



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

SAFETY EVALUATION REPORT FOR EMPLOYEE CONCERN

TENNESSEE VALLEY AUTHORITY

SEQUOYAH NUCLEAR POWER PLANT, UNITS 1 AND 2

DOCKET NOS. 50-327 AND 50-328

I. SUBJECT

Category: EN Engineering 20800
Subcategory: Human Factors 20801
Element: Human Factors Review Program (NUREG-0700)

II. SUMMARY OF ISSUE

Total Number of Concerns: 5

Employee Concern: WI-85-122-020, XX-85-122-021 and XX-85-122-022, stated that "Sequoyah: Human Factors Engineering and/or reviews have not been implemented for control panels and stations." Employee concern OE-QMS-3 stated that "The Program Plan for Control Room Design Review is not adequate."

Employee concern OE-QMS-3 questioned the adequacy of the Control Room Design Review Program Plan to identify and resolve all human engineering concerns that could significantly affect the safe shutdown of TVA's Sequoyah Nuclear Plant.

A concerned individual (CI) expressed that this is a violation of NUREG-0700. CI further stated that there are too many poor engineering practices in this area.

III. BACKGROUND

The TVA program plan for the CRDR consists of eight main tasks. These are:

- ° Develop the CRDR plan
- ° Perform an operator experience review
- ° Survey the main control room (MCR) and the auxiliary control room (ACR)
- ° Perform test analysis
- ° Assess for priority
- ° Develop recommendations for corrective action
- ° Prepare an action plan
- ° Prepare the Summary Report for NRC.

8803210363 880311
PDR ADCK 05000328
P PDR

The development of the CRDR plan took place during the period from November 1980, when NRC issued the TMI Action Plan (NUREG-0737), until the end of 1984. The final revision to the CRDR plan occurred in August, 1985 at which time NRC comments and the lessons learned from having initiated the program were incorporated.

The actual implementation of the program began August 23, 1983, when a training course on human factors was conducted for the CRDR team members. The review of operator experience was conducted in several steps. Initially the operators completed a basic questionnaire and the results were used to develop an addendum to the questionnaire. This new questionnaire was then given to the operators, who the CRDR team felt could best provide answers.

In addition to using questionnaires, the CRDR team interviewed 17 operators after having first received instruction in effective interview techniques from a consultant human factors specialist.

In order to survey industry experience, the CRDR team reviewed an INPO sort of Licensee Event Reports (LERs), Significant Event Reports (SERs), and INPO Operations and Maintenance Reminders (OMRs) involved either directly or indirectly with control room design. A detailed review was also performed of all Sequoyah LERs and reactor trips to identify any with control room or operator involvement. Finally, the results of the CRDR effort at Watts Bar were also reviewed for applicability to Sequoyah. These above described efforts were completed by March 1986.

Surveys of the MCR and the ACR were initiated in September 1984. The associated tasks of performing a sound survey, a lighting survey, and a survey of the HVAC for the MCR were completed during 1984 and 1985. The MCR/ACR surveys were completed in March 1986.

The CRDR team performed a task analysis for all emergency operating procedures (EOPs) identified for SQN. The EOPs, which had been developed by the EOP team, were analyzed by the CRDR team. The task analysis was completed in April 1986.

In March 1986 the Essex Corporation reviewed the Sequoyah CRDR documentation. Essex reviewed only the documentation related to the operating experience review, the control room surveys, and the task analysis, as the remaining portions of the CRDR were not complete. Based on their review, Essex concluded that the SQN CRDR documentation is responsive to the guidelines of NUREG-0700; adequately describes the Human Engineering Concerns (HECs); and provides a track to data collection methods and NUREG-0700 guidelines. The report summarized the documentation as "... adequate and, when complete, should provide an adequate basis for control room design improvements and for NRC audit." The report also mentioned that Essex would work with the CRDR team to develop additional task analysis information. In addition to reviewing CRDR documentation, Essex has also provided consulting services in essentially all phases of the CRDR since February 1986, including significant participation in the preparation of the Summary Report.

IV. EVALUATION

TVA submitted the Detailed Control Room Design Review (DCRDR) Summary Report for Sequoyah Nuclear Power Plant Units 1 and 2, to NRC on November 26, 1986. A preliminary evaluation of the Summary Report was conducted by SAIC which resulted in the identification of a number of concerns. In order to resolve the concerns and evaluate the Sequoyah DCRDR, a pre-implementation audit was conducted from June 22 to June 25, 1987. During the audit, the NRC staff, accompanied by SAIC and Comex representatives, performed a detailed evaluation of TVA's DCRDR. The evaluation included examination of TVA's DCRDR documentation, discussions with the DCRDR study team, inspection of the existing control room, and inspection of mockups and proposed corrective action modifications. This report reflects the consolidated finding and conclusions of the NRC audit team. The conclusions are provided below, organized by the nine Supplement 1 to NUREG-0737 DCRDR requirements.

1. The establishment of the multidisciplinary review team used for the DCRDR meets the requirement of Supplement 1 to NUREG-0737.
2. The system function and task analysis, which was based on Revision 1 of the Westinghouse Emergency Response Guidelines and supplements, meets the requirements of Supplement 1 to NUREG-0737.
3. The control room inventory meets the requirements of Supplement 1 to NUREG-0737.
4. The control room survey methodology and results meets the requirement of Supplement 1 to NUREG-0737.
5. The methodology for and results of assessment of human engineering discrepancies meet the requirements of Supplement 1 to NUREG-0737.
6. It was the audit team's judgement that TVA has conducted an appropriate program for selection of design improvements. However, in order for TVA to meet the Supplement 1 to NUREG-0737 requirement for selection of design improvements it will be necessary for TVA to submit the confirmatory document described in the DCRDR Safety Evaluation Report.
7. The methodology for verifying that the control room modifications correct the HEDs meets the requirements of Supplement 1 to NUREG-0737.
8. The methodology for verifying that the control room modifications do not introduce new HEDs meets the requirements of Supplement 1 to NUREG-0737.
9. The coordination of the DCRDR with other programs, including upgraded EOPs, SPDS, Reg. Guide 1.97, and training, meets the requirements of Supplement 1 to NUREG-0737.

IV. CONCLUSION

The NRC staff concludes that the licensee's investigation of the concerns was adequate and the resolution of the concerns described in Element Report EN 20801 concerning the Human Factors Review Program, is acceptable. Specifically, the NRC concluded that the Detailed Control Room Design Review Summary Report for Sequoyah Nuclear Power Plant Units 1 and 2 presents an acceptable program for meeting the requirements in Supplement 1 to NUREG-0737.

SEQUOYAH NUCLEAR POWER PLANTS, UNITS 1 & 2
SAFETY EVALUATION REPORT FOR EMPLOYEE CONCERNS
ELEMENT REPORT ENG-209.1(B) - SQN
"Q-LIST DIFFERENCES"

I. Subject

Category: Engineering (20000)
Subcategory: Q-List (20900)
Element: Q-List Differences (20901)
Employee Concerns: IN-85-407-001, IN-85-688-003
IN-86-087-004, IN-86-090-001

The bases for Element Report 209.1(B), Rev. 1, dated January 23, 1987 are the Watts Bar Employee Concerns listed above which state:

- IN-85-407-001 "CSSC Q-List is not accurate. Not all components covered by QA program are listed. QE Department has list that documents the inaccuracies. The CSSC Q-List is used to determine if QC inspections are required. CI has no further information."
- IN-85-688-003 "Concern over validity of Critical System, Structures and Components 'Q' listing. Details known to QTC. Details withheld to maintain CI confidentially."
- IN-86-087-004 "Significant differences exist in the content of the Nuclear Power 'Q' List and the Critical Structures, Systems and Components (CSSC) 'Q' List. Many items originally placed on the NUC Power 'Q' List are not reflected on the CSSC 'Q' List, which could adversely affect establishment of appropriate quality controls on items which are related to plant safety. Nuclear Power concern. No specifics provided. CI has no further information."
- IN-86-090-001 "NUC PWR (No name/dept. given) issued a Critical Structures, Systems and Components List (CSSC) that does not include all items identified on the site 'Q' List (No specifics given). This was done without Office of ENG, ENG Design Group input/approval (The originator of the site 'Q' List). By referring to the CSSC, the possibility exists for installing 'Non-Q' items in a Safety-Related System. CI has no additional information. NUC POWER concern."

These concerns were evaluated by TVA as potentially nuclear safety-related and potentially applicable to Sequoyah (generic).

II. Summary of Issues

The issues defined by TVA are that Q-lists (or equivalent) used on SQN to identify the applicability of QA program controls are not accurate and complete, that various Q-lists (or equivalent) exist for SQN which differ in content, and that the engineering design group does not provide input to the SQN Q-list (or equivalent).

Another issue on these employee concerns is covered in Element Report 209.2(B).

III. TVA Evaluation, Conclusion, and Corrective Action

TVA personnel determined that

- a. The SQN CSSC (Critical Structures, Systems, and Components) list is the "Q-List" type document in use on SQN to identify items that require QA program controls. A complete review of the SQN CSSC List for accuracy and completeness has not been performed to date.

The activities of the SQN CSSC Review Committee are a positive factor towards maintaining the SQN CSSC List as a "living" document. However, the following shortcomings are evident in the Review Committee actions:

- o A TVA review of the SQN CSSC List for accuracy and completeness has not been accomplished to date. Therefore the baseline, to which the CSSC Review Committee is providing updates for plant modifications etc., is of undetermined accuracy and completeness.
 - o The practice of deferring numerous classification actions to a pending Q-List development by the Division of Nuclear Engineering (DNE) contributes to the questionable status of SQN CSSC List's accuracy and completeness.
- b. The investigation indicated that only a single listing, the SQN CSSC List, was used on Sequoyah. The Engineering organization had developed a "trial use" SQN Q-List, but it was not used on the project. Thus, the problems associated with the existence of several Q-Lists having different content were not applicable to Sequoyah.

Further, the TVA commitment to implement the forthcoming DNE-developed and maintained Q-List will adhere to the principle that a single list prescribing QA program applicability will be in existence for SQN. Thus, at some future date, the SQN CSSC List will apparently be superseded by an SQN Q-List.

- c. The SQN CSSC List was initially developed and issued by the Office of Nuclear Power and is presently the responsibility of the SQN Nuclear Site Director, through the Operations organization. The CSSC List is maintained by the SQN CSSC Review Committee. Although the controlling procedure does not require a member from the Division of Nuclear Engineering (DNE) on the committee, the DNE has actively participated in CSSC Review Committee activities on an as-needed

basis. The interface with DNE tempers the employee concern related to the issue of lack of engineering design group input/approval of the CSSC List and indicates a DNE "de facto" involvement with the list.

The TVA evaluation concluded that

- a. The issue relating to the accuracy and completeness of the SQN CSSC List is valid. This conclusion is tempered by the positive factor that the on-going activities of the SQN CSSC Review Committee provide a reasonable assurance that there are not major problems with the SQN CSSC List. However, it is prudent for TVA to perform a confirmatory review of the accuracy and completeness of the SQN CSSC List, to address various TVA internal references (direct or inferred) to the need for such a review. The review should be performed with input from DNE to determine the degree of completeness appropriate for the list, and should include resolution of those agenda items previously deferred by the SQN CSSC Review Committee.
- b. The issue relating to the existence of multiple Q-Lists (or equivalents) with different contents is not valid for SQN.
- c. The issue related to the lack of engineering design group input to the Q-lists (or equivalents) is not valid for SQN.

As regards to corrective action, TVA has developed a corrective action plan which was reviewed by the evaluation team and discussed with the responsible line organization. The discussions clarify the corrective action plan and were documented. The corrective action plan commits that all active items on the SQN CSSC Review Committee agenda will be reviewed to identify any items that require actions prior to restart. This review will include those items that were noted as "deferrals to the development of the Q-List."

IV. Conclusion

The NRC staff believes that the TVA investigation of the concerns was adequate. Also, the resolution of the issues as described in those Element Reports are generally acceptable.

However, a recent NRC review of TVA's status of their review of the SQN CSSC List for accuracy and completeness revealed that TVA may not conduct such a confirmatory review since, they have sufficient confidence in the accuracy and completeness of the list. This confidence is based on the results of inspections and audits by the QA and Engineering organizations and active involvement of the CSSC Review Committee in determining CSSC classification.

The NRC inspection of the SQN-CSSC classification process concluded that while the process for determining CSSC classification is cumbersome and that there are several areas of inconsistencies and errors in the list there were however, no major problems with the overall CSSC Lists and that the listing is in general agreement with regulatory requirements.

SEQUOYAH NUCLEAR POWER PLANTS, UNITS 1 & 2
SAFETY EVALUATION REPORT FOR EMPLOYEE CONCERNS
ELEMENT REPORT ENG-209.2(B) - SQN
"IMPACT AND SIGNIFICANCE OF Q-LIST DIFFERENCES"

I. Subject

Category: Engineering (20000)
Subcategory: Q-List (20900)
Element: Impact and Significance of Q-List Differences (20902)
Employee Concerns: IN-85-407-001, IN-86-087-004, IN-86-090-001

The bases for Element Report 209.1(B), Rev. 1, dated January 23, 1987, are Watts Bar Employee Concerns listed above which state:

- IN-85-407-001 "CSSC Q-List is not accurate. Not all components covered by QA program are listed. QE Department has list that documents the inaccuracies. The CSSC Q-List is used to determine if QC inspections are required. CI has no further information."
- IN-86-087-004 "Significant differences exist in the content of the Nuclear Power 'Q' List and the Critical Structures, Systems and Components (CSSC) 'Q' List. Many items originally placed on the NUC Power 'Q' List are not reflected on the CSSC 'Q' List, which could adversely affect establishment of appropriate quality controls on items which are related to plant safety. Nuclear Power concern. No specifics provided. CI has no further information."
- IN-86-090-001 "NUC PWR (No name/dept. given) issued a Critical Structures, Systems and Components List (CSSC) that does not include all items identified on the site 'Q' List (No specifics given). This was done without Office of ENG, ENG Design Group input/approval (The originator of the site 'Q' List). By referring to the CSSC, the possibility exists for installing 'Non-Q' items in a Safety-Related System. CI has no additional information. NUC POWER concern."

These concerns were evaluated by TVA as potentially nuclear safety-related and potentially applicable to Sequoyah (generic).

II. Summary of Issue

The issue defined by TVA is that the use of inadequate Q-Lists (or equivalent) on SQN could have adversely affected the establishment of appropriate QA program controls on items that are related to plant safety. By reference to an inadequate Q-List, the possibility exists that "Non-Q" items are installed in a safety-related system.

Other issues on these employee concerns are covered in Element Report 209.1(B).

III. TVA Evaluation, Conclusion, and Corrective Action

TVA personnel determined that:

- a. The SQN CSSC (Critical Structures, Systems, and Components) List, which identifies items that require QA program controls, has been used only by the Operations organization; the list was not used by Construction or Engineering on SQN. Therefore, the potential effects of using an inaccurate or incomplete SQN CSSC List are limited to Operations activities, which include procurement, maintenance, and modification.
- b. SQN procedures that control procurement, maintenance, and modification activities of the Operations organization establish the SQN CSSC List as the base reference for identifying safety-related (CSSC) items. Erroneous classification of an item as non-CSSC could result in omission of essential requirements and activities.
- c. No specific deficiencies in the SQN CSSC List were identified in the review of the case file materials.

The TVA evaluation concluded that, in addition to the conclusions of Element Report 209.1(B) that a review of the accuracy and completeness of the SQN CSSC List is prudent and that items previously deferred by the SQN CSSC Review Committee should be resolved, the issues related to the possibility that use of an inadequate SQN CSSC List could adversely affect QA program controls on safety-related items is valid. That is, an inaccurate or incomplete SQN CSSC List could result in misclassification of an item or work activity as not being safety-related and omission of QA program requirements. This could adversely affect the establishment of appropriate QA program controls on items affecting plant safety and therefore needs resolution prior to restart.

As regards to corrective action, TVA has developed a corrective action plan which provides that if the corrective action for Sequoyah Element 209.1 discloses inaccuracies or omissions in the SQN CSSC List, the items will be dispositioned (prior to restart if appropriate) in accordance with TVA procedures for conditions adverse to quality.

Conclusion

The NRC staff believes that the TVA investigation of the concerns was adequate. Also, the resolution of the issues as described in those Element Reports are generally acceptable.

However, a recent NRC review of TVA's status of their review of the SQN CSSC List for accuracy and completeness revealed that TVA may not conduct such a confirmatory review since, they have sufficient confidence in the accuracy and completeness of the list. This confidence is based on the results of inspections and audits by the QA and Engineering organizations and active involvement of the CSSC Review Committee in determining CSSC classification.

The NRC inspection of the SQN-CSSC classification process concluded that while the process for determining CSSC classification is cumbersome and that there are several areas of inconsistencies and errors in the list there were however, no major problems with the overall CSSC Lists and that the listing is in general agreement with regulatory requirements.

SEQUOYAH NUCLEAR POWER PLANT, UNITS 1 & 2
SAFETY EVALUATION REPORT FOR EMPLOYEE CONCERN
ELEMENT REPORT EN 21001, "SENSITIVE EQUIPMENT
LOCATED IN HARSH ENVIRONMENT"

I. Subject

Category: Engineering (EN 200)

Subcategory: EQ Process (EN 210)

Element: Sensitive Equipment Located In Harsh Environment (EN 21001)

The basis for Element Report EN 21001, Revision 1, dated January 22, 1987, is Employee Concern IN 85-068-002 which states:

"Sensitive equipment, i.e, instruments and instrument panels are located in a harsh environment. CI stated that the location of this equipment is in the bottom of the reactor and part way up the building. Unit not specified."

This concern was evaluated by TVA as potentially nuclear safety-related and potentially applicable to Sequoyah (generic).

II. Summary of Issue

The issue defined by TVA is that certain sensitive equipment, such as instruments and instrument panels, is located in a harsh environment near the lower portion of the reactor.

III. Evaluation

TVA personnel determined that the concern is valid in that sensitive equipment is located in the areas described. However, it was determined that the concern was known (reference WESTEC/TVA report entitled "Management Review of Environmental Qualification Activities and Documentation for Compliance with 10 CFR 50.49," dated September 25, 1985) and appropriate measures are being taken to ensure operability of this equipment in the environmental conditions that exist.

Since the concerned individual (CI) did not identify specific equipment or elaborate as to what specific environmental conditions (normal operating environment or design basis accident environment) were of concern, TVA evaluated the concern relative to safety-related equipment located in harsh environments and covered under 10 CFR 50.49. TVA concluded that the Sequoyah equipment qualification (EQ) program, which was developed as a result of the WESTEC/TVA report, is adequate to ensure that safety-related, sensitive equipment located in the areas described will perform their respective functions in the harsh environments in which they must operate.

IV. Conclusions

The NRC staff believes that the TVA investigation of the concern was adequate, and their resolution of the concern as described in Element Report EN 21001, Revision 1, is acceptable. The NRC has conducted inspections of the Sequoyah EQ program January 6-17, February 10-14, June 23-27, and December 8-12, 1986, and a final inspection of the program is scheduled prior to the Unit 2 restart. Although deficiencies were found during the inspections, TVA has corrected the deficiencies or will have them corrected prior to restart. Subject to completion of the Sequoyah EQ program by TVA and certification that Sequoyah is in compliance with 10 CFR 50.49, the staff believes that the Sequoyah EQ program will ensure satisfactory resolution of this issue.

V. Addendum

Since the writing of this SER, TVA has completed the Sequoyah EQ program and has certified that Sequoyah Unit 2 is in compliance with 10 CFR 50.49 in letters to the NRC dated March 24, 1987 and February 27, 1988. The staff concludes that the issuance of 10 CFR 50.49 qualification of electrical and I&C equipment has been satisfactorily resolved by the Sequoyah EQ program.

SEQUOYAH NUCLEAR POWER PLANT, UNITS 1 & 2
SAFETY EVALUATION REPORT FOR EMPLOYEE CONCERN
ELEMENT REPORT EN 21002, "INADEQUATE
EQ OF ELECTRICAL AND I&C"

I. Subject

Category: Engineering (EN 200)

Subcategory: EQ Process (EN 210)

Element: Inadequate EQ Program (21002)

The basis for Element Report EN 21002, Revision 2, dated February 2, 1987, is the following employee concerns:

WI-85-100-005

XX-85-122-014

XX-85-122-015

XX-85-122-016

"Environmental qualification of electrical and I&C equipment and components is inadequate. Qualification was often not done, or if it was done, records do not exist in many cases, which results in modification or replacement. Current upgrade program for environmental qualifications need scrutiny. CI has no further information. Anonymous concern via letter."

XX-85-094-013

"Sequoyah: It is the quality problems regarding environmental qualifications of components per NUREG-0588 that made the Sequoyah plant shutdown. CI has no specifics or hardware details."

HI-85-077-N13

"NRC identified the following concern from review of the QTC file:
"Inadequate environmental qualification/documentations."

OE-QMS-4

"Individual had information that might be helpful in the equipment qualification effort."

II. Summary of Issue

The issue defined by TVA is:

- A. The environmental qualification (EQ) program at Sequoyah is inadequate.
- B. Not all required equipment was qualified.
- C. Qualification records do not exist or are inadequate in many cases.
- D. Current upgrade program for EQ needs scrutiny.

III. Evaluation

TVA personnel determined that the concerns with the EQ program were valid; however, the Sequoyah EQ program had been determined to be inadequate by TVA management reviews independent of and prior to the filing of these concerns. The inadequate program was documented in WESTEC/TVA report entitled "Management Review of Environmental Qualification Activities and Documentation for Compliance with 10 CFR 50.49," dated September 25, 1985. As a result of the findings, Sequoyah was shutdown on August 21-22, 1985, and an extensive new EQ program was implemented at Sequoyah to ensure qualification of all equipment within the scope of 10 CFR 50.49. This program will be completed prior to restart of the plant.

TVA has also addressed these concerns in Nuclear Safety Review Staff (NSRS) Report I-85-225-SQN, "Environmental Qualification/Electrical/I&C Equipment/Components," dated March 12, 1986, and drew the same conclusions that the WESTEC/TVA report did. The NSRS report concluded that the corrective actions listed in the report, as augmented by the new EQ program described in the SQN Nuclear Performance Plan, should be sufficient to resolve these concerns.

The element report further acknowledged that there were outstanding items to be completed in the EQ program; however, it concluded that once the EQ program was complete these program concerns would be adequately resolved. The report determined that a long term EQ program has been established to provide continued support in these areas to Sequoyah and other TVA operating units.

IV. Conclusions

The NRC staff believes that the TVA investigation of the concerns was adequate, and their resolution of the concerns as described in Element Report EN 21002, Revision 2, is acceptable. The NRC has conducted inspections of the Sequoyah EQ program January 6-17, February 10-14, June 23-27, and December 8-12, 1986, and a final inspection of the program is scheduled prior to Unit 2 restart. Although deficiencies were found during the inspections, TVA has corrected the deficiencies or will have them corrected prior to restart. Subject to completion of the Sequoyah EQ program by TVA and certification that Sequoyah is in compliance with 10 CFR 50.49, the staff believes that the Sequoyah EQ program will ensure satisfactory resolution of this issue.

V. Addendum

Since the writing of this SER, TVA has completed the Sequoyah EQ program and has certified that Sequoyah Unit 2 is in compliance with 10 CFR 50.49 in letters to the NRC dated March 24, 1987 and February 27, 1988. The staff concludes that the issuance of 10 CFR 50.49 qualification of electrical and I&C equipment has been satisfactorily resolved by the Sequoyah EQ program.