a DCRDR task to the TROI system is also not judged to be significant because this action does not directly result in physical changes to any safety-related component.

The human engineering discrepancies found in all TVA control rooms would have been identified without this ECTG evaluation because the DCRDR is required by Supplement 1 to NUREG-0737.

TVA has engineering procedures in place to implement human factors engineering practices in future control room design changes. The procedures ensure that the principles of human factors engineering are applied at the earliest stages of planning. Therefore, a comprehensive human factors review of the entire control room should not be needed in the future.

The quantity and diversity of human engineering discrepancies identified so far at all TVA control rooms suggest that human factors represents an area of needed improvement to meet today's standards. This situation is not uncommon to other nuclear plants, considering the circumstances under which human factors engineering was applied to nuclear power plant control rooms following TMI. Much work is yet to be performed at TVA's four nuclear plants to correct what are perceived as human engineering discrepancies by modern standards. Upon completion of the DCRDR summary reports, the NRC will evaluate TVA's proposed control room modifications and proposed implementation schedules. These evaluations will be documented in a Safety Evaluation Report (SER). According to Section 18.1 of the NRC's Standard Review Plan:

"the SER will state whether the NRC staff concludes that the proposed modifications to the licensee's/applicant's control room equipment and operations as a result of the DCRDR will accomplish the basic requirements established by the Commission. Any additional corrections or schedule modifications necessary to comply with the basic requirements established by the Commission will be documented in the SER."

The NRC staff will then confirm whether sufficient information has been provided to conclude:

"that the applicant/licensee meets the relevant requirements of Supplement 1 to NUREG-0737 for conducting a detailed control room design review and finds evidence to indicate that the operator-machine interfaces of the control room and remote shutdown areas are adequate to support safe operation of the plant."

To assess the collective impact of the human engineering discrepancies on plant safety would require an extensive systems analysis. This was not done as it is not part of the detailed control room design review specified in NUREG-0737. However, with the prioritized implementation of control room modifications on a schedule approved by the NRC, TVA's control rooms will be brought into acceptable compliance with NRC human factors guidelines to support safe operation.

A review of the Corporate Nuclear Performance Plan by the evaluation team reveals no commitments specifically related to the subject matter in this report.

The findings, causes, and significance of corrective actions were considered collectively for both elements in this subcategory to determine whether new insights from the element evaluations could be established. Most of the findings/corrective actions for individual issues were similar for all applicable plants. As such, no additional insights over those apparent in the element evaluations were gained.

The results of this subcategory evaluation are being combined with the other subcategory evaluations and reassessed in the Engineering category evaluation.

TABLE 1
CLASSIFICATION OF FINDINGS AND CORRECTIVE ACTIONS

Element	Issue/ Finding**	Finding/Corrective Action Class*			
		SN	WBN	BFN	BLN
208.1 Human Factors Review	a	A	A	A	A
	b	C6	C6	C6	C6
	c	C6	C6	C6	C6
	d	C6	C6	C6	C6
	e	A	C6	A	C6
	f	-	C6	-	D3
	g	-	***	-	-
208.2 Control Room Design	a	-	A	-	-
	b	-	A	-	-
	c	-	A	-	-

*Classification of Findings and Corrective Actions

- | | |
|--|------------------|
| A. Issue not valid.
No corrective action required. | 1. Hardware |
| B. Issue valid but consequences acceptable.
No corrective action required. | 2. Procedure |
| C. Issue valid. Corrective action
initiated before ECTG evaluation. | 3. Documentation |
| D. Issue valid. Corrective action
taken as a result of ECTG evaluation. | 4. Training |
| E. Peripheral issue uncovered during ECTG
evaluation. Corrective action required. | 5. Analysis |
| | 6. Evaluation |
| | 7. Other |

**Defined in Attachment B.

*** The finding/corrective action classification is not included here because the corrective action is addressed in element 201.5, Issue "a" (see Subcategory Report 24500, Attachment B).

TABLE 2
FINDINGS SUMMARY

<u>Classification of Findings</u>	<u>Plant</u>				<u>Total</u>
	<u>SQN</u>	<u>WBN</u>	<u>BFN</u>	<u>BLN</u>	
A. Issue not valid. No corrective action required.	2	4	2	1	9
B. Issue valid but consequences acceptable. No corrective action required.	0	0	0	0	0
C. Issue valid. Corrective action initiated before ECTG evaluation.	3	5	3	4	15
D. Issue valid. Corrective action taken as a result of ECTG evaluation.	0	0	0	1	1
E. Peripheral issue uncovered during ECTG evaluation. Corrective action required.	0	0	0	0	0
Total	5	9	5	6	25

GLOSSARY SUPPLEMENT
FOR THE ENGINEERING CATEGORY

Causes of Negative Findings - the causes for findings that require corrective action are categorized as follows:

1. Fragmented organization - Lines of authority, responsibility, and accountability were not clearly defined.
2. Inadequate quality (Q) training - Personnel were not fully trained in the procedures established for design process control and in the maintenance of design documents, including audits.
3. Inadequate procedures - Design and modification control methods and procedures were deficient in establishing requirements and did not ensure an effective design control program in some areas.
4. Procedures not followed - Existing procedures controlling the design process were not fully adhered to.
5. Inadequate communications - Communication, coordination, and cooperation were not fully effective in supplying needed information within plants, between plants and organizations (e.g., Engineering, Construction, Licensing, and Operations), and between interorganizational disciplines and departments.
6. Untimely resolution of issues - Problems were not resolved in a timely manner, and their resolution was not aggressively pursued.
7. Lack of management attention - There was a lack of management attention in ensuring that programs required for an effective design process were established and implemented.
8. Inadequate design bases - Design bases were lacking, vague, or incomplete for design execution and verification and for design change evaluation.
9. Inadequate calculations - Design calculations were incomplete, used incorrect input or assumptions, or otherwise failed to fully demonstrate compliance with design requirements or support design output documents.
10. Inadequate as-built reconciliation - Reconciliation of design and licensing documents with plant as-built condition was lacking or incomplete.

11. Lack of design detail - Detail in design output documents was insufficient to ensure compliance with design requirements.
12. Failure to document engineering judgments - Documentation justifying engineering judgments used in the design process was lacking or incomplete.
13. Design criteria/commitments not met - Design criteria or licensing commitments were not met.
14. Insufficient verification documentation - Documentation (Q) was insufficient to audit the adequacy of design and installation.
15. Standards not followed - Code or industry standards and practices were not complied with.
16. Engineering error - There were errors or oversights in the assumptions, methodology, or judgments used in the design process.
17. Vendor error - Vendor design or supplied items were deficient for the intended purpose.

Classification of Corrective Actions - corrective actions are classified as belonging to one or more of the following groups:

1. Hardware - physical plant changes
2. Procedure - changed or generated a procedure
3. Documentation - affected QA records
4. Training - required personnel education
5. Analysis - required design calculations, etc., to resolve
6. Evaluation - initial corrective action plan indicated a need to evaluate the issue before a definitive plan could be established. Therefore, all hardware, procedure, etc., changes are not yet known
7. Other - items not listed above

Peripheral Finding (Issue) - A negative finding that does not result directly from an employee concern but that was uncovered during the process of evaluating an employee concern. By definition, peripheral findings (issues) require corrective action.

Significance of Corrective Actions - The evaluation team's judgment as to the significance of the corrective actions listed in Table 3 is indicated in the last three columns of the table. Significance is rated in accordance with the type or types of changes that may be expected to result from the corrective action. Changes are categorized as:

- o Documentation change (D) - This is a change to any design input or output document (e.g., drawing, specification, calculation, or procedure) that does not result in a significant reduction in design margin.
- o Change in design margin (M) - This is a change in design interpretation (minimum requirement versus actual capability) that results in a significant (outside normal limits of expected accuracy) change in the design margin. All designs include margins to allow for error and unforeseeable events. Changes in design margins are a normal and acceptable part of the design and construction process as long as the final design margins satisfy regulatory requirements and applicable codes and standards.
- o Change of hardware (H) - This is a physical change to an existing plant structure or component that results from a change in the design basis, or that is required to correct an initially inadequate design or design error.

If the change resulting from the corrective action is judged to be significant, either an "A" for actual or "P" for potential is entered into the appropriate column of Table 3. Actual is distinguished from potential because corrective actions are not complete and, consequently, the scope of required changes may not be known. Corrective actions are judged to be significant if the resultant changes affect the overall quality, performance, or margin of a safety-related structure, system, or component.

ATTACHMENT C

REFERENCES

Regulatory Documents

1. 10 CFR 50, Appendix A: Code of Federal Regulations, Title 10, Part 50, Appendix A, General Design Criteria
2. Generic Letter 82-33, Requirements for Emergency Response Capability, NRC, (12/17/82)
3. NUREG-0660, NRC Action Plan Developed as a Result of the TMI-2 Accident, NRC, (05/30)
4. NUREG-0700, Guidelines for Control Room Design Reviews, NRC, (11/81)
5. NUREG-0737, Supplement 1, Requirements for Emergency Response Capability, NRC, (01/83) (Enclosure to Generic Letter 82-33)
6. NUREG-0737, Section I.D.1, Clarification of TMI Action Plan Requirements, Control Room Design Reviews, NRC, (11/80)
7. NUREG-0800, Standard Review Plan, Chapter 18, Human Factors Engineering, NRC (Section 18.1, Appendix A incorporates draft NUREG-0801)
8. NUREG-0801 (Draft), Evaluation Criteria for Detailed Control Room Design Reviews, NRC, (10/81)
9. NUREG-0847, Safety Evaluation Report (SER) Related to the Operation of Watts Bar Nuclear Plant, Units 1 and 2, NRC, (06/82)

TVA Documents

10. AI-4.8, Controlled Documents, Watts Bar Nuclear Plant Administrative Instruction, Rev. 9, (09/12/86)
11. EEB-EP-22.32, Human Factors Engineering - Design Review, Engineering Procedure, Electrical Engineering Branch, [B05 861222 534], (12/17/86)
12. EN DES-E18.1.11, Human Factors Engineering in Design of Operator Work Stations, Design Guide, Rev. 0, (05/11/82)
13. EN DES-E18.1.12, Human Factors Engineering in Control Console, Cabinet, and Panel Layout, Rev. 0, (04/30/82)

14. EN DES-E18.1.13, Human Factors Engineering in Alarm Systems, Rev. 0, (07/16/82)
15. EN DES-E18.1.14, Human Factors Engineering in Controls and Visual Displays, Rev. 0, (04/30/82)
16. EN DES-E18.1.15, Human Factors Engineering in Operator/Computer Interface and Dialog, Rev. 0, (05/19/82)
17. NEP-6.1 (was OEP-11), Change Control, Nuclear Engineering Procedure, Division of Nuclear Engineering, Rev. 0, (07/01/86)
18. OE-SEP 82-17, Control Room Design Reviews for All TVA Nuclear Plants, Special Engineering Procedure, TVA Office of Engineering, Rev. 2, (08/20/85) [Originally issued as SEP 82-17, Rev. 0 (04/12/83)]
19. SP SQA-179, Conduct of the Detailed Control Room Design Review and Other Major Human Factor Reviews at Sequoyah Nuclear Plant, Sequoyah Nuclear Plant Standard Practice, TVA, Rev. 1, (05/21/86)
20. TROI, Tracking and Reporting of Open Items, pp. 33-34, (05/15/87)
21. WB 6.3.14, Conduct of the Detailed Control Room Design Review and Other Major Human Factor Reviews at Watts Bar Nuclear Plant, WBN Standard Practice, Rev. 1, (05/05/86)

TVA External Correspondence

22. Letter to Schwencer (NRC) from Mills (TVA), Re: Results of Preliminary Design Review of WBN's Control Room, (01/13/81)
23. Letter to Parris (TVA) from Tedesco (NRC), Control Room Design Review/Audit Report for Watts Bar Nuclear Plant, Unit 1, (05/27/81)
24. BWR Owners' Group Control Room Improvements Committee, Human Factors Design Review of the Browns Ferry 1, 2, 3 Control Rooms - Summary Report, [82 022 6A0243], (02/11/82)
25. Letter to E. Adensam (NRC) from D. S. Kammer (TVA), Re: Submittal of TVA's Generic Control Room Design Review Program Plan for Sequoyah, Watts Bar, Bellefonte, and Browns Ferry, [A27 830609 001], (06/09/83)
26. Letter to H. G. Parris (TVA) from T. M. Novak (NRC), Re: Comments on TVA Program Plan for Control Room Design Reviews, [A02 831229 001], (12/23/83)

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27. Letter to H. G. Parris (TVA) from T. M. Novak (NRC), Re: Request for Meeting to Discuss the Qualifications, Structure and Management of the DCRDR Review Team, [A02 841126 003], (11/19/84)
28. Letter to TVA from Kenyon (NRC), Summary of Meeting to Discuss the Detailed Control Room Design Reviews for TVA's Nuclear Facilities, [L44 850108 382], (12/27/84)
29. Letter to H. G. Parris (TVA) from T. M. Novak (NRC), Draft License and Final Draft Technical Specifications for the Watts Bar Nuclear Plant, Unit 1, [L44 850610 537], (05/20/85)
30. Letter to H. G. Parris (TVA) from Grace (NRC), Notice of Violation and Proposed Imposition of Civil Penalty (NRC Inspection Reports 50-390/84-35, 84-77, and 85-38, and Investigation Report 2-84-010, [B45 850910 826], (08/29/85)
31. Letter to TVA from NRC, Concerns Regarding TVA Nuclear Program, [A02 860224 020], (02/18/86)
32. Memo to J. R. Walker (TVA), Essex Control #00798/7/86 from H. P. Van Cott (Essex Corp.), Review of Sequoyah Nuclear Plant (SNP) Control Room Design Review Documentation, (03/28/86; revised 04/09/86)
33. Letter to S. A. White (TVA) from B. J. Youngblood (NRC), Re: Transcript of the Investigation Interview Conducted by the NRC on 02/21/86 at the First Tennessee Bank Building in Knoxville, TN, [B45 860714 832], (06/23/86)
34. Letter to W. S. Raughley (TVA), Essex Control #00798/47/86 from H. D. Van Cott (Essex Corp.), (11/13/86)
35. Letter to Youngblood (NRC) from R. Gridley (TVA), Re: Submittal of Sequoyah DCRDR Summary Report, [L44 861126 809], (11/26/86)
36. Letter to D. Muller (NRC) from J. Domer (TVA), Re: Submittal of the Browns Ferry Nuclear Plant Detailed Control Room Design Review Summary Report, [L44 861280 803], (12/30/86)
37. Letter to J. Ebnetter (NRC) from J. Domer (TVA), Watts Bar Nuclear Plant (WBN) - Schedule for Submittal of Detailed Control Room Design Review (DCRDR) Summary Report, [L44 870325 805], (03/25/87)
38. Letter to NRC from R. Gridley (TVA), Watts Bar Nuclear Plant (WBN) - Schedule for Submittal of Detailed Control Room Design Review (DCRDR) Summary Report, [L44 870731 806], (07/31/87)

39. Letter to S. White (TVA) from J. Zwolinski (NRC), Safety Evaluation for the Detailed Control Room Design Review (DCRDR) (TAC 51203, 51204), [A02 870902 012], (08/27/87)

TVA Internal Correspondence

40. Report to Project Manager, Bellefonte Design Project, Bellefonte CRDR Team, Bellefonte Nuclear Plant Control Room Design Review Human Engineering Discrepancy Action Plan, [no RIMS number], (08/15/83)
41. Memo to Electrical Engineering Files from Baumgartel, Sequoyah, Watts Bar, and Browns Ferry Nuclear Plants - Control Room Design Review (CRDR) - Core Review Team Training - Human Factors Training Course, [EEB 830912 928], (09/09/83)
42. Memo to EE Files - Meeting with NRC, from M. C. Brickey, Main Control Room Design Review - All Nuclear Plants, [EEB 840626 927], (06/22/84)
43. Memo to J. A. Raulston from F. W. Chandler, Watts Bar Nuclear Plant - Control Room Design Review (CRDR), [B43 850304 902], (02/27/85)
44. Memo to EE Files from J. A. Martin and J. R. Maner, Watts Bar Nuclear Plant - Control Room Design Review (CRDR) - Review for Closure of SER Appendix D Items and Other Human Factors Efforts, [B43 850312 925], (03/12/85)
45. Memo to Nuclear Engineering Branch Files from E. J. Sheehy, All Nuclear Plants - Unresolved Comments on Program Plan for Plants (Special Engineering Procedure SEP 82-17), [B45 850802 256], (08/02/85)
46. Memo to Electrical Engineering Files from Edwards, SQN - Control Room Design Review (CRDR) - Status Meeting (Telephone Conference), [B43 850920 938], (09/12/85)
47. Memo to J. A. Raulston from F. W. Chandler, All Nuclear Plants - NEB Employee Concern on the Program Plan for Control Room Design Review (CRDR) of TVA's Nuclear Plants, [B43 850919 903], (09/13/85)
48. Memo to J. W. Hutton from C. F. Dilworth, Control Room Design Review (CRDR) - All Nuclear Plants, [B43 851010 923], (10/09/85)
49. Memo to CRDR Files from Martin, SQNP - Status of CRDR, [no RIMS number], (04/25/86)

50. Memo to H. P. Pomrehn, BFN Site Director, from J. P. Stapleton, Re: Forwarding the Browns Ferry Nuclear Plant Control Room Design Review Action Plan, Including Volume 1 of CRDR Action Plan, [B43 860723 904], (07/21/86)
51. Memo to H. P. Pomrehn, BFN Site Director, from T. G. Chapman, Re: CRDR Team Action Plan Supplement, [B22 570109 099], (12/29/86)

Evaluation Team Correspondence

52. IOM 189, TVA Concern 208, Human Factors Issues, Bechtel Memo to W. E. Purcell from D. L. Damon, (06/17/86)
53. IOM/TCon 770, Telecon to D. Bradley (TVA) from T. R. McDonnell (Bechtel), (03/18/87)
54. TTB 140, List of 35 Emergency Operating Procedures for SQN, Item 3 (10/28/86)
55. Telecon to P. B. Nesbitt/J. A. Martin (TVA) from W. E. Purcell (Bechtel), (10/14 and 10/15/86)
56. IOM/TCon 1921, Telecon to S. Pannell (TVA) from T. McDonnell (Bechtel), (10/06/87)

Other Documents

57. Letter to D. Vassallo (NRC) from J. Pilant (Nebraska PPD), Re: Submittal of Cooper Nuclear Station Detailed Control Room Design Review (DCRDR) Summary Report, (02/04/85)
58. Letter to J. Pilant (Nebraska PPD) from NRC, Re: Cooper Nuclear Station Detailed Control Room Design Review (DCRDR) - Evaluation of Summary Report, (09/05/85)
59. TCAB-289, Employee Concern Evaluation Program - Watts Bar Nuclear Plant - Corrective Action Plan (CAP), Line CAP for Fact Sheet 208.1; CATD 20801-WBN-01, G. R. McNutt (TVA), 03/13/87)
60. OP 30500, TVA Employee Concerns Special Program, Subcategory: Accessibility, C. W. Touchstone, Rev. 1, (08/12/87)
61. Subcategory Report 24500, Incorporation of Requirements, Commitments, and Experience in Design, Bechtel, Rev. 2, (08/21/87)

ATTACHMENT A

EMPLOYEE CONCERNS
FOR SUBCATEGORY 20800

Attachment A -- lists, by element, each employee concern evaluated in the subcategory. The concern's confidential number is given along with notation of any other element or category with which the concern is shared; the plant sites to which it could be applicable are noted; the concern is quoted as received by TVA and characterized as safety related, not safety related, or safety significant.

ATTACHMENT A

EMPLOYEE CONCERNS FOR SUBCATEGORY 20800

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ELEMENT	CONCERN NUMBER	PLANT LOCATION	APPLICABILITY				CONCERN DESCRIPTION *
			SQN	WBN	BFN	BLN	
208.1	OE-QMS-3	WBN	X	X	X	X	"The program plan for control room design review is not adequate to assure identification and resolution of all human engineering concerns that could significantly affect safe shutdown of TVA's nuclear plants." (SR)
	WI-85-100-007	WBN	X	X	X	X	"Human Factors Engineering and/or reviews have not been implemented for control panels and stations. CI expressed that this is a violation of NUREG-0700. CI further stated that there are too many poor engineering practices in this area. CI has no further information. Anonymous concern via letter." (SR)
	XX-85-122-020	SQN	X	X	X	X	"Sequoyah: Human Factors Engineering and/or reviews have not been implemented for control panels and stations. CI expressed that this is a violation of NUREG-0700. CI further stated that there are too many poor engineering practices in this area. CI has no further information. Anonymous concern via letter." (SR)
	XX-85-122-021	BLN	X	X	X	X	"Bellefonte: Human Factors Engineering and/or reviews have not been implemented for control panels and stations. CI expressed that this is a violation of NUREG-0700. CI further stated that there are too many poor engineering practices in this area. CI has no further information. Anonymous concern via letter." (SR)
	XX-85-122-022	BFN	X	X	X	X	"Browns Ferry: Human Factors Engineering and/or reviews have not been implemented for control panels and stations. CI expressed that this is a violation of NUREG-0700. CI further stated that there are too many poor engineering practices in this area. CI has no further information. Anonymous concern via letter." (SR)
	IN-85-102-001	WBN		X			"Control room modifications have not been made. There are 1600 outstanding unanswered concerns. Reference Appendix D to the Safety Evaluation Report. Individual considers this a material false statement." (SR)
	BLN-OMP-EC-011	BLN				X	"CI worried that human engineering concerns (NEC's) might not be properly reviewed due to delayed start up and reduction of manpower at BLN." (SR)

* SR/NO/SS indicates safety related, not safety related, or safety significant per determination criteria in the ECTG Program manual and applied by TVA before evaluations.

ATTACHMENT A

EMPLOYEE CONCERNS FOR SUBCATEGORY 20800

REVISION NUMBER: 3
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ELEMENT	CONCERN NUMBER	PLANT LOCATION	APPLICABILITY				CONCERN DESCRIPTION *
			SYN	WBN	BFN	BLN	
208.2	IN-85-102-002	WBN		X			"The NRC performed an inadequate review of the Watts Bar control room design. The review was politically motivated to specifically not identify all the problems. (Sequoyah had just been licensed prior to the Watts Bar review). Over 1700 concerns have been generated by TVA about control room inadequacies since the NRC approved the control room design. The NRC has, to date, refused to refute their original evaluation. (SR)
208.3			-	-			DELETED

* SR/NO/SS indicates safety related, not safety related, or safety significant per determination criteria in the ECTG Program manual and applied by TVA before evaluations.

ATTACHMENT B

SUMMARY OF ISSUES, FINDINGS, AND
CORRECTIVE ACTIONS FOR
SUBCATEGORY 20800

Attachment B -- contains a summary of the element-level evaluations. Each issue is listed, by element number and plant, opposite its corresponding findings and corrective actions. The reader may trace a concern from Attachment A to an issue in Attachment B by using the element number and applicable plant. The reader may relate a corrective action description in Attachment B to causes and significance in Table 3 by using the CATD number which appears in Attachment B in parentheses at the end of the corrective action description.

ATTACHMENT B
SUMMARY OF ISSUES, FINDINGS, AND CORRECTIVE ACTIONS
FOR SUBCATEGORY 70800

REVISION NUMBER: 3
Page B-2 of 18

Issues

Findings

Corrective Actions

Element 708.1

- Human Factors Review Program NUREG-0700

SQN

SQN

SQN

- a. Control Room design review plan is inadequate to find and resolve all problems affecting safe shutdown.
- b. Human Factors Engineering has not been implemented for control panels or stations.
- c. Human Factors Review has not been implemented for control panels or stations.
- d. There are too many poor engineering practices in Human Factors area.

- a. Standard Practice SQA 179, R1 was reviewed by the evaluation team for adequacy to serve as a program plan for CRDR of the Sequoyah Nuclear Plant. This document describes a program which when implemented properly will be adequate to achieve the objective of identifying and resolving human engineering concerns that could significantly affect the safe shutdown of TVA's nuclear plant.
- b. Human factors engineering resulting from the CRDR has not yet been implemented for the Sequoyah control room. The Summary Report of the SQN CRDR due to NRC in November 1986* is required to contain recommendations for modifications to the control room. The Summary Report is also required to present a schedule for implementing the modifications. TVA has engineering design guides to assist with the engineering of changes that will be required in the control room.
 - * The report has been transmitted to the NRC on 11/26/86
- c. The human factors review of the Sequoyah control room required by NUREG-0737 Supplement 1 was initiated in 1983 and has been completed. The Summary Report of the CRDR was transmitted to the NRC in November 1986 as required by the confirmatory order.
- d. The poor engineering practices in the human factors area are identified in the 1399 human engineering concerns (NECs) identified by the CRDR. The assessment of these NECs resulted in 455 human engineering discrepancies (NEDs) which will require some corrective actions.

- a. No corrective action is required.
- b. The SQN summary report has been completed.
- c. The SQN summary report has been completed.
- d. The control room modifications recommended in the DCRDR summary report will resolve past poor engineering practices in the human factors area.

ATTACHMENT B
SUMMARY OF ISSUES, FINDINGS, AND CORRECTIVE ACTIONS
FOR SUBCATEGORY 20800

REVISION NUMBER: 3
Page B-3 of 18

Issues

Findings

Corrective Actions

Element 208.1 - SQN (Continued)

The application of human factors engineering principles for future TVA engineering design activities is specified and controlled by NEP 6.1. Although EP J.36, which was a procedure specific for human factors engineering, was cancelled in 1985, the EEB has proposed another procedure to replace it. This new procedure will require a human factors review for future changes to the main control room, the auxiliary control room, or local control stations.

e. Possible violation of NUREG-0700.

e. NUREG-0700 provides guidance for licensees when conducting a CRUR. This NUREG does not define a regulation and as such cannot be violated. In fact NUREG-0700 allows alternative approaches as long as deviations are identified and justified. The requirement to conduct a CRUR is contained in NUREG-0737 Supplement 1 (Generic Letter B2-33). TVA has conducted the required CRUR, has complied with the guidance of NUREG-0700, and the program plan has been reviewed and commented on by NRC.

e. No corrective action is required.

MBN

MBN

MBN

a. The control room design review program plan is inadequate to find and resolve all problems affecting safe shutdown.

a. NRC requires that a program plan be submitted by the plant owner upon completion of the planning phase of its detailed control room design review (DCRDR) to describe how the elements of the DCRDR will be accomplished. TVA submitted its Program Plan (identical to TVA generic document OE-SEP B2-17, RO) to the NRC staff, who reviewed and commented on it. OE-SEP B2-17 has been revised in response to the NRC's comments. The TVA Program Plan has the NRC's implied acceptance. The Watts Bar DCRDR Program has progressed through the phase of "finding problems" and is in the phase of "resolving" such problems (see Finding "b"). The NRC will review the results of the DCRDR program, as discussed further in Finding "f." Therefore, the NRC's impending review will constitute final assessment of the adequacy of the Program Plan.

a. No corrective action is required.

ATTACHMENT B
SUMMARY OF ISSUES, FINDINGS, AND CORRECTIVE ACTIONS
FOR SUBCATEGORY 20800

REVISION NUMBER: 3
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Issues

Findings

Corrective Actions

Element 208.1 - WBN (Continued)

b. Human factors review has not been implemented for control panels or stations.

b. The implementation of the human factors review is in progress. The human factors review effort (i.e., the UCRUR) is proceeding in phases, in accordance with the Program Plan, OE-SEP 87-17, which is controlled at the Watts Bar site by Administrative Instruction AI 4.8. A Watts Bar procedure, WB 6.3.14 ("Standard Practice"), provides additional administrative details and responsibilities specific to the Watts Bar UCRUR effort. Currently, some sections of the "Standard Practice" are only briefly outlined or are incomplete. These sections are being augmented as the Watts Bar human factors review program proceeds.

The TVA "Standard Practice" governs in cases of conflict between it and the Program Plan and requires that TVA identify any significant changes from the Program Plan in the UCRUR Summary Report. Such changes are permitted by the NRC, as long as they are described and justified. (NRC requires that a Summary Report be submitted by the plant owner at the completion of the UCRUR to document the results of the review; to outline proposed control room changes, including the proposed schedule for implementation; and to provide a summary justification for any human engineering discrepancies (HEDs) (defined in Finding "d") with safety significance that are to be left uncorrected or partially corrected.)

The fact that the human factors review program conducted under this procedure is not fixed or rigid allows flexible investigation of potential human engineering discrepancies. This approach accommodates new information developed during the course of the review effort and facilitates the identification and correction of such discrepancies.

The Watts Bar human factors review program has progressed through the identification and assessment of HEDs and the preparation of proposed corrective actions. The proposals are being reviewed by plant management.

b. The Corrective Action Plan (CAP) (as submitted in TCAB-289 dated 03/13/87) for CATD 208 01 WBN 01 states:

"The Control Room Design Review (CRDR) process specified by NUREG-0737, and meeting the intent of NUREG-0700 is essentially complete. Corrective actions are being finalized for review and approval. The summary report is currently scheduled for submittal to the Nuclear Regulatory Commission (NRC) by August 1, 1987."

ATTACHMENT B
SUMMARY OF ISSUES, FINDINGS, AND CORRECTIVE ACTIONS
FOR SUBCATEGORY 20000

REVISION NUMBER: 3
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Issues

Findings

Corrective Actions

Element 200.1 - MHN (Continued)

c. Human factors engineering has not been implemented for control panels at stations.

c. Implementation of human factors engineering, interpreted here to refer to actual implementation of corrective actions resulting from the human factors review (see Finding "b") will take place after submission of the UCRIR Summary Report. The Summary Report is required to contain recommendations for modifications to the control room. The Summary Report is also required to present a schedule for implementing the modifications.

c. Same as issue "b."

The Summary Report, required to be submitted to the NRC by a licensing condition, is not completed yet. In general, the NRC prefers that modifications be deferred until it has reviewed the Summary Report, evaluated the proposed corrective actions, and issued its Safety Evaluation Report (SER) Supplement.

Control room modifications arising out of the UCRIR Program will be implemented in accordance with the established TVA engineering change notice process and will reflect consideration of existing TVA engineering design guides.

d. A total of 1,600 outstanding human engineering concerns have not been resolved.

d. "Human engineering concern" (HEC) is a term defined by TVA in OE-SEP 82-17 to refer to any item identified by a UCRIR team member as a potential human engineering discrepancy (HEU). HECs are identified as a result of operator interviews, control room surveys by team members, task analysis (an assessment of the control room design with respect to performance of emergency operating procedures), etc. As a result of the ongoing UCRIR Program, the number of outstanding HECs has grown from 1,600 to approximately 1,850. These HECs have been assessed. Approximately 600 HECs have been disposed of because they are either (1) duplicates of other HECs, (2) not valid, (3) previously corrected, or (4) maintenance items. The remaining HECs (approximately 1,100) have been grouped into 203 categories, referred to by TVA as "human engineering discrepancies" (HEDs).

d. Same as issue "b."

"Human engineering discrepancy" (HED) is defined by TVA as "a characteristic of the existing control room that does not comply with the human engineering criteria used in the control room survey" (OE-SEP 82-17). NRC's definition in NUREG-0700 of HEU is "the term . . . used

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Element 208.1 - MHN (Continued)

to denote a deviation from some benchmark such as a standard or convention of human engineering practice, an operator preference or need, or an instrument/equipment characteristic implicitly or explicitly required for an operator task."

Corrective action plans to resolve approximately three-fourths of the HECs have been proposed and are being reviewed by plant management. No further corrective action is proposed for the remaining HECs; justifications have been prepared and are being reviewed with plant management. Documentation of HEC resolution will be included in the DCRDR Summary Report which will be submitted to NRC. The Summary Report will also contain a schedule for implementing corrective actions, where appropriate.

e. There are too many poor engineering practices in the human factors area.

e. Before the TMI-2 accident in March 1979, there was no systematic, uniform treatment of the human factors engineering aspects of control room design in the nuclear power industry. Although regulatory and industry attention then began to focus on human factors engineering, the application of human engineering concepts to nuclear power plant control room designs was evolving during the period from 1979 to 1982. Thus, prior to issuance of Supplement 1 of NUREG-0737 (Generic Letter 82-33) and the guidance in NUREG-0700, there was no formal regulatory guidance for applying human engineering principles to nuclear power plant control rooms.

e. Same as issue "b." The control room modifications to be recommended in the DCRDR summary report will resolve past poor engineering practices in the human factors area.

Consequently, it would be expected that a coordinated, formal human engineering review of the Watts Bar control room would result in expressions of concern for certain design features. The "poor engineering practices" in the human factors area which may have existed prior to the initiation of TVA's human factors engineering review program are exemplified somewhat by the approximately 1,850 HECs identified by the DCRDR. However, a review of these HECs indicates that many are not related to design but rather to operating procedures and that, of those HECs which are related to design, there is considerable duplication.

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Element 208.1 - WBN (Continued)

TVA's further assessment and grouping of these HECs resulted in 203 HEUs (see Finding "d"). Corrective action plans or justification of no further action for all 203 HEUs have been prepared and are currently being reviewed and approved. As discussed in Finding "d," NRC will review TVA's entire DCRDR Program, including corrective actions or justifications, upon submission of the Summary Report and will document this review in an SER Supplement. The outcome of this process will be the schedule for plant modifications, including those modifications which will have to be completed prior to fuel load.

The application of human factors engineering principles for future TVA engineering design activities is specified and controlled by Engineering Procedure EEB-EP 22.32, "Human Factors Engineering - Design Review" (12/17/86). This procedure requires a human factors review for future changes impacting the human-machine interface, i.e., changes to the main control room, the auxiliary control room, or local control stations. Such changes will be made in accordance with the existing process by which all plant changes are implemented, per DNE Nuclear Engineering Procedure NEP-6.1, "Change Control" (07/01/86). These procedures should assure continued good practices in the human factors area.

- f. Compliance with NUREG-0700 is questioned. f. NUREG-0700 provides guidelines for licensees and applicants in conducting a DCRDR to ensure consideration of human factors in completed nuclear power plant control room designs. The requirement to conduct a DCRDR is contained in NUREG-0737, Supplement 1 (Generic Letter 82-33), to which TVA has committed by letter to the NRC. The purpose of NUREG-0700, then, is to lead utilities to appropriate levels of compliance. TVA's program plan, which describes TVA's approach to following the guidelines of NUREG-0700, has been reviewed by the NRC and has subsequently been revised by TVA in response to NRC's comments. TVA is in the process of conducting the required DCRDR, utilizing the guidance of NUREG-0700 when appropriate. NUREG-0700 allows alternative approaches as long as they are identified and justified. Final compliance will be achieved upon TVA's completion of the DCRDR by submittal of the Summary Report, followed by NRC review and issuance of an SER Supplement.
- f. Same as issue "b." Final compliance with NUREG-0700 will be achieved upon TVA's completion of the DCRDR by submittal of the summary report.

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Element 208.1 - WBN (Continued)

q. There is possibly a material false statement related to Appendix D to the Safety Evaluation Report.

q. The NRC contended that material false statements were made by TVA to the NRC in a series of status reports that inaccurately reported the completion of corrective measures for human engineering deficiencies listed in Appendix D to the SER. NRC Region II issued a Notice of Violation and Proposed Imposition of Civil Penalty for these misstatements. The NRC stated that there was apparently no attempt by TVA to deliberately mislead NRC personnel. The NRC contended that TVA's inaccurate status reports resulted from a breakdown in management controls. In its Notice of Violation, the NRC did not express concern with the conduct of the DCRUR program itself.

TVA admitted the violation and paid the fee. TVA attributed the violation to lack of specificity in commitments, inadequate commitment tracking, and initial lack of responsiveness by TVA to NRC's questions. The matter is treated more fully in Element Report No. 201.5, "Tracking of Commitments and Design Changes."

q. The corrective action is addressed in Subcategory Report 24500, element 201.5 for watts Bar.

(As specified in the Corporate Nuclear Performance Plan, TVA has established a Corporate Commitment Tracking System (CCTS) to track open NRC commitments.

The TVA proposed corrective action plan (CAP) submitted on 03/13/87 by TCAB-274 for CATD 201 05 NPS 02 is to also enter into the CCTS data base commitments resulting from NRC violations where actions taken are completed prior to TVA's response to NRC. These completed NRC violation actions (as stated in the TVA letters to NRC) will be input back to January 1, 1986 (November 1, 1985 for watts Bar) for each plant on the following schedule:

- o Sequoyah Nuclear Plant: prior to startup (currently July, 1987)
- o Browns Ferry Nuclear Plant (BFN): prior to startup
- o Watts Bar Nuclear Plant (WBN): prior to startup
- o Bellefonte Nuclear Plant (BLN): complete

Further, the definition of a commitment to be provided in appropriate upper-tier standard(s) will clarify this matter.

For those commitments that are part of the 06/82 SER, App. D, the DCRUR team will verify their completion.)

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Corrective Actions

Element 208.1 - BFN

BFN

BFN

a. Control room design review program plan is inadequate to find and resolve all problems affecting safe shutdown.

a. NRC requires that a program plan be submitted by the plant owner upon completion of the planning phase of its UCRDR to describe how the elements of the UCRDR will be accomplished. TVA submitted its Program Plan (identical to TVA generic document SEP 82-17, RO) to the NRC staff, which reviewed and commented on it. SEP 82-17 has been revised in response to the NRC's comments. The TVA Program Plan has the NRC's implied acceptance. The Browns Ferry UCRDR Program has progressed through the phase of "finding problems" and is in the phase of "resolving" such problems (see Findings "b" and "c"). NRC requires that a Summary Report be submitted by the plant owner at the completion of the UCRDR to document the results of the review; to outline proposed control room changes, including the proposed schedule for implementation; and to provide a summary justification for any HEDs with safety significance that are to be left uncorrected or partially corrected. TVA submitted the Summary Report of the Browns Ferry UCRDR to the NRC on 12/30/86. The NRC is presently reviewing the results of the UCRDR Program, as discussed further in Finding "e." Therefore, the NRC's review will constitute final assessment of the adequacy of the Program Plan.

a. No corrective action is required.

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Corrective Actions

Element 208.1 - BFN (Continued)

b. Human factors review has not been implemented for control panels or stations.

b. TVA's submittal of the UCRUR Summary Report completes the implementation of the Browns Ferry human factors review. The human factors review effort (i.e., the UCRUR) has proceeded in phases, in accordance with the Program Plan, OE-SEP 82-17.

b. The BFN UCRUR summary report has been completed.

Appendix A, Section 4, to SRP 18.1 (NUREG-0800) requires that any significant changes from the originally submitted Program Plan be identified in the UCRUR Summary Report. Such changes are permitted by the NRC, as long as they are described and justified, as has been done by TVA in the Summary Report.

The Browns Ferry human factors review program has progressed through the identification and assessment of HEUs and the preparation of proposed corrective actions. The proposals have been reviewed by plant management.

c. Human factors engineering has not been implemented for control panels or stations.

c. Implementation of human factors engineering, interpreted here to refer to actual implementation of corrective actions resulting from the human factors review (see Finding "b"), will take place in accordance with the recommendations and schedule contained in the Browns Ferry UCRUR Summary Report. The Summary Report is required to contain recommendations for modifications to the control room. The Summary Report is also required to present a schedule for implementing the modifications and to provide a summary justification for any HEUs with safety significance that are to be left uncorrected or partially corrected. The BFN Summary Report proposes to correct all safety significant (i.e., Category 1 and 2) HEUs.

c. The BFN UCRUR summary report has been completed.

In general, the NRC prefers that modifications be deferred until it has reviewed the Summary Report, evaluated the proposed corrective actions, and issued its SER.

Control room modifications arising out of the UCRUR Program will be implemented in accordance with the established TVA engineering change notice process and will reflect consideration of existing TVA engineering design guides.

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Element 208.1 - BFN (Continued)

In accordance with the UCRDR program plan, the BFN UCRDR team utilized a two-step process in identifying HEDs. First, HEDs are identified as a result of operator interviews, control room surveys by team members, task analysis (an assessment of the control room design with respect to performance of emergency operating instructions), etc. As a result of the UCRDR program, 1,274 HEDs were identified. These HEDs have been assessed and have been grouped into 297 categories, referred to by TVA as "human engineering discrepancies" (HEDs).

During assessment, certain HEDs were determined to be invalid or not part of the UCRDR scope and were assigned to a special category called "non-rated." The remaining HEDs were placed in one of four HED categories.

Proposed corrective actions for TVA Category 1 and 2 HEDs have been prepared, reviewed, and approved by Browns Ferry plant management. (TVA Category 1 and 2 HEDs are considered "safety significant.")

TVA has scheduled Category 1 HED corrective actions for completion by the end of the second refueling outage on a per-unit basis following restart of each unit. Category 2 HEDs are scheduled for completion by the end of the third refueling outage following restart of each unit.

Implementation of Category 3 corrections will be on a case-by-case basis.

Specific corrective actions for Category 4 HEDs were not proposed; however, some Category 4 HEDs will be corrected incidental to the process of implementing corrective actions for Category 1, 2, or 3 HEDs.

d. There are too many poor engineering practices in human factors area.

d. Before the TMI-2 accident in 03/79, there was no systematic, uniform treatment of the human factors engineering aspects of control room design in the nuclear power industry. The application of human engineering concepts to nuclear power plant control room designs

d. The control room modifications recommended in the UCRDR summary report will resolve past poor engineering practices in the human factors area.

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Element 208.1 - BFN (Continued)

evolved during the period from 1979 to 1982. Thus, prior to issuance of Supplement 1 of NUREG-0737 (Generic Letter 82-33) and the guidance in NUREG-0700, there was no formal regulatory guidance for applying human engineering principles to nuclear power plant control rooms.

Consequently, it would be expected that a coordinated, formal human engineering review of the Browns Ferry control room would result in expressions of concern for certain design features. The "poor engineering practices" in the human factors area which may have existed prior to the initiation of TVA's human factors engineering review program are exemplified somewhat by the 1,274 HECs identified by the DCRDR. However, a review of these HECs indicates that many are not related to design but rather to operating procedures and that, of those HECs which are related to design, there is considerable duplication.

TVA's further assessment and grouping of these HECs resulted in 297 HEDs. Corrective action plans for Category 1 and 2 HEDs have been prepared, reviewed, and approved. NRC is reviewing TVA's entire DCRDR Program, including corrective actions, as described in the Summary Report and will document this review in an SER. The outcome of this process will be the final, approved schedule for plant modifications.

The application of human factors engineering principles for future TVA engineering design activities is specified and controlled by Engineering Procedure EEB-EP 22.32, "Human Factors Engineering - Design Review" (12/17/86). This procedure requires a human factors review for future changes impacting the human/machine interface, i.e., changes to the main control room, the auxiliary control room, or local control stations. Such changes will be made in accordance with the existing process by which all plant changes are implemented, per UNE Nuclear Engineering Procedure NEP-6.1, "Change Control" (07/01/86). These procedures should assure continued good practices in the human factors area.

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Element 208.1 - BFN (Continued)

e. Compliance with NUREG-0700 is questioned.

e. NUREG-0700 provides guidelines for licensees and applicants in conducting a UCRUR to ensure consideration of human factors in completed nuclear power plant control room designs. The requirement to conduct a UCRUR is contained in NUREG-0737, Supplement 1 (Generic Letter 82-33), to which TVA has committed by letter to the NRC. The purpose of NUREG-0700, then, is to lead utilities to appropriate levels of compliance. TVA's program plan, which describes TVA's approach to following the guidelines of NUREG-0700, has been reviewed by the NRC and has subsequently been revised by TVA in response to NRC's comments. TVA has conducted the required UCRUR, utilizing the guidance of NUREG-0700 when appropriate. NUREG-0700 allows alternative approaches as long as they are identified and justified. Final compliance will be determined by NRC's review of the UCRUR Summary Report (possibly including an onsite, pre-implementation audit) and issuance of an SER.

e. No corrective action is required.

BLN

BLN

BLN

a. Control room design review program plan is inadequate to find and resolve all problems affecting safe shutdown.

a. NRC requires that a program plan be submitted by the plant owner upon completion of the planning phase of its UCRUR to describe how the elements of the UCRUR will be accomplished. TVA submitted its Program Plan (identical to TVA generic document SEP 82-17, RO) to the NRC staff, which reviewed and commented on it. SEP 82-17 has been revised in response to the NRC's comments. The TVA Program Plan has the NRC's implied acceptance. The NRC requires that a Summary Report be submitted by the plant owner at the completion of the UCRUR to document the results of the review; to outline proposed control room changes, including the proposed schedule for implementation; and to provide a summary justification for any HEUs with safety significance that are to be left uncorrected or partially corrected. TVA plans to complete the Summary Report of the Bellefonte UCRUR by 07/09/92. The NRC will review the results of the UCRUR Program, as discussed further in Finding "e." Therefore, the NRC's review will constitute final assessment of the adequacy of the Program Plan.

a. No corrective action is required.

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Element 208.1 - BLN (Continued)		
b. Human factors review has not been implemented for control panels or stations.	b. TVA's submittal of the UCRDR Summary Report will complete the implementation of the Bellefonte human factors review of the main control room (MCR), auxiliary control room (ACR) and remote boards required to transfer control to the ACR. The human factors review effort (i.e., the UCRDR) has proceeded in phases, in accordance with the Program Plan, OE-SEP 82-17. However, the Bellefonte human factors review program has been suspended because the fuel load date has been postponed.	b. The UCRDR Summary Report is scheduled in TROI, under item BLN-R036, to be finished 07/09/92.
c. Human factors engineering has not been implemented for control panels or stations.	c. Implementation of human factors engineering, interpreted here to refer to actual implementation of corrective actions resulting from the human factors review of the MCR, ACR, and transfer devices (see Finding "b"), will take place in accordance with the recommendations and schedule contained in the Bellefonte UCRDR Summary Report. The Summary Report is required to contain recommendations for modifications to the control room. The Summary Report is also required to present a schedule for implementing the modifications and to provide a summary justification for any HEDs with safety significance that are to be left uncorrected or partially corrected. In general, the NRC prefers that modifications be deferred until it has reviewed the Summary Report, evaluated the proposed corrective actions, and issued its SER. Control room modifications arising out of the UCRDR Program will be implemented in accordance with the established TVA engineering change notice process and will reflect consideration of existing TVA engineering design guides.	c. Same as Issue "b."
d. There are too many poor engineering practices in human factors area.	d. Before the TMI-2 accident in 03/79, there was no systematic, uniform treatment of the human factors engineering aspects of control room design in the nuclear power industry. The application of human engineering concepts to nuclear power plant control room designs evolved during the period from 1979 to 1982. Thus, prior to issuance of Supplement 1 of NUREG-0737 (Generic Letter 82-33) and the guidance in NUREG-0700, there was no formal regulatory guidance for applying human engineering principles to nuclear power plant control rooms.	d. Same as Issue "b." The control room modifications to be recommended in the UCRDR Summary Report will resolve past poor engineering practices in the human factors area.

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Element 208.1 - BLN (Continued)

Consequently, it would be expected that a coordinated, formal human engineering review of the Bellefonte control room would result in expressions of concern for certain design features. The "poor engineering practices" in the human factors area which may have existed prior to the initiation of TVA's human factors engineering review program are exemplified somewhat by the HEDs identified so far by the DCRDR.

NRC will review TVA's entire DCRDR Program, including corrective actions, as described in the Summary Report and will document this review in an SER. The outcome of this process will be the final, approved schedule for plant modifications.

The application of human factors engineering principles for future TVA engineering design activities is specified and controlled by Engineering Procedure EEB-EP 22.32, "Human Factors Engineering - Design Review" (12/17/86). This procedure requires a human factors review for future changes impacting the human/machine interface (i.e., changes to the main control room, the auxiliary control room, or local control stations). Such changes will be made in accordance with the existing process by which all plant changes are implemented, per DNE Nuclear Engineering Procedure NEP-6.1, "Change Control" (07/01/86). These procedures should assure continued good practices in the human factors area.

e. Compliance with NUREG-0700 is questioned.

e. NUREG-0700 provides guidelines for licensees and applicants in conducting a DCRDR to ensure consideration of human factors in completed nuclear power plant control room designs. The requirement to conduct a DCRDR is contained in NUREG-0737, Supplement 1 (Generic Letter 82-33), to which TVA has committed by letter to the NRC. The purpose of NUREG-0700, then, is to lead utilities to appropriate levels of compliance. TVA's program plan, which describes TVA's approach to following the guidelines of NUREG-0700, has been reviewed by the NRC and has subsequently been revised by TVA in response to NRC's comments. Final compliance will be determined by NRC's review of the DCRDR Summary Report (possibly including an onsite, pre-implementation audit) and issuance of an SER.

e. Same as Issue "b." Final compliance with NUREG-0700 will be achieved upon TVA's completion of the DCRDR by submittal of the Summary Report.

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Element 208.1 - BLN (Continued)

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| <p>f. Human engineering concerns (HECs) might not be properly reviewed because of delayed startup and reduction of manpower at BLN.</p> | <p>f. Nineteen HECs were identified during the task analysis portion of the UCRUR. These HECs still need to be assessed when the UCRUR resumes. TROI does not list review of these HECs as a UCRUR item to be completed.</p> | <p>f. The 19 HECs will be input to the Tracking and Reporting of Open Items (TROI) computer as open items to be completed when the detailed control room design review is resumed.</p> |
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Element 208.2 - Control Room Design Review by NRC

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| <p>SQN

(N/A)

WBN</p> <p>a. The NRC review of the Watts Bar control room, as reported in its Safety Evaluation Report (SER), Chapter 18 and Appendix D, June 1982, was inadequate. That inadequacy is attested to by the fact that over 1,700 human engineering concerns have been identified during the first two phases of the TVA Detailed Control Room Design Review (DCRDR) completed on February 1, 1985: (a) review of operating experience, including a personnel survey, and (b) an onsite control room survey.</p> | <p>SQN

(N/A)

WBN</p> <p>a. As documented in the Safety Evaluation Report (SER), the NRC performed an evaluation of TVA's preliminary assessment of the WBN control room design and conducted an onsite review/audit. The purpose of the evaluation was to identify significant human factors and instrumentation problems and to require correction of priority 1 and 2 deficiencies noted (a total of 79) before granting an operating license, because the correction of these items would significantly reduce the potential for operator error. As a condition to the issuance of an operating license, the NRC required that, after licensing, a detailed control room design review (DCRDR) be undertaken by TVA to identify and correct, as necessary, all other human engineering control room design deficiencies. The NRC, as detailed in NUREG-0800 and NUREG-0801, evaluates the UCRUR program in four phases:</p> <ul style="list-style-type: none"> o Evaluation of program plan report o Possible scheduled site visit during the review phase o Evaluation of the UCRUR summary report, including pre-implementation audit o Verification of implemented changes <p>Upon completion of the first two phases of the TVA UCRUR on 02/01/85, over 1,700 human engineering concerns (HECs) had been identified that required further assessment as to possible redesignation as a human engineering discrepancy (HED).</p> | <p>SQN

(N/A)

WBN</p> <p>a. No further corrective action by TVA is required at this time. When the NRC completes its ongoing evaluation of the WBN UCRUR, if new issues are identified they will be addressed at that time.</p> |
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Element 208.2 - WBN (Continued)

- b. Had the NRC conducted a thorough review of the Watts Bar design (which could have identified similar concerns), it would have been placed in an embarrassing situation having previously authorized operating licenses to Sequoyah Units 1 and 2 (which have basically identical control rooms) in September 1980 and September 1981, respectively.
- b. The preliminary assessment for Watts Bar conducted by the NRC, as reported in the SER, was based to a large extent on the 02/80 NRC-sponsored ESSEX review at Sequoyah Unit 1. Significant items requiring immediate attention derived from this review were also applied to Watts Bar, because the control rooms for these two plants are basically identical. However, TVA continued the WBN preliminary control room assessment by conducting design studies, task analyses, and site visits. The site visits included walk-throughs of operating instructions and interviews with operators at the plant and instructors at the simulator. Sequoyah is subject to the same detailed control room design review program as the one at Watts Bar, which is being conducted under a TVA generic program plan monitored by the NRC. The DCRDR efforts at the two sites are independent of each other, however. Thus, the NRC's earlier control room review was never intended to constitute its final review of human factors engineering at WBN.
- b. Same as Issue "a."

In a special SALP report on Watts Bar (dated 03/26/85) for the period from 03/01/84 through 12/31/84, the NRC noted that "appropriate attention was not paid [by TVA] to control room human factors concerns to ensure that all instances of concerns were identified and corrected." These concerns were related to modifications required by Appendix D to the 06/82 SER. As a result of NRC findings at WBN, the NRC expressed concern in 11/84 that a serious deficiency existed in the management and organization of the TVA [generic] control review team. However, TVA views Appendix D modifications as separate from the detailed control room design review.

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Element 208.2 - WBN (Continued)

c. The NRC will not, as of early 1985, reevaluate its original Watts Bar control room review and revise its SER in which it approved the control room design fully aware of TVA's subsequent findings.

c. The NRC is on record (SER 18.2) that it will conduct confirmatory audits to verify that actions have been implemented to correct control room deficiencies noted in the Safety Evaluation Report. Results will be reported in a supplement to the SER prior to the issuance of an operating license. Similarly, the NRC is also committed to document the results of its evaluation of TVA's DCRUR in an SER or SER supplement.

c. Same as Issue "a."

BFN

BFN

BFN

(N/A)

(N/A)

(N/A)

BLN

BLN

BLN

(N/A)

(N/A)

(N/A)