The evaluation team believes that the above programs correct the deficiencies related to the past organizational structure and will result in an organization that is better able to communicate, control, and measure the quality of work. When fully implemented, these programs will remove the organizational impediments and eliminate the poor definition of responsibilities that led to the ineffective design control and poor communication of design requirements. Therefore, no additional corrective action is needed to address organizational structure.

3.2.3 Design Review and Quality Measurement Process

Design deficiencies were not consistently identified in a timely manner and experience, interface information, and licensing commitments were not systematically incorporated into the design because an integrated, comprehensive, and systematic design review process was not implemented. Many design errors and omissions went undetected because the working-level verification process was not consistently effective and thorough technical reviews were not conducted by the discipline Branch Chiefs on a systematic basis. When deficiencies were identified, Engineering management did not fully or promptly implement the actions necessary to correct the problems and prevent recurrence. This situation was evident from Engineering management's failure to evaluate plant-specific nonconformances for generic applicability to other nuclear plants and from its failure to identify deficiencies in both original and design change documents.

TVA's current Engineering management has taken a number of significant steps to improve the design review process. These steps are intended to improve design output through better control and results measurement. The principal measures taken are discussed in the following paragraphs.

In the CNPP, TVA recognized the need for instituting accountability for work performed within discrete functional areas. Each of the ONP departments created by organizational restructuring has been assigned responsibility and is accountable for the technical adequacy of all activities within its respective functional area.

Technical design responsibility, authority, and accountability of the Project Engineers and Branch Chiefs have been clearly established in DNE policy memo PM 87-35. The Project Engineer is responsible for ensuring that project work is executed according to plan and in conformance with approved DNE procedures, the requirements of the corporate QA program, and the technical direction of the Branch Chiefs. The Branch Chiefs are responsible for staffing projects with qualified technical personnel and for the technical adequacy of the engineering design. The Branch Chiefs are the final technical authority within DNE and have the authority to stop work that does not conform to established requirements.

In the past, the Branch Chiefs' authority and resources to fully administer technical reviews were limited because of fragmented and unclear design responsibilities. Under the restructured organization, DNE is responsible for all nuclear-related engineering work and the Branch Chief provides qualified engineers and technical direction to the Project Engineer. The Branch Chief also assesses the need for technical reviews, develops a document review and approval matrix, and schedules reviews as required.

On June 1, 1986, DNE issued NEP-5.2, "Review," which provides for comprehensive control of the design review process. Branch Instructions to implement NEP-5.2 are scheduled to be fully developed by April 1988. The five types of reviews described in the procedure are:

- Design Verification: Used to check or verify calculations, design input, and output documents

- Review for Approval: Overview to ensure that the essential elements of the design process have been used and documented

- Interface Review: For the coordination and resolution of design interfaces

- Operation and Maintenance Data Review: Ongoing review to ensure that past problems in design, operations, and maintenance do not recur

- Technical Review: Primary means for evaluating the quality, technical accuracy and adequacy, and economy of the design products

The content and status of these reviews are discussed in Subsections 3.2.3.1 through 3.2.3.6.

3.2.3.1 Design Verification

NEP-5.2 requires a review performed by qualified individuals assigned by the lead engineer "to check or verify calculations, design input and output documents before the results are used in the next step of the design process."

To improve the quality of design verification reviews, interface reviews, and reviews for approval, DNE has initiated extensive training of working-level supervisors and managers (discussed in Subsection 3.2.4). In addition, to augment DNE's staff, contracted engineering personnel have been used extensively.

In August 1987, Stone & Webster Engineering Corporation (SWEC) reviewed 335 MEB and 158 NEB essential calculations (required as licensing commitments) for SQN unit 2 (RIMS number B44 870915 002). Although minor discrepancies were noted in a majority of the calculations reviewed, only five calculations from each of these two disciplines were considered by SWEC to require changes prior to SQN unit 2 restart. SWEC stated, "The primary conclusion that can be drawn from this data is that the MEB (and NEB) calculations reviewed by SWEC are generally of high quality and support the SQN design basis." Required changes to 9 of the 10 essential calculations have been completed since the SWEC review, and the tenth is under revision to be completed before SQN unit 2 restart.

In the EEB, all essential calculations for SQN unit 2 were regenerated, an effort completed in June 1987. Sargent & Lundy (S&L) recently completed a review of 40 of these calculations. This review identified "major concerns" for five of the calculations, "moderate concerns" for 10, and "minor concerns" for 24 of the remaining 25. Resolutions of all 39 of these "concerns" are essentially completed. The significant technical issues are resolved and remaining open items are limited to providing appropriate documentation for closure of the S&L "concerns." In addition, EEB intends to revise or regenerate 100 percent of the essential EEB calculations for all of the nuclear units. The work is under way with the assistance of an outside contractor who, over the next 16 months, will provide engineers to help guide TVA engineers in reformatting the calculations and ensuring resolution of all "concerns." Essential EEB calculations applicable to Sequoyah will be completed before the restart of unit 2.

The Civil Engineering Branch (CEB) calculations have been reviewed in part by a number of architect-engineer organizations, including Gilbert-Commonwealth, R. L. Cloud Associates, Black and Veatch, and Bechtel. Reviews performed by TVA's EA and the NRC have identified a number of technical deficiencies, and additional reviews as well as corrective action plans for all identified deficiencies are under way. An overall assessment of the adequacy of CEB essential calculations is currently being prepared. However, in accordance with approved corrective action plans, all CEB essential calculations required for SQN unit 2 restart have been completed. CEB is actively issuing instructions for implementing the new Nuclear Engineering Procedures (NEPs) and for auditing its own calculations. However, even with these corrective actions, the evaluation team has found that many of the weaknesses identified during the ECTG evaluations persist. This observation is supported by CEB's difficulties in performing timely and technically acceptable corrective actions that it has committed to in response to the negative findings of element and subcategory evaluations. Additional corrective action is required (see Subsection 3.3.2).

CEB's recent performance in completing corrective action plans for Sequoyah restart revealed insufficient and incomplete efforts in addressing seismic qualification of instruments, overfill of cable trays, and thermal expansion of structural elements. Also, coordination between CEB and other Branches and departments was found still to be lacking in these areas. These problems should have been detected if the tasks had been properly planned and thorough design reviews performed, including checking, reviewing, and approving the corrective actions. Thus the evaluation team concludes that the programs currently being implemented are not sufficiently effective to remedy the weaknesses in the design verification type of reviews. This conclusion, DNE's proposed corrective action plan, and the evaluation team's agreement that the plan will resolve the problem in this area are discussed in Subsection 3.3.2.

3.2.3.2 Review for Approval

NEP-5.2 requires the Branch Chief and lead engineer/group head or his designee to perform an overview review (not detailed checking or verification) to ensure conformance to procedures, criteria, and codes and standards; use of up-to-date input and licensing commitments; and incorporation of appropriate interface and feedback information. However, the scope of this type of review needs more specific definition at the branch level to assure consistent comprehensive reviews, appropriate documentation, and feedback of results to engineering management to provide a measurement of design output quality. This observation, DNE's proposed corrective action plan, and the evaluation team's concurrence that the plan will achieve the needed improvements in this area are discussed in Subsection 3.3.2.

3.2.3.3 Interface Review

NEP-5.2 requires interdisciplinary review of "design input and output documents and calculations (including vendor documentation) for the coordination and resolution of design interfaces." The lead engineer and group head are responsible for ensuring that these reviews are conducted.

System design tasks require extensive coordination of design interfaces among engineering disciplines. It should be noted, however, that neither the employee concerns, the SWEC audit, nor the NRC's Integrated Design Inspection (IDI) directly addressed the system design aspects of nuclear plant design. It is difficult to judge the adequacy of the systems design coordination from the limited evaluations performed; however, it was observed that system responsibility was not clearly delineated in the documentation reviewed by the evaluation team.

The NRC Sequoyah Design Calculation Review Reports 50-327/87-27 and 50-328/87-27, Finding EEB-11, identified systems coordination problems between disciplines similar to those discussed in Section 2 of this report. In response (RIMS Number L44 871021 800), TVA committed to issue a division procedure that "specifically defines the interdisciplinary responsibility regarding specification of system performance criteria." On December 15, 1987, TVA issued NEP-3.12, "Safety Related Setpoints for Instrumentation and Controls - Establishment and Validation." This NEP addresses the specific NRC finding for instrument setpoints but does not include the broader issue of interface review for other systems. NEP-3.3, "Internal Interface Control," and NEP-5.3, "External Interface Control," require that internal and external interface control shall be established. However, only procedural guidance is contained in these NEPs, not specific technical review requirements nor methodology. Thus, the evaluation team believes that additional corrective action is required in this area. This conclusion, DNE's proposed corrective action plan, and the evaluation team's concurrence that the plan will provide for the needed improvements are described in Subsection 3.3.2.

3.2.3.4 Operation and Maintenance Data Review

NEP-5.2 requires the Branch Chief and Project Engineer to gather data from various sources to identify recurring problems in construction, operation, and maintenance. These data will be incorporated into the designs, design guides, standards, and criteria on an ongoing basis to ensure that problems are not repeated. The methodology to accomplish this effort is included in NEP-2.5. Programmatic inconsistencies between NEP-2.5 and NEP-5.2 need to be resolved to ensure that the evaluated information from the Nuclear Experience Review Program is systematically integrated into the operations and maintenance data reviews for design improvement purposes.

The Nuclear Experience Review (NER) program has been established to identify and incorporate significant internal and external problem and operating event data into programs of design, construction, operations, and training. However, efforts to implement the NER program are minimal at present because of conflicting priorities. The evaluation team believes additional corrective action is required in this area to provide specific direction ensuring that management has adequate methodology for evaluating nuclear utility industry experience. DNE proposed corrective action plan and the evaluation team's concurrence that the plan will provide for improved implementation of NEP-5.2 are discussed in Subsection 3.3.2.

3.2.3.5 Technical Review

NEP-5.2 requires technical reviews to be performed "by the branch chiefs or lead engineers as the primary means for evaluating the quality, technical accuracy and adequacy, and economy of the products and services for which they are responsible." Technical reviews are "performed as scheduled by the branch chief/lead engineer ... Technical reviews occur before approval for issue."

In August 1987, the Manager of Engineering and Technical Services issued a memo (RIMS number B44 870803 010) that requested the Branches to prepare Branch Instructions to establish a document review and approval matrix and a formal technical review process.

In October 1987, the Mechanical Branch issued a new Branch Instruction, "Formal Technical Review," which will implement the technical review requirements of NEP-5.2. However, future reviews by the branch chief or his designee, based on this Branch Instruction, have not been scoped or scheduled at this time.

The other Branches are also developing new Branch Instructions to implement NEP-5.2. CEB, EEB, and NEB all have scheduled their initial issue of the Branch Instructions, "Formal Technical Review," for early 1988. The scope and schedules for these reviews will be developed after the new Branch Instructions are issued. Since implementation of NEP 5.2 is not complete or fully effective, the evaluation team believes that additional corrective action is required to ensure timely implementation of NEP-5.2. DNE proposed corrective action plan and the evaluation team's concurrence that the plan will provide for improved implementation of NEP-5.2 are discussed in Subsection 3.3.2.

3.2.3.6 Present Status of Design Reviews and Quality Measurement

The evaluation team finds that TVA's programs to improve the design review process are conceptually acceptable, but the various Branches are presently at quite uneven stages in developing and issuing instructions for implementation and in training employees in their use. The considerable efforts required for SQN restart have impacted and delayed these program activities. In addition, the evaluation team has observed deficiencies in the present design efforts that indicate the intents of the CNPP have not yet matured into an effective design review and quality measurement process. This situation exists because of the extremely heavy workload, or because of other higher priority work, and the time required for the numerous corrective programs to take effect.

At present, there is a tendency to wait for internal or external audit results before taking corrective action. To provide credible evidence that the design review process is working, each Branch and project needs to measure improvement in the quality of the design product by regular feedback from users and from audits. This measurement is also necessary to establish performance goals that ensure the proper balance between quality, productivity, and schedule. Working-level supervisors and line managers need to comprehend the present status of the quality of design output through persistent, reliable, in-process monitoring. The present monitoring system furnishes only document schedule status; it does not assess technical adequacy or quality of the design output, nor does it ensure that user feedback is taken into account to prevent repeating design errors or omissions.

Nearly all of the necessary activities are identified. However, until the new instructions are issued and implemented and the design reviews are scoped, scheduled, conducted, and reported, conclusive evidence will not be available to determine whether the existing programs will eventually result in a satisfactory design review and quality measurement process. Progress needs to be demonstrated in some aspects of the design review process, specifically:

- Overall assessment of EEB and CEB essential calculations
- Timely and technically correct closeout of ECTG and other corrective action plans
- Coordination between CEB and other branches and departments
- Implementation of a procedure defining requirements and responsibility for system interface reviews
- Full implementation of the NER program
- Full implementation of Branch Instructions for technical reviews

Accordingly, the evaluation team concludes that the programs currently being implemented are not complete or sufficiently effective to remedy the weakness in the design review and quality measurement process and to ensure prevention of problem recurrence. DNE's proposed corrective action plan to resolve this issue and the evaluation team's concurrence that the plan will resolve the problem in this area are described in Subsection 3.3.2.

3.2.3.7 Engineering Assurance Organization

The EA organization was formally established March 1, 1986 within DNE to assure that the Nuclear Quality Assurance Program is appropriately applied to all ONP nuclear engineering and design activities. Additionally, EA is responsible for performing in-depth technical audits to assess the adequacy of Engineering design work and to ensure that the Branch design reviews are effective. The Manager of EA reports to the director of DNE on all matters other than QA. In matters relating to implementation of the Nuclear Quality Assurance Program, the manager of EA reports to and takes direction from the Director of Nuclear Quality Assurance. The manager of EA has authority to stop engineering work that does not conform to established requirements.

The EA organization adds an independent dimension to DNE's design review process by performing in-depth technical audits using qualified engineers. At present, EA is actively reviewing the output of ONP's major technical programs. In reviewing EA's audits at SQN of the DBVP, the evaluation team finds that the methodology and performance have been effective in identifying problems and in ensuring implementation of corrective action plans. While QA and EA are not responsible for the quality of the design output documentation, the evaluation team concludes that their audits can provide valuable feedback to Engineering management on the frequency of deficiencies and are a source of useful information to assess trends. Because these are not 100 percent audits, they only provide a limited independent assessment of the design output quality.

3.2.4 Qualification and Training of Personnel

The design process deficiencies identified in the Engineering and other category evaluations that pertained to the quality of design output documents are largely attributable to a shortage of engineering supervisors and managers with nuclear power plant design experience. From the inception of TVA's nuclear power program and through the period of its rapid expansion into the 1980s, TVA had a policy of favoring internal promotions. The result of this policy was that many engineering supervisors and managers did not have adequate experience in nuclear power plant design and its associated special requirements. (The subject of internal promotions is addressed in Management and Personnel Subcategory Report 71800.) As a consequence, Engineering management did not recognize the need to train and develop personnel with limited nuclear power plant design experience to meet the increasing demands of the expanding nuclear program.

The result was further weakness in procedural adequacy, implementation, and adherence, and in quality of design documentation. Training in procedural intents and requirements and in nuclear design process requirements was given lower priority than scheduling design production activities. Inexperienced managers and supervisors remained weak in their knowledge of nuclear design process requirements and in leadership skills and attitudes that are essential for persons directing nuclear engineering activities. Also, this overall lack of training led to employees' having an incomplete conceptual understanding of the design process. This may have created doubt among employees as to the competence and sincerity of management and fostered loss of employee commitment to the performance requirements of the engineering design activities.

The failure to educate both engineers and users in how the engineering output was to be used resulted in communication and design interpretation problems. As a result, vague, overly complex, or conflicting requirements appeared in design documents.

The CNPP addresses employee qualifications and the use of a management review board to monitor employment selections in the recently initiated nationwide recruiting effort. The board will also review recommended promotions and management assignments. The process of matching employee qualifications to job requirements has been simplified and made more precise with the issuance of position descriptions for all managers, from corporate to engineering Branch level.

Recruiting efforts have resulted in the hiring of a significant number of new managers with nuclear power experience. In DNE, newly hired senior managers include the Director of the Division of Nuclear Engineering, the Manager of Engineering Assurance, and several Branch Chiefs and Project Engineers. Recruiting efforts were under way at all levels of the DNE organization. In addition, there was significant use of outside contractor organizations to supplement TVA resources and to encourage transfer of design process methods.

The CNPP describes measures to be taken to correct skill deficiencies:

- Assign a Director of Nuclear Training, reporting directly to the Manager of Nuclear Power, to ensure management attention to the development and execution of training programs

- Develop management training to inculcate basic skills at all levels of management

- Assign responsibility to Engineering Assurance for training all engineers in quality-related NEPs

- Develop training in the fundamentals of the nuclear design process and stress why design reviews, design verifications, configuration control, traceability, documentation, and records management are important in the nuclear design process

- Train procurement, construction, and site personnel to use design documents

Implementation of the CNPP actions has begun. DNE procedure NEP-1.2, "Training," discusses training programs being conducted or to be conducted by Engineering Assurance, Personnel Services Staff of Human Resources, and the Engineering Branch Chiefs' staffs. These programs cover:

- Engineering procedures

- Discipline technical skills

- Communication skills

- Management skills

- Supervisory techniques

These training plans are being implemented by ONP, including Branch and EA organizations. Procedural, supervisory, communication, and management skills training courses are currently under way and will be ongoing.

In the fall of 1986, an outside contractor's assessment of the Division of Nuclear Training (DNT) identified strengths and weaknesses in DNT's program and recommended improvements such as training program evaluation and feedback, expansion of DNT's organizational scope, long-range planning, and implementation of qualification standards. The DNT analyzed and responded to all conclusions and recommendations relative to DNE training, and all actions have been completed.

Technical training coordinators for the Branches have been identified, and each TVA Engineering Branch Chief is reviewing his current training program for engineers in relation to the 1987 INPO Technical Support and Design Engineering Workshop item, "Training for Engineers." NEB has determined that its training program is fairly consistent with the practices of other utilities represented at the INPO workshop. NEB, as well as the other Branches, has developed training matrices to show minimum required training and actual training for each engineer. MEB has attended EA courses on pressurized water reactor and boiling water reactor systems. MEB also responds to specific training needs, such as the recent "Fire Protection Design Techniques" course presented to central staff and on-project engineers involved in fire protection work. Supervisors in each Branch are responsible for determining the training needs of their personnel, ensuring that these needs are met, and keeping the training matrices up to date. EEB now has an extensive training program with two full-time central staff employees assigned to training administration. CEB has developed a plan for a new training program that identifies minimum training requirements for each employee and develops new Branch training procedures and a training staff. Implementation of the program is to be completed in March 1988.

The evaluation team has reviewed DNE's evolving training programs and finds that they address the root causes of previous deficiencies in training that were, in themselves, causes of other problems in the nuclear design process. By exercising vigilance, DNE can identify areas of poor performance, which should be candidates for increased training. This is a long-range effort; however, with continuing development, monitoring, and management support, corrective actions taken by TVA in the area of qualification and training should be satisfactory to resolve the root cause problem.

3.2.5 Planning and Monitoring

DNE management failed to effectively plan and monitor, and thus lost its ability to effectively control engineering activities and processes. Poor planning was demonstrated by work activities that were only partially completed, not completed on time, or not properly integrated with other activities. Past schedules were based primarily on dates set by management priorities without adequate consideration of limitations on the working-level groups. Furthermore, there was no systematic effort to track incomplete items and associated causes to ensure an orderly progression of the work.

Because there had not been sufficient planning and monitoring of design activities by management, there was an imbalance in the overall design process, with insufficient control of quality, as evidenced by the deficiencies noted in the design documentation and by the observed late and incomplete closeout of actions to resolve identified problems. The major contributing factor was the large number of concurrent engineering activities, which was more than TVA could handle effectively with its limited experienced manpower. Meeting schedules is a critical factor in managing and controlling costs and completing work activities. Yet there was an inadequate assessment of resources required to meet schedules. TVA appears to have emphasized meeting schedule dates without equal emphasis on measuring the quality of the product.

The CNPP discusses the measures ONP is taking to correct deficiencies in this area. Corporate guidelines provide that:

- The scope of the work is defined, down to the task level
- Schedules are prepared that integrate the efforts of all groups and that are consistent with the resources available
- Budgeting of work activities is consistent with their scope
- Schedules are revised and updated in a timely manner to reflect progress and are adjusted for necessary changes resulting from uncontrollable conditions or circumstances
- Plans, schedules, and budgets are measured by management
- Each manager is held accountable for completing his work scope and meeting the attendant schedule
- Overall project schedule is a "living" document to minimize impacts from technical problems, late vendor information, changes in requirements, and other unavoidable delays

To implement these guidelines, ONP has established organizations responsible for managing a centralized nuclear information system, for planning and scheduling, and for maintaining financial control of TVA's nuclear activities using input furnished by responsible managers. These organizations have put in place a number of programs to implement this commitment. ONP Policy 4.7 was issued to direct project management to integrate all activities necessary to define, plan, schedule, estimate, budget, monitor, report, and direct successful completion of specific projects. DNE policy memo PM 86-09 issued in May 1986 establishes project planning requirements within DNE.

Additionally, each site has established a Site Planning and Scheduling Group that reports directly to the Site Director but takes overall direction from the Central Planning and Financial Staff in the execution of activities through corporate directives and standards.

The Engineering Branches are currently planning their activities for Branch technical training and for Branch technical reviews. The early fruits of this effort have been draft Branch training procedures and instructions and schedules for their implementation.

However, examples of DNE policies that are not being fully implemented have been encountered by the Engineering category evaluation team. TVA working-level engineers have experienced difficulty in implementing previously committed corrective actions because of continuing resource restraints and conflicting priorities. There is still an apparent deficiency in the planning process at the working level and with its integration into higher-level plans.

The examples observed by the evaluation team suggest that corporate guidelines and goals emphasizing the paramount importance of safety and quality have not been effectively committed to by all levels in the DNE organization. The balance between quality, productivity, and schedule appears to remain tilted towards meeting schedule dates. An effective performance measurement and control system could substantially improve communication at the management level. For programs in this area to be successful, management must give equal weight to meeting schedules and ensuring technical adequacy, and must see to it that the necessity of adequate planning at the working level is recognized and acted upon. This approach has not been evident to the evaluation team. These observations, DNE's proposed corrective action plan, and the evaluation team's concurrence that the plan will effect the needed improvements in this area are discussed in Subsection 3.3.3.

3.3 Category Level Corrective Action Plans

The preceding subsections of Section 3 discussed the causes believed to be at the root of the problems found by the Engineering Category Evaluation Group during its work as part of the ECTG. These root causes have been reviewed against the various programs that TVA has begun or has planned. In general, the TVA programs discussed in Section 3.2, when fully implemented, should achieve the goal of improving the design process. However, three areas of the design process appear to require additional management attention and action to ensure credible and reliable prevention of recurrent root cause problems. Corrective action plans for these three areas are discussed in the following subsections.

3.3.1 Assessment of Changes in Employees' Commitment Towards Performance and Technical Excellence and Improvement in Management Effectiveness

No method currently exists by which DNE management can assess changes in employees' commitment towards performance and technical excellence and improvement in management effectiveness goals outlined in the NPPs (CATD 20000 NPS 03).

DNE's proposed corrective action plan is as follows:

> The quantifiable measurement of improvement in DNE management effectiveness and shifts in employees' attitudes towards [performance] and management may best be achieved through a continuous review and assessment of indicators generated through formal and informal processes.
>
> - Training - DNE is committed to supporting the ONP program to schedule approximately 3,700 ([sic] 3,000) management and supervisory personnel through the three day Supervisory Development Course (SDC) and/or the six day Managing For Excellence (MFE) Courses. In addition, selected DNE and ONP managers are attending the Franklin Institute's "Focus on Time Management" Seminar. These training programs are critical in ensuring that managers and supervisors manage equitably and professionally in order to increase the effectiveness and morale of ONP employees.
>
>   Equally important is the manager's responsibility to ensure that employees are properly trained through formal and informal programs and processes as defined in NEP, Branch, and Project instructions. Within DNE, NEP-1.2, "Training," prescribes the responsibilities and requirements of DNE branches, projects, and staffs for the identification, development, and conduct of training.
>
> - The Division of Nuclear Training has an established external evaluation process. The Supervisor Development Course (SDC) and Management For Excellence (MFE)

course will be evaluated according to the established assessment procedure in DNT. This process involves post training assessments from supervisors and course participants, while concentrating on course effectiveness and perceived behavioral changes. The SDC has undergone an initial evaluation; the MFE evaluation is scheduled for the beginning of FY89 due to the small number of course participants that have completed the course to date.

- Engineering has instituted an ongoing program of conducting periodic "round table" information and discussion sessions involving levels of Engineering management, staff, and personnel. These sessions are used to discuss relevant Engineering issues and concerns as well as to serve as a feedback mechanism to assess employee attitude towards various programs, quality, and management effectiveness.

- The Director of Nuclear Engineering has directed, via an informal note, that Engineering Assurance develop and present a training course entitled "An Overview of the Engineering Process" by April 15, 1988. This course will be utilized to explain the interrelationships of the engineering process, products, and quality requirements, thereby increasing DNE personnel awareness of the engineering and design process.

- Performance Indicators - There are a number of performance indicators that DNE management will look at to determine management effectiveness. The quality of the DNE product can be measured against the number of documented deficiencies and conditions adverse to quality; review and results of trending programs; quality of procedures and instructions; and significant results of NEP-5.2 reviews reported to DNE management. Both NEP-9.1, "Corrective Action," and NEP-9.2, "Trending of Conditions Adverse to Quality," contain specific requirements for the programmatic and technical trending and reporting to management of conditions adverse to quality on both a monthly and semiannual basis, respectively.

- **External Surveys - INPO and the NRC have conducted management effectiveness inspections of TVA. Implementation of new commitments from these types of evaluations will establish management effectiveness indicators.**

- **Walking Spaces - The Manager of Nuclear Power has instituted an informal management practice called "Walking Your Spaces." This process requires that managers and supervisors get out and talk to their people, determine what problems exist, and know what is going on. This program is an excellent tool to assess employee attitudes and concerns.**

- DNE 1988 Goals and Objectives - DNE is in the final process of establishing 1988 objectives and goals via a J. A. Kirkebo memorandum to branch chiefs and project engineers dated December 21, 1987 [B05 1221 001]. Encompassed within these objectives is the enhancement of employee trust and confidence by providing an atmosphere for professional and leadership growth where enthusiasm is recognized and rewarded. Additionally, emphasis is being placed on technical excellence in deliverables through more involvement by line personnel, demonstration of DNE ownership of the design, and managing to obtain closure of activities. Projects and branches will be required to develop a set of measurable goals to implement these objectives. DNE shall also sponsor a management meeting in January 1988 to emphasize this objective as a top priority.

- Fulfillment of commitments addressed under CATD No. 20000-NPS-01 relative to improvements in the design verification and review processes, coupled with the inherent feedback to executive management, shall further demonstrate management effectiveness in these areas.

The evaluation team concurs that effective implementation of the proposed corrective action plans will give management the assessment tools it requires to determine where its efforts have been successful and where additional improvements are necessary. Monitoring the improvement in the quality of design output through interface with user organizations is essential in measuring employee commitment towards performance and technical excellence.

3.3.2 Design Review and Quality Measurement

Implementation of NEP-5.2, "Review," was not complete or fully effective at the time of the category level assessment. The following items need to be addressed (CATD 20000 NPS 01):

- Design verification is not yet fully effective, as demonstrated by continued difficulties in completing technically sound corrective action plans.
- Means are not in place for branch chiefs and line management to measure improvements in the quality of design output through review and assessment of user feedback and to ensure conformance to procedures and commitments.
- Systematic interfaces or system reviews are not yet scoped, scheduled, or proceduralized.
- Scope and methodology of operation and maintenance data reviews are not available.
- Technical review Branch instructions are not yet issued in EEB, CEB, and NEB. Planning and scheduling of technical reviews have not been completed in any of the Branches.

DNE's proposed action to improve the design review process is as follows:

- DNE has recognized concerns with the design verification process and has subsequently implemented several short term solutions. Difficulties in completing technically sound corrective actions as related to design verification will be partially resolved via the full development of branch instructions to implement NEP-5.2, "Reviews." NEP-5.2 was issued on June 1, 1986, and supplemented by an Interim Order on December 22, 1986. In accordance with NEP-1.2, "Training," Engineering Assurance (EA) is in the final stages of preparing a NEP-5.2 training course to DNE branch and project Lead Engineer and above audiences. This training is scheduled to begin in January 1988 and will require approximately 4-6 months before all required personnel are trained. In light of this CATD, NEP-5.2 shall be reviewed by DNE/EA and further revised by February 29, 1988, to require branch instructions to provide for better defined review areas (scope), methodologies for how these reviews will be accomplished by line management, documentation of results and reporting of significant results to the Director of DNE.

- The methodologies identified above will require consideration of feedback from the design output users (Construction, Operations, Quality Assurance, vendors, etc.) on trends for Field Change Requests, Conditions Adverse to Quality, Engineering Change Notices, etc. Based on this feedback, DNE management shall initiate corrective action and preventive action to include the correction of root causes to all identified deficiencies. This process will require the technical branch managers and line managers [to] be more involved in and cognizant of their review responsibilities and corrective actions associated with the design process and employee concerns program. The design verification and review processes have been further strengthened by a November 19, 1987, Interim Order to NEP-3.1, revision 1, "Calculations." This order provides details for performing the technical adequacy review as well as providing for documentation of the method of design verification (independent reviewer) used. DNE shall utilize the EA audit program, which includes design review and verification under the design control audit plan and review and approval as a standard audit attribute for all audits, and NRC and INPO inspections as further measurement tools in determining the effectiveness of the design process.

- NEP-3.3, "Internal Interface Control," and NEP-5.3, "External Interface Control," establish or reference procedures covering the DNE requirements and methods to control internal and external design interfaces and for requesting or conveying design information across DNE interfaces. These two NEPs shall be reviewed by Engineering Assurance and appropriately revised by April 15, 1988, to reflect specific review requirements and methodologies for how these reviews are to be conducted, as well as for other interface areas needing systematic/system reviews. Relative to TVA's commitment [L44 871021 800] to issue a division level procedure to specifically define the interdiscipline responsibilities regarding the specification of system performance criteria, NEP-3.12, "Safety Related Setpoints for Instrumentation and Controls - Establishment and Validation," was issued on

December 15, 1987. New NEP-6 series procedures, "Change Control," once fully implemented, have been issued to not only meet Corporate Nuclear Performance Plan commitments but to provide improvements in the design control and modification processes which include extensive interfaces. These procedures will consolidate and integrate the design change control and plant modifications processes.

- NEP-5.2 provides requirements for the conduct of five types of reviews to be used within DNE. Operation and Maintenance Data reviews are a performance review of facilities, both operating and under construction, which may be used as feedback for design improvements, vendor selection, reliability and availability evaluation, or as an aid to other DNE reviews. Branch Chiefs and project engineers will establish the interfaces necessary for acquiring operation and maintenance data. The implementation of NEP-2.5, "Nuclear Experience Review," will be a primary interface and support document for input to the operation and maintenance review. The NER program requires that industry and TVA nuclear experience is made available to TVA organizations and that appropriate corrective action, when necessary, is implemented. NEP-5.2, relative to O&M data reviews, shall be revised by February 29, 1988, to highlight and better establish this interface with NEP-2.5 and provide for documentation and reporting the results of these reviews to the Director of DNE. Implementation of these requirements will be addressed under branch instructions and schedules as shown below.

- DNE branch implementation of NEP-5.2 requirements will be governed by branch instructions issued/to be issued in accordance with the following schedule:

NEB: April 25, 1988	Scheduled Issue
EEB: February 29, 1988	Scheduled Issue
CEB: February 1, 1988	Scheduled Issue
MEB: October 1, 1987	Issued (MEBI 23.11)

Engineering Assurance will ensure that these branch instructions, to include MEBI 23.11, contain sufficient guidance requirements and direction for the adequate performance of the review function governed by the above changes to NEP-5.2.

The evaluation team concludes that the proposed corrective actions, when fully implemented, will provide the additional line management involvement to direct and monitor the design review process. The verification of this corrective action should identify the quantitative and qualitative improvements in the design output brought about by the design review process, before the corrective action plan is closed.

3.3.3 Planning and Monitoring

Difficulties experienced by TVA working-level engineers in adequately performing their design activities within schedule constraints indicate that TVA corporate guidelines and goals regarding planning have not been fully implemented. Resource constraints and conflicting priorities have not been balanced against commitment dates (CATD 20000 NPS 02).

DNE's proposed corrective action plan is as follows:

- DNE has recognized problems encountered due to conflicting priorities and resource constraints. This recognition, as both a management and process problem, has resulted in the development and implementation of the Engineering Work Management System (EWMS). The EWMS represents an integrated and comprehensive management system to control and support all DNE work. Once fully implemented and under the scope of Project Services Branch sponsorship, the EWMS will provide the necessary controls and integration of activities to define, plan, schedule, estimate, budget, monitor, report, and direct the completion of engineering work. EWMS will balance the gap between schedule, priorities, and the planning function at all levels.

TVA documents to implement this plan are ONP Policy 4.7, DNE PM 86-09, and DNE Administrative Instruction AI 107. Full DNE implementation was scheduled for January 1988.

The evaluation team has reviewed DNE AI-107 and concludes that it contains the essential elements that, when fully implemented, will correct the deficiencies identified in this category report.

4.0 CONCLUSIONS

The Engineering category employee concerns evaluations and corrective action plans completed through February 1988 have resulted in relatively few changes to safety-related hardware. Only one of these, the redistribution of electrical loads on the emergency diesel generators, was considered reportable to the Nuclear Regulatory Commission because it represented a potential reduction in the degree of protection provided to public health and safety. Most of the findings in the Engineering category evaluations related to weaknesses in Engineering management's definition, control, and quality measurement of the design process. Many of the findings require corrective actions by TVA; however, half of the issues raised were found to be invalid or to require no corrective actions. About half of the remaining valid issues were already being addressed by TVA when the Employee Concerns Special Program (ECSP) began. In many cases, the issues of concern had been recognized by TVA, but the depth of the problems and their causes were not fully appreciated. Thus, the corrective action plans previously initiated by TVA were not sufficiently specific or detailed, and their implementation would not have completely resolved the identified problems.

The employee concerns did, however, highlight several significant technical and programmatic issues. Evaluation of these issues revealed deficiencies in design and design control of electrical raceway and cable systems, in design of electrical systems, in preparation and control of safety-related calculations, and in incorporation of experience feedback and complete design and licensing requirements into the design basis (baseline). Other technical issues that were identified in the electrical, civil, and mechanical engineering disciplines were not of major significance individually but, when evaluated collectively, revealed a pattern of weakness in the design process.

Through February 1988, relatively few corrective actions initiated by the Engineering category evaluations had resulted in hardware changes to safety-related systems, structures, or components. Most of the corrective action plans consist of evaluation, analysis, and verification, which, when completed, will determine if any additional changes to documentation and hardware are required. Although the consequences of potential changes are not expected to be of major significance, the final assessment of any required change cannot be made until the evaluations, analyses, and verifications called for in the corrective action plans are completed.

The evaluations of employee concerns within the Engineering subcategories found technical and programmatic problems in the engineering Branch disciplines and in the engineering functions at project locations. Corrective action needs not previously resolved have been addressed by TVA-developed corrective action plans that were reviewed and concurred with by the evaluation team. Implementation of these plans is under way, and those designated as "SQN unit 2 restart items" have been completed and verified by the evaluation team.

The corporate and site-specific nuclear performance plans and DNE's design control programs should be effective in achieving the goal of improving the design process and in resolving the issues raised by the employee concerns. The most significant action at present is the completion, implementation, and follow-up monitoring of the results of the programs initiated by the various NPPs to ensure that root cause problems are resolved. This category report identifies three areas within the programs that are incomplete in their scope and implementation or where their implementation was not effective at the time of the category level assessment. The corrective action plans proposed by TVA to alleviate these deficiencies need to be carried out to completion. Only when the results of these actions clearly demonstrate improvements in the engineering process will their effectiveness be credible.

The Manager of Nuclear Power and the Director of Nuclear Engineering must continue to be the primary motivating forces behind the implementation and maintenance of these crucial programs to ensure that the effectiveness of the design process is improved and sustained.

Evidence that this is being done becomes apparent when documents prepared subsequent to this evaluation are reviewed. In TVA's responses to the NRC's Independent Design Inspection (TVA letter to NRC dated December 29, 1987, RIMS L44 871229 810), DNE identifies additional actions being taken to increase overall management involvement in the design process and to improve system engineering performance. These actions include formation of project teams to evaluate unresolved Condition Adverse to Quality (CAQ) reports and systematically prioritize and track their closeout. The system engineering concept is being implemented by establishing three types of system engineers (Plant System Engineer, Project System Engineer, and a Discipline Staffed System Engineering Specialist). Responsibilities for each will be defined and controlled by procedures. DNE Interim Order to NEP-3.1, revision 1, issued November 19, 1987, establishes additional programmatic improvements to ensure technical adequacy by requiring that calculations receive a technical adequacy review and an independent review subsequent to the initial calculation preparation and review.

Although these new initiatives were in the development stages and were not reviewed by the evaluation team, they have elements that should enhance the design process and demonstrate DNE management's willingness to seek out and implement new initiatives.

ABBREVIATIONS AND ACRONYMS

10 CFR 50	Title 10, Code of Federal Regulations, Part 50
AI	Administrative Instruction
ANSI	American National Standards Institute
ASME	American Society of Mechanical Engineers
BFN	Browns Ferry Nuclear Plant
BLN	Bellefonte Nuclear Plant
C/R	Commitment/Requirements
CAP	Corrective Action Plan
CAQ	Condition Adverse to Quality
CATD	Corrective Action Tracking Document
CCTS	Corporate Commitment Tracking System
CEB	Civil Engineering Branch
CNPP	Corporate Nuclear Performance Plan
DBD	Design Basis Document
DBVP	Design Baseline Verification Program
DNE	Division of Nuclear Engineering
DNQA	Division of Nuclear Quality Assurance
DNT	Department of Nuclear Training
EA	Engineering Assurance
ECM&D	Engineering-Construction Monitoring and Documentation
ECN	Engineering Change Notice
ECSP	Employee Concerns Special Program
ECTG	Employee Concerns Task Group
EEB	Electrical Engineering Branch
EWMS	Engineering Work Management System
FSAR	Final Safety Analysis Report
IDI	Integrated Design Inspection
IE	Inspection and Enforcement (an NRC Branch)
INPO	Institute of Nuclear Power Operations
MEB	Mechanical Engineering Branch
NEB	Nuclear Engineering Branch
NEP	Nuclear Engineering Procedure
NER	Nuclear Experience Review

NPP	Nuclear Performance Plan
NQAM	Nuclear Quality Assurance Manual
NRC	Nuclear Regulatory Commission
OIE	Office of Inspection and Enforcement
ONP	Office of Nuclear Power
QA	Quality Assurance
RIMS	Records Information Management System
S&L	Sargent & Lundy
SAR	Safety Analysis Report
SER	Safety Evaluation Report
SQN	Sequoyah Nuclear Plant
SWEC	Stone & Webster Engineering Corporation
UFSAR	Updated Final Safety Analysis Report
WBN	Watts Bar Nuclear Plant

APPENDIX A
ENGINEERING CATEGORY TABLE OF REPORTS

The Engineering Category, contains 124 separate reports: one category report, 27 subcategory reports, and 96 element reports specific to Sequoyah Nuclear Plant. Each report is listed below by title and part number corresponding to its Employee Concerns Special Program report number.

PART	REPORT TYPE	TITLE
20000	**Category**	**Engineering Category Summary and Conclusions**
20400	**Subcategory**	**Engineering Organization and Operating Procedures**
20401	Element	Organizational Structure
20402	Element	System Design Responsibility
20403	Element	Design Responsibility
20404	Element	Design Document Completeness
20405	Element	Design Review Process/Independent Verification
20406	Element	ECN Process
20407	Element	Vendor Documents
20408	Element	Communication and Interface Control
20409	Element	Use of Reverse Prints
20600	**Subcategory**	**As-Built Reconciliation**
20601	Element	As-Built Inaccuracies
20800	**Subcategory**	**Human Factors**
20801	Element	Human Factors Review
20900	**Subcategory**	**Q-List**
20901	Element	Q-List Differences
20902	Element	Impact and Significance of Q-List Differences
21000	**Subcategory**	**Environmental Qualification**
21001	Element	Sensitive Instruments/Harsh Environments
21002	Element	Inadequate Environmental Qualification Program
21200	**Subcategory**	**Pipe Support Program**
21202	Element	NRC Bulletin 79-14, ABR Program

21300 Subcategory	**Electrical Testing and Planning**
21302 Element	Inadequate Electrical Testing, Planning and Engineering Participation; Deviations to Preoperational Test Acceptance Criteria
21800 Subcategory	**Pipe Stress Calculations**
21801 Element	Thermal Analysis of Piping Subjected to Temperatures Less Than 120
21804 Element	Widespread Deficiencies Within Pipe Stress Calculations
21807 Element	Acceptance Criteria for Overlap Areas of Calculations
22000 Subcategory	**Support Design General**
22001 Element	'A' Series Hanger Drawings and 0-50 Notes
22003 Element	Design of Pipe Supports
22011 Element	Temperature Variation Consideration
22100 Subcategory	**Pipe Support Design**
22102 Element	Evaluation of Difference in Analyzed Design Loads for Pipe Supports
22106 Element	Observed Bending of Pipe Clamp Ears
22110 Element	Use of Snubber
22300 Subcategory	**Instrument Supports Design**
22301 Element	Instrument Line Support Connections
22302 Element	Instrument Mounting Brackets
22303 Element	Local Instrument Seismic Qualification
22400 Subcategory	**Raceway Support Design**
22405 Element	Support of Cables
22500 Subcategory	**Battery Support Design**
22500 Element	Battery Support Design
22600 Subcategory	**Seismic Interaction Design**
22600 Element	Seismic Interaction Design
22800 Subcategory	**Unistrut Support Design**
22800 Element	Unistrut Support Design
22900 Subcategory	**Instrumentation and Control Design**
22901 Element	Questionable Calculation of Orifice Hole Design
22902 Element	Radioactive Panel Drains into Floor Drains
22905 Element	Control Air System Adequacy following Pipe Break
22906 Element	Lack of Valves in Sampling and Water Quality System
22908 Element	Chilled Water System, Level Switches
22910 Element	Mercury Switches in Diesel Generator Building
22911 Element	Quality of RMS Detection Equipment
22912 Element	Panel/Instrument Distance

23000 Subcategory	**HVAC Design**
23001 Element	Fire Damper Latching Test
23005 Element	Airborne Radioactivity in CDWE Building
23100 Subcategory	**Fire Protection Design**
23101 Element	Undersized Distribution Headers
23104 Element	Lack of Fire Dampers in Additional Diesel Generator Room
23105 Element	Adequacy of Battery Room Ventilation System Design
23106 Element	Fire Protection QA Designation
23300 Subcategory	**Essential Raw Cooling Water Piping**
24200 Subcategory	**Electrical Separation**
24200 Element	Electrical Separation (Inadequate Electrical and Physical Separation between Redundant and between Q and Non-Q Wiring, Cabling, Equipment, and Components)
24500 Subcategory	**Incorporation of Requirements, Commitments, and Experience in Design**
20101 Element	Regulatory Requirements (Regulatory Guides, NUREG, Bulletins, etc.)
20103 Element	Design Criteria
20104 Element	Standards and Guides
20105 Element	Tracking of Commitments and Design Changes
20106 Element	Traceability of Design Requirements
20303 Element	Experience Feedback Not Properly Utilized
20406 Element	ECN Process and Scope of Engineering Required for Modifications
20502 Element	Calculation Control and Interface Requirements
20702 Element	Safety and Licensing Evaluations
20704 Element	CAQ Documentation
21303 Element	Inadequate Electrical Design Criteria
21304 Element	Electrical Procedures Do Not Properly Identify IEEE Standards
24600 Subcategory	**Design Calculations**
20501 Element	Calculation Preparation, Updating, and Records Retention Requirements
20502 Element	Calculation Control and Interface Requirements
20503 Element	Calculation Records Retention
20504 Element	Verification/Documentation of Quality Related Design Computer Codes
21301 Element	Inadequate Management, Control, and Status Listing of AC and DC Electrical Loads, Including Diesel Generator Margins
24300 Element	Inadequate Diesel Generator Margins
25000 Subcategory	**Civil/Structural Design and Pipe Whip Restraint Design**
21501 Element	Seismic Criteria
21502 Element	Cut Rebar Control

21506 Element — Hanger Loads on Structures
21510 Element — Feedwater Heater Monorail Design

25500 Subcategory — **Support Weld Design**
22202 Element — Box Anchors With Excessive Welding
22203 Element — Drawings Do Not Always Show Weld Size
22205 Element — Structural Steel Connection Design/Bolts Replaced by Weld
21509 Element — Structural Steel Connection Design
22206 Element — AISC Minimum Weld Criteria

26000 Subcategory — **Flushing and Piping Valve Design**
23202 Element — Carbon Steel vs. Stainless Steel Drainage Piping
23203 Element — Improper Piping Insulation Material
23206 Element — Rubber Gasket Deterioration
23208 Element — Criteria for Minimum Pipe Wall Thickness
23209 Element — Freezing of Condensate Lines

26500 Subcategory — **Electrical Safety and Systems Design**
23501 Element — 480 V Power Receptacles Unsafe
23502 Element — Exposed 480 V Bus at Panel Top
23504 Element — Exposed HV Cable Routed Without Raceway - Personnel Hazard
23508 Element — PVC Liquid-tight Flex Conduit
23511 Element — Malfunction of Westinghouse W-2 Switch
23701 Element — Bypass of Thermal Overload and Over-Torque Limit Switches
23702 Element — 400 to 500 Breakers Unacceptably Set
23704 Element — Bypass of Over-torque Limit Switches
23706 Element — Gassing of Current Transformers
24101 Element — Inadequate Splicing and Termination Practices and Procedures
24102 Element — Crimp Connections
24103 Element — No Megger Test on Low Voltage Cables
24104 Element — Amphenol Connector
24105 Element — Wire Corrosion and Deterioration of Sealant Material in Containment Penetrations

26600 Subcategory — **Raceway and Cable System Design**
23801 Element — Conduit Overfills and Cable Damage
23803 Element — Cable Tray Overfills and Wall and Floor Penetrations
23900 Element — Cable and Raceway Program Inadequate (Routing)
24000 Element — Cable Derating (Design) and Cable Coating Derating

APPENDIX B
EVALUATOR PROFILES

This appendix presents information about the relevant experience of members of the Engineering Category evaluation team. Education and years of engineering experience are listed on pages B-2 through B-4 for the 55 individuals responsible for signing subcategory reports as preparer, technical reviewer, or category evaluation group head. These 55 persons have an average of 23 years of engineering experience including an average of 16.3 years of nuclear power plant engineering. Of the 55, 43 are registered professional engineers. Resumes' of 14 key personnel are also included on pages B-5 through B-25.

During the course of the Engineering Category evaluations a total of 186 people participated in portions of the program. Of these, 156 were technical individuals (including 102 registered professional engineers) and 30 were nontechnical.

EVALUATION TEAM PROFILE

AT PEAK OF FULL-TIME ASSIGNED PERSONNEL

CLASSIFICATION	NUMBER OF PERSONNEL	REGISTERED PEs
CEG Head	1	1
Project Manager	1	1
Engineering Manager	1	1
Evaluator Group Supervisors	5	5
Evaluators	70	47
Technical Reviewers	7	6
Cost and Schedule Personnel	5	1
Technical Writers	5	0
Administrative personnel	11	0
Field Liaison	7	2
Total	113	64

INDIVIDUAL EXPERIENCE SUMMARY

Name	Education	Experience, Total/Nuclear (yr)
Allred, R.	B.Sc. Nuclear Eng. M.Sc. Nuclear Eng.	3/3
Aronson, C. A.	B.S. Indust. Eng.	32/31
Beaulaurier, L. O.	B.S. Mech. Eng.	26/1
Benkert, J. W.	BAE Aeronautical Eng.	23/19
Blumer, W. M.	B.S. Mech. Eng.	20/18
Bree, A.	B.S. Mech. Eng.	13/10
Chin, D.	B.S. Mech. Eng.	14/10
Damon, D. L.	B.S. Elect. Eng. Certificates in nuclear engineering, digital control, solid state electron.	27/27
Denny, G. R.	M.S. Nuclear Eng. B.S. Nuclear Eng.	6/6
Dodds, J. C.	M.S. Nuclear Eng. B.S. Nuclear Eng.	15/15
Don-Doncow, I.	Electrical Eng. Degree M.B.A.	15/14
Duncan, D.	B.S. Eng. Physics	30/30
Frane, J. T.	B.S. Marine Eng.	24/15
Gott, J. L.	B.S. Mech. Eng.	20/16
Griffith, J. S.	B.S. Mech. Eng.	39/.2

Name	Education	Experience, Total/Nuclear (yr)
Grill, J.	B.S. Arch. Eng. B.S. Business	25/14
Haggerty, R. A.	B.S. Elect. Eng.	15/5
Hills, R. P.	B.S.M.E. M.E.M.E.	13/12
Hui, Y. K.	B.S. M.S. Civil Eng.	15/13
Jaksche, M. G.	Technician, Eng. Power Systems	36/20
Jandu, K. S.	B.S. Mech. Eng.	20/14
Jones, R. B.	B.S. Elect. Eng	42/18
Jordan, C. W.	B.Sc.E.E. M.B.A.	28/23
Kuhn, P.	M.S. Elect. Eng.	22/17
Kuo, C.	B.S. Elect. Eng. M.S. Elect. Eng.	23/14
Langtry, A.	B.S. Mech. Eng. M.S. Mech. Eng.	39/6
Leslie, J. K.	B.S. Eng. Physics	41/41
Lew, L.	B.S. Elect. Eng.	20/17
Lodh, B.	B.S. Elect. Eng.	32/20
Martin, G.	B.S.	26/22
Mason, P. F.	B.A. Geography M.A. Geography Ph.D. Geography	14/11
Matyas, A. A.	B.S. Civil Eng.	13/12

Name	Education	Experience, Total/Nuclear (yr)
McDonnell, T.	B.A. J.D.	13/18
McNutt, G. R.	B.S. Mech. Eng.	29/19
Mikdadi, S. D.	B.S. Mech. Eng. M.B.A.	8/8
Mohanty, D.	M.S. Mech. Eng.	16/13
Pang, A.	B.A. Architecture	6/6
Parkinson, G. L.	B.S. Mech. Eng.	40/25
Peters, A. T.	B.S. Mech. Eng. Certificate in piping stress analysis	15/15
Rieder, U.	B.S. Elect. Eng.	27/19
Sarver, T.	B.S. Elect. Eng.	6/6
Schmitz, R. P.	B.S. Chem. Eng. M.E.A. Eng. Admin.	35/35
Schuetz, P. W.	B.S. Civil Eng. M.S. Civil Eng.	13/13
Shah, G. H.	Engineer, Civil Eng. M.S. Civil Eng. M.B.A. Management	23/20
Shah, N. G.	M.S. Structural Eng. M.B.A.	24/13
Szalay, L.	B.S.E.E. (Power) B.S.E.E. (Electronics)	39/20
Violette, J. B.	B.S. Mech. Eng. M.E. Certificates in nuclear engineering	39/35

Name	Education	Experience, Total/Nuclear (yr)
Weyandt, J. A.	B.S. Mech. Eng.	36/33
Wheeler, J. B.		15/15
Wiedner, K.	B.S. Civil Eng. M.S. Struct. Eng.	35/29
Wilkinson, R. C.	B.S. Mech. Eng.	14/12
Williams, J. C.	B.S. Nuclear Eng.	3/3
Wolters, R. A.	B.S. Mech. Eng.	29/15
Youssef, S.	B.Sc. Civil Eng. M.Sc. Struct. Eng. Ph.D. Struct. Eng.	26/8
Zwicky, D. A.	Diploma in Aeronaut. Eng. Certificates in power utilities eng., nuc. power plant design	35/15

GEORGE R. MCNUTT — ENGINEERING CEG-H

EDUCATION: B.S. Mechanical Engineering
University of Tennessee

SUMMARY: Twenty-nine years of engineering experience, with 19 years in the nuclear field. Experience in supervision and management, mechanical design, and evaluation of criteria.

EXPERIENCE:

Previous to his current responsibility, Mr. McNutt was responsible and accountable for assisting the Bellefonte project manager in establishing the project objectives for engineering and design and in evaluating and reporting on the performance of the supplier of engineering and design services.

Mr. McNutt had technical and administrative responsibilities for the final detailed design of the mechanical features for the Hartsville and Phipps Bend nuclear design projects.

He was supervisor of a steam plant machinery and piping design section for a nuclear power plant.

He worked 3-1/2 years for Union Carbide Nuclear, Inc. at the Oak Ridge National Laboratory. His assignments included establishing mechanical design criteria for new laboratories, mechanical design revisions to existing facilities, and mechanical designs and revisions to various experimental projects.

Mr. McNutt began his professional career with TVA at the beginning engineer level and progressed to the senior engineer level with work assignments on various coal and hydro projects.

PROFESSIONAL DATA:

Registered professional engineer, Tennessee
Member, American Society of Mechanical Engineers and Project Management Institute

GORDON L. PARKINSON **PROJECT MANAGER**

EDUCATION: B.S., Mechanical Engineering, Detroit Institute of Technology Nuclear Engineering, University of Michigan

SUMMARY: Forty years of experience on nuclear and fossil power projects including management of design, engineering, and construction activities.

EXPERIENCE:

Before becoming project manager of the TVA project, Mr. Parkinson organized and implemented a program for categorizing and trending design review concerns identified in the Engineering Assurance Program of the South Texas Project.

Previously, Mr. Parkinson was project manager for conducting an HELB/MELB supplementary review and an independent design review (IDR) of the Clinton Power Station. He was deputy project manager on the IDR of the Byron Nuclear Power Station. He was also project manager for the proposed design and construction of a cogeneration facility.

As assistant project completion manager for the Diablo Canyon project jobsite, he managed and coordinated activities to prepare the plant for low-power licensing.

Mr. Parkinson was project manager for the design and construction of additions and upgrading of a fuel handling and emissions control project for the four-unit coal-fired Monroe Power Plant for the Detroit Edison Company.

He spent 2 years as project engineer on fossil plant siting and design studies for a coal-fired unit for Wisconsin Electric Power Company. As resident project engineer, he provided general management of third-party engineering on a utility plant for the Syncrude project in Alberta, Canada, and led the Bechtel staff engineering development of an in-service inspection program manual for nuclear power plants.

Before that, Mr. Parkinson was project engineer for the Pennsylvania Power & Light Company Susquehanna Steam Electric Station, units 1 and 2 during the licensing period leading to the acquisition of the NRC construction permit. He was also project engineer on the Monticello Nuclear Generating Plant project for Northern States Power Company.

G. L. PARKINSON

As project manager, Mr. Parkinson was responsible for engineering, procurement, and construction of Duane Arnold Energy Center 540 MW BWR, for Iowa Electric Light and Power Company.

Before joining Bechtel, Mr. Parkinson was a staff member of General Atomic providing engineering liaison with architect-engineers on high temperature gas-cooled reactors, including jobsite residency at Peach Bottom Atomic Power Station, unit 1.

Mr. Parkinson was a project engineer on the design and construction of the nuclear piping systems and components for the fast breeder, sodium-cooled, Enrico Fermi Atomic Power Plant.

Mr. Parkinson started his engineering career at the Detroit Edison Company performing as draftsman through design supervisor designing power piping systems on 11 fossil units.

PROFESSIONAL DATA:

Registered professional engineer, California, Iowa, Michigan, Minnesota, Pennsylvania, and Wisconsin
Member, American Society of Mechanical Engineers
Past Member, ASME Nuclear Power Piping Committee

CHARLES (CHUCK) W. JORDAN ENGINEERING MANAGER

EDUCATION: B.Sc., Electrical Engineering, Heald Engineering College
M.B.A., Golden Gate University

SUMMARY: Twenty-eight years of experience with 23 years in the nuclear field. It includes management and supervisory positions, with specialty in control systems and electrical engineering.

EXPERIENCE:

Before working on the TVA project, Mr. Jordan was manager of systems engineering for Bechtel Power Management, responsible for coordinating the technical and standardization aspects of systems engineering in the five Power Division offices. He also served as a team leader for the readiness review program on the Vogtle nuclear plant project.

Previously, Mr. Jordan was a team leader on the independent design review team for the Clinton Power Station and the Byron Generating Station.

Before these assignments, Mr. Jordan was chief electrical engineer, responsible for scheduling and allocating manpower for project electrical groups, and for the technical quality of electrical engineering on all San Francisco Power Division projects. Previously, he was chief electrical engineer for the Petroleum and Chemical Eastern Division in London.

Mr. Jordan's earlier assignments included senior engineer, electrical engineering supervisor, project engineer, and assistant chief electrical engineer. In these positions, he worked with increasing supervisory responsibilities on various projects, including a high temperature gas reactor, two boiling water reactors, and a pressurized water reactor.

Before joining Bechtel, Mr. Jordan was an electrical engineer with a consulting engineering firm, participating in the design of industrial and commercial projects.

PROFESSIONAL DATA:

Registered professional electrical engineer, California
Member: IEEE, IEEE Power Engineering Society, San Francisco State University Industrial Advisory Board, California State University, Sacramento, Electrical Power Education Institute Advisory Board, and University of California, Berkeley, MESA Program Industrial Advisory Board

PETER F. MASON **TECHNICAL REVIEW COMMITTEE**

EDUCATION: **B.A., Geography, Fresno State College**
M.A., Geography, University of Colorado
Ph.D., Geography, University of California

SUMMARY: Fourteen years of engineering experience as assistant project engineer, environmental engineer and supervisor, and assistant project manager. Additional experience in teaching, research, and consulting.

EXPERIENCE:

Before his current assignment for TVA, Dr. Mason was an assistant project engineer assigned to the Pacific Gas and Electric (PG&E) Diablo Canyon Rate Case. He was in charge of Special Projects for PG&E's Engineering Rate Case Coordinator with responsibility for planning, testimony development, preparing responses to data requests from the California Public Utilities Commission (CPUC), and performance of special studies.

Previously, Dr. Mason was an assistant project engineer assigned to the PG&E/Bechtel Diablo Canyon project. In this capacity, he carried out various assignments for the project engineer and project management. He coordinated the development of the GPMA Procedures Manual. Additional activities included assisting with unit 2 licensing; coordinating various allegations investigations relating to design, construction, operations, and quality assurance; rate case preparation; interfacing with NRC Region V at both the home office and jobsite regarding allegations investigations; and assisting in the planning of the Long-Term Seismic Review Program and preparing a response to the CPUC regarding rate case. When he was in charge of special projects in the verification group, he was responsible for the coordination of the project interface with various Independent Design Verification Program subcontractors.

Dr. Mason has also provided assistance in the preparation of a coal gasification screening study, the development of an approach for review and evaluation of design review issues associated with the South Texas Project, and preparation of the Clinton Station HELB/MELB Supplementary Review for Illinois Power Company.

Before this, Dr. Mason was an assistant to the programs manager of the Clinton Power Station Independent Design Review where he assisted with the preparation of the final report and coordinated responses to various issues and concerns raised by the NRC.

P. F. MASON

Dr. Mason was assistant project engineer on a flue gas desulfurization system retrofit project in Wyoming. As assistant project engineer on the Kaiser Gramery Plant Conversion project, he had discipline review responsibility for control systems and instrumentation, electrical, mechanical, and environmental engineering. He coordinated the preparation of the final project report and managed the conduct of a coal gasification study alternative to the coal-fired boiler plant project.

He was previously supervisor of environmental engineering for Bechtel's San Francisco Power Division responsible for all environmental matters, regulations, reports, permits, and licenses related to nuclear and fossil power projects.

Before this, he was manager of site selection and infrastructure planning for a major regional development planning project overseas. He coordinated the environmental section of several nuclear and coal-fired power plant siting studies and served as project environmental engineer for a spent-fuel storage facility.

Dr. Mason's previous experience includes various teaching positions at the undergraduate, graduate, and administrative levels in geography, environmental studies, resource planning and conservation, and public administration. He also researched various land use planning, meteorology, climatology, air quality, and geomorphology problems; served as a consultant to government and industry; and wrote more than 60 papers on these subjects.

PROFESSIONAL DATA:

Member, American Association for Advancement of Science and
Arizona Academy of Science
Listed in Who's Who in Industry and Finance, American Men and Women of Science

R. PAUL SCHMITZ TECHNICAL REVIEW COMMITTEE

EDUCATION: B.S., Chemical Engineering
University of Missouri

Master of Engineering Administration
George Washington University

SUMMARY: Thirty-five years of nuclear engineering experience, including design, testing, safety analysis, licensing, environmental engineering, project supervision, advanced power systems, energy analysis, and management.

EXPERIENCE:

Before his current TVA position, Mr. Schmitz was chief nuclear engineer, responsible for overall coordination of nuclear activities in the Bechtel Power Corporation.

He was previously assigned to the U.K. Pressurized Water Reactor Project in Leicester, England, for technical consulting and activities concerned with the Sizewell B public inquiry.

For several years he was manager of engineering and materials in Bechtel's Research and Engineering Department. He was responsible for Bechtel's advanced power developmental activities on breeder reactors, fusion, geothermal, solar, and wind, and for Bechtel's energy planning activities. He was also responsible for Bechtel's metallurgical and welding activities.

Previously, Mr. Schmitz was chief nuclear engineer in Bechtel's San Francisco Power Division. He progressed to corporate chief nuclear engineer responsible for the safety, licensing, and environmental aspects of nuclear projects in Bechtel's six design offices for power projects.

In Bechtel's Research and Engineering operation, he worked on safety analysis, licensing, and nuclear design aspects of the Peach Bottom unit 1 HTGR, San Onofre unit 1, and Palisades. In other significant assignments, he was on project teams for the FARET fast reactor test facility, the NASA environmental test facility at Houston, and a proposed NERVA engine test facility in Nevada.

R. PAUL SCHMITZ

Before working at Bechtel, Mr. Schmitz was project engineer with the U.S. Atomic Energy Commission (AEC), Division of Reactor Development, Washington, D.C., responsible for coordination of the technical and budget aspects of the AEC's organic cooled reactor programs. At General Electrical Company, Hanford Atomic Products Operation in the Pile Technology Group, he was responsible for fluid flow and heat transfer experiments associated with increased reactor power levels.

PROFESSIONAL DATA:

Registered chemical engineer, Missouri
Registered nuclear engineer, California
Certified by the National Council of Engineering Examiners
Member, American Nuclear Society and the Health Physics Society (Associate)

JOE B. VIOLETTE **TECHNICAL REVIEW COMMITTEE**

EDUCATION: **B.S. Mechanical Engineering**
Oregon State University

Master of Engineering, M.E.
Yale University

Nuclear engineering certificates,
University of California

SUMMARY: **Thirty-nine years of industrial experience with 35 years engineering and management experience in the nuclear field, specializing in commercial nuclear power.**

EXPERIENCE:

Mr. Violette's most recent assignment at Bechtel before TVA's Employee Concerns Program was as manager of projects for Bechtel National's Defense and Space, Nuclear Operations, Environmental Operations, Manufacturing Operations, and Research and Technology.

As Bechtel manager of business development and technical services, he was responsible for developing new power business technical services in Japan.

For several years previously, Mr. Violette was project manager of the Susquehanna Nuclear Power Plant project.

As Bechtel executive engineer, he was responsible for developing and implementing an action plan from lessons learned from the Three Mile Island Unit 2 accident. He was senior technical representative to Brazilian Utility to complete Brazil's first nuclear power plant.

Mr. Violette was Bechtel's corporate manager of quality assurance, responsible for the quality program for all nuclear power projects.

Previously, as Bechtel manager of projects, he had management responsibility for six major nuclear power projects: Susquehanna, Peach Bottom, Limerick, Duane Arnold, Pilgrim 2, and Hope Creek.

Mr. Violette spent 15 years at General Electric Nuclear Energy Division. His positions and responsibilities were as follows:

- Manager of project engineering - LMFBR Program
- Project manager responsible for Monticello Nuclear Generating Plant (turnkey)

J. B. VIOLETTE

- Principal plant design engineer responsible for Monticello and Oyster Creek design

- Manager of Power Reactor Test Operation responsible for reactor technology and fuel development test program

- Manager of VBWR operation responsible for reactor operation and maintenance

- Licensed senior reactor operator

- Principal reactor design engineer responsible for design, procurement, and installation of reactor and reactor auxiliary components for VBWR - first licensed reactor in the United States; shift supervisor for reactor startup

At Stanford Research Institute, he was research engineer responsible for selection and evaluation of industrial plant sites. As engineer for California Research and Development Co., he was responsible for low power research reactor and piping design. At Standard Oil Co. of California, he was design engineer responsible for design of special oil field equipment and petroleum delivery equipment.

PROFESSIONAL DATA:

Registered nuclear engineer and quality engineer, California

JACK A. WEYANDT **TECHNICAL REVIEW COMMITTEE**

EDUCATION: **B.S., Mechanical Engineering, University of California**

SUMMARY: **Thirty-six years of engineering experience, with 33 years in nuclear engineering. Positions include project engineer responsible for closeout, and group supervisor responsible for mechanical, nuclear, and control system work, and licensing.**

EXPERIENCE:

At Bechtel, Mr. Weyandt has been assigned to the following projects:

- Susquehanna Project - a two-unit boiling water reactor (BWR) nuclear power plant for Pennsylvania Power & Light Company. As project engineer, he closed out the project. He served on this project also as assistant project engineer and as mechanical group supervisor. At various times, he was responsible for the mechanical, civil, architectural, and piping design groups; quality engineering; and equipment qualification. He was also the project representative to the BWR Mark II Owners Group, which defined the hydrodynamic loads caused by unstable steam condensation in the suppression pool.

- Duane Arnold Project - a single-unit BWR for Iowa Electric Light & Power Company. As mechanical group supervisor, he was responsible for all mechanical, nuclear, and control system design, and for licensing.

- Point Beach Project - a two-unit pressurized water reactor (PWR) nuclear power plant for Wisconsin Electric Power Company. As assistant to the mechanical group supervisor, he helped oversee the mechanical, nuclear, and control system design work, and the licensing effort.

- Tarapur Nuclear Project - a BWR nuclear power plant in India. As senior engineer, he was responsible for the design and purchase of prefabricated insulation for shipment to India and for the nitrogen inerting system.

Previously, Mr. Weyandt was associated with Kaiser Engineers, Oakland, California, in the design and construction of various nuclear projects.

PROFESSIONAL DATA:

Registered mechanical engineer, California

KARL WIEDNER **TECHNICAL REVIEW COMMITTEE**

EDUCATION: **B.S., Civil Engineering**
Technical University of Graz, Austria

M.S., Structural Engineering
Technical University of Graz, Austria

SUMMARY: Thirty-five years of experience in engineering and management. Almost 30 years are in nuclear engineering and over 20 years are in supervision and management. This experience includes the design of nuclear power and conventional facilities, industrial plants, and rapid transit systems. His responsibilities include civil/structural design supervision, multi-discipline project management, and management of independent design reviews.

EXPERIENCE:

Over the last several years, Mr. Wiedner has had extensive involvement in independent design review activities for several nuclear power plants. He was also a member of the Georgia Power Co. Readiness Review Board for the Vogtle Nuclear Plant.

In 1982, he was assigned to Bechtel Power management as chief civil/structural engineer, where he was responsible for coordinating design reviews, standardization, and experience feedback for plant design and civil and architectural activities in the five Power Division offices.

From 1972 to 1982, he worked in the Ann Arbor Power Division office, first as chief civil/structural engineer, responsible for project staffing and the technical surveillance and guidance of civil/structural design work being performed. Later he was engineering manager overseeing the technical design work and administration of two major projects and the computer-aided drafting department.

Before transferring to Ann Arbor, Mr. Wiedner was the assistant chief civil/structural engineer in the San Francisco Power Division, where he was responsible for the Mark III Containment Design Task Force, in addition to his staff responsibilities.

From 1964 to 1970, Mr. Wiedner's engineering supervisory positions covered a wide range of assignments. These assignments included civil/structural group supervisor for the Monticello Nuclear Plant for the Northern States Power Company, the Trojan Nuclear Plant for the Portland General Electric Company, and the Tarapur Nuclear Plant Facilities in India.

K. WIEDNER

When Mr. Wiedner joined Bechtel as an engineer, he was assigned to the structural design of nuclear and fossil facilities, including the reactor building for the Dresden, Hallam, and Big Rock Point nuclear power plants.

Before joining Bechtel, Mr. Wiedner was an engineering instructor and worked for 2 years with a consulting engineering firm as a structural engineer on the design of various industrial plants.

PROFESSIONAL DATA:

Registered professional engineer, California and Oregon
Member: Engineering Subcommittee on Design Innovations, member (1972) and chairman (1973); two special task forces: Over/Under Containment, and GE Mark I and III Containments; American Nuclear Society Committee 2.0 and Subcommittee 2.3; American Concrete Institute; American Society of Civil Engineers; Technical Advisory Panel - EPRI Seismic Center

JOHN W. BENKERT **CIVIL GROUP SUPERVISOR**

EDUCATION: **B.A.E. Aeronautical Engineering, Georgia Institute of Technology**

SUMMARY: **Twenty-three years of engineering experience, including 19 years on nuclear projects. Supervisory experience; engineering experience also on fossil and cogeneration projects.**

EXPERIENCE:

Before working on the TVA project, Mr. Benkert was assigned to the chief civil engineer's staff to assist in technical review and assistance of project-originated requests and in the development and maintenance of design standards. He has developed design criteria and prepared licensing documents for cogeneration projects in California subject to California Energy Commission regulations.

Previously, he was assigned to Limerick Generating Station (a 1088 MW boiling water reactor) as civil group supervisor directing the activities of up to 80 engineers for completion of unit 1 and continuing engineering on unit 2.

Earlier, he was assigned to Susquehanna Steam Electric Station (a 1100 MW twin unit BWR plant) as civil deputy group supervisor. He assisted the civil group supervisor in directing activities of 50 to 60 engineers for completion of unit 1 and finalization of unit 2. As civil/structural engineer on the Susquehanna Steam Electric Station project, he developed specifications and procurement documents and handled bid evaluations and negotiations, post-award liaison with vendors, resolution of technical and quality interfaces with vendors, construction, and client and concrete technology.

Mr. Benkert was employed by Gilbert Associates as a structural engineer on Crystal River unit 3 and earlier by Combustion Engineering on the structural design of 12 fossil plants. He was also employed by Hayes International Corporation for work on NASA projects.

PROFESSIONAL DATA:

Registered professional civil engineer, California
Registered professional engineer, Pennsylvania
Member, American Society of Civil Engineers and American Concrete Institute

D. LARRY DAMON **MECHANICAL GROUP SUPERVISOR**

EDUCATION: **B.S.E.E., Electrical Engineering, University of Nevada**

Certificates in nuclear physics, electronics, nucleonics (University of California), and computer control (Stanford)

SUMMARY: **Twenty-seven years of engineering experience in the nuclear field: design of nuclear power systems, nuclear instrumentation, computer-based controls/simulations, human factors engineering, licensing, field operations/startup multidiscipline design control, and overall project management.**

EXPERIENCE:

Mr. Damon's most recent assignment at Bechtel before the TVA project was as project engineer, providing engineering support, expediting, and problem resolution to the Palo Verde transition team. The team, composed of the lead site managers, met daily to address startup issues. The engineering position required fast resolution of technical problems, development of alternatives, quick implementation of design changes, adjustment of priorities, and general expediting of engineering design work.

Previously, as project engineering manager, he was responsible for coordinating the turnover of engineering for the Houston Power and Light Company's South Texas Nuclear Plant by Brown & Root to Bechtel Power Corp. He established the methodology of transfer of engineering documentation, coordinated licensing interface with the NRC, prepared interim project procedures, and assessed the technical adequacy of the existing design.

Mr. Damon was chief engineer, leading the staff responsible for all technical aspects of control systems engineering on all nuclear and fossil power projects. He directed discipline recruiting activities and personnel assignments. He modernized standards and design guides to incorporate more recent industry developments (ASME, IEEE, NUREGs, etc.) and developed techniques for response to changes on regulatory standards. He initiated a system of design compliance to corporate and industry codes and standards, developed new business lines/services using computer simulations, and distributed digital control techniques to enhance operations of nuclear power systems.

On the Trojan Nuclear Plant project, Mr. Damon was project engineer for several years, managing the multidiscipline engineering design efforts for modification and upgrading of the operational nuclear unit. He was assistant project engineer in charge of startup support during the accelerated project completion program.

D. L. DAMON

Earlier, he was the corporate standards coordinator, managing the corporate standards program on technical specifications, topical reports, and design guides. He was previously the mechanical standards coordinator.

As staff engineering specialist, he gave technical guidance, conducted training programs, and consulted with discipline group leaders on nuclear projects. He was responsible for the composition of control systems sections of BESSAR. He reviewed and commented on sections developed by other disciplines, prepared control systems engineering standards and guidelines, and participated in the development of several nuclear industry standards.

On the Mendocino Nuclear Plant project, he was supervising engineer, group leader, with responsibility for the control systems group.

On the Peach Bottom Atomic Power Station, units 2 and 3 project, he was assistant mechanical group leader, responsible for technical direction and administration of the mechanical/instrumentation group's engineering efforts. Responsibilities included systems design, equipment selection and procurement, and safety analysis report revisions. Earlier, he had been subgroup leader responsible for instrumentation and control systems engineering.

For two years, he was a control systems engineer, assisting in the design of power systems, including the Tarapur Atomic Power Station.

For Tracerlab Inc. Reactor Monitoring Center, Mr. Damon was project engineer with responsibility for design and development of radiation monitoring systems for land-based nuclear power plants, as well as for development of air particulate monitoring devices for the Polaris submarine program.

PROFESSIONAL DATA:

Registered professional engineer, California
Member: National Society of Professional Engineers, California Society of Professional Engineers, American Nuclear Society, Institute of Electrical and Electronics Engineers, and Instrumentation Society of America

I. DON-DONCOW **ELECTRICAL GROUP SUPERVISOR**

EDUCATION: **Degree in Electrical Engineering, University of Chile**

M.B.A., Golden Gate University

SUMMARY: **Fifteen years of electrical engineering experience, with 14 years on nuclear power plant projects. Field and supervisory experience with involvement in design and licensing. Also has experience in water treatment industry.**

EXPERIENCE:

On the Limerick Generating Station project, Mr. Don-Doncow was the deputy electrical group supervisor. As such, he was involved in the different technical, licensing, administrative, work plan, cost estimate, manpower, budget, and forecast-related activities for the electrical group. Previously, Mr. Don Doncow was the electrical schemes group leader on the same project, responsible for all activities associated with the design of electrical schematic diagrams. Additional duties on this job included a field assignment supervising a special task force responsible for the engineering review of preoperational test procedures and results to expedite their approval under a tight fuel load schedule.

Before working on the Limerick project, Mr. Don-Doncow was assigned to the Arkansas Nuclear One - Units 1 and 2 project. On this project, he was the deputy electrical group supervisor and the electrical systems group leader, and earlier, the electrical schemes group leader with responsibilities similar to those on the Limerick assignment. As a schemes engineer on the same job, duties included the design and checking of different schematic diagrams for the various safeguard and nonsafeguard systems. Additional involvement included review and approval of electrical calculations and vendor drawings, preparation of specifications and material requisitions, and review of startup procedures. He was also assigned as the electrical discipline QE and as a construction/home office liaison engineer at the jobsite.

Before joining Bechtel, Mr. Don-Doncow was an electrical engineer for California Filter Company, assigned to the electrical design of water treatment systems.

PROFESSIONAL DATA:

Registered electrical engineer, California

JOHN S. GRIFFITH **TECHNICAL REVIEW COMMITTEE**

EDUCATION: **B.S, Mechanical Engineering**
University of Colorado

SUMMARY: **Thirty-nine years of engineering experience with management and supervisory positions and special interest in thermodynamics, heat transfer, and fluid dynamics.**

EXPERIENCE:

Mr. Griffith's most recent assignment before the TVA project was as resident project engineer at the Vogtle Nuclear Power Plant jobsite, where he coordinated HVAC system design verification between engineering construction and startup.

On the Korea Nuclear Units 5 and 6 project, Mr. Griffith was resident project engineer. He organized and supervised a jobsite multidiscipline resident engineering team, performing design completion, field-identified design changes, as-built reconciliations, and related engineering tasks.

On the 1200 MW Pilgrim 2 pressurized water reactor project, Mr. Griffith was assistant project engineer. His responsibilities included planning and supervising engineering activities of the mechanical and plant design disciplines within the project and providing a principal liaison contact with the client. He managed Bechtel engineering efforts in support of backfit and plant betterment tasks, including verifying the validity of the seismic analysis of all safety-related piping systems.

He was senior engineer and resident engineer on the Trojan nuclear project and resident engineer on the Bowline Point project (oil-fired units); he also held various positions on several coal-fired unit projects.

Mr. Griffith spent several years at Stearns-Roger Corporation, Power Division, as chief mechanical process engineer and senior staff engineer specializing in fossil-fueled thermal power plant engineering, construction, and testing. He began his engineering career at Westinghouse Electrical Corp., specializing in thermodynamic design of industrial, marine, and central station types of steam turbines, including USS Nautilus prototype propulsion turbines.

PROFESSIONAL DATA:

Registered professional engineer, Colorado
Member, American Society of Mechanical Engineers

ALLEN T. PETERS **PLANT DESIGN GROUP SUPERVISOR**

EDUCATION: **B.S.M.E., California State Polytechnic College**

Graduate work toward Master of Engineering, California State Polytechnic College

Piping Stress Analysis Certificate, Bechtel Power Corp.

SUMMARY: **Fifteen years of nuclear engineering experience, including group supervision, piping layout, stress analysis, and pipe support design.**

EXPERIENCE:

Before his TVA assignment, Mr. Peters was engineering group supervisor, operating plants. He was responsible for the overall supervision and management of the piping layout, stress analysis, and pipe support design tasks for two operating nuclear power plants. Specific duties included preparing and monitoring budgets and schedules, generating design specifications, and coordinating system modifications with other disciplines, the field, and the client. All work is in compliance with the ASME Section III and ANSI B31.1 codes, plant FSAR, and NRC requirements.

As plant design staff engineer, Mr. Peters performed various assignments, including leading the technical review of project design work, preparing and reviewing specifications, preparing proposals, and coordinating small projects.

For several years, he was engineering group supervisor, supervising the piping layout, stress analysis, and pipe support design for various Japanese power plants. Tasks were done to Japanese MITI code requirements and Japanese practices. CAD was used for the first time to generate piping isometrics and computer modeling in the metric system. Increased productivity and cost- saving methods were successfully implemented. He also conducted project review meetings with Japanese clients in Japan.

Previously, he was engineering group leader, organizing and supervising the piping stress analysis work for a two-unit nuclear power plant.

As stress analysis engineer, he performed piping stress analysis calculations to ASME Boiler and Pressure Vessel Code Section III and ANSI B31.1 requirements. He performed field walkdowns of piping systems before plant startup.

PROFESSIONAL DATA:

Registered professional mechanical engineer, California
Member, American Society of Mechanical Engineers

ROBERT A. WOLTERS **PROGRAMMATIC GROUP SUPERVISOR**

EDUCATION: **B.S.M.E., University of California**

SUMMARY: **Twenty-nine years of experience in multidiscipline design engineering, construction, installation and startup, maintenance and operation of mechanical equipment, piping systems, and control systems for power plant facilities, chemical manufacturing plants, and petroleum refineries.**

EXPERIENCE:

Before his current TVA assignment, Mr. Wolters was assigned to the Defense Waste Processing Plant (DWPP) project as deputy group supervisor for the control systems group. He was responsible for the planning and control of design work, and for computer-aided drafting activities, field construction and subcontract support, discipline input to project model activities, and preparation, coordination with other disciplines, and issue of instrument location plans, instrument installation details, and publication of the project instrument index.

Mr. Wolters was assigned to the Limerick project as a special assistant to the project engineer, managing and participating in the resolution of special problems, primarily in the mechanical area, associated with the startup of Limerick Unit 1 of Limerick Generating Station, a two-unit BWR nuclear power plant. A major special assignment was the resolution of the problems with microbiologically influenced corrosion of the tubes in the unit 1 and unit 2 main condensers.

Before working on the Limerick project, Mr. Wolters was on special assignment as team leader for a task force of senior Bechtel engineers assigned to provide a broad scope technical review of the WNP-2 BWR nuclear power plant design. The review was based on Bechtel experience in achieving fuel load, power ascension, and commercial operation status at plants recently licensed for commercial operation. The technical review encompassed the entire plant and included all engineering disciplines. The task force concentrated on those areas where design-related problems had adversely affected fuel load and power ascension programs at other plants.

On the Susquehanna Steam Electric Station (SSES) nuclear power plant project, Mr. Wolters was the General Services Agreement (GSA) project engineer responsible for engineering design activities for the Service and Administration Building modification and expansion. The work, which was mostly external to the power generating portion of the plant, included direct supervision of all engineering disciplines and coordination of the project with field construction personnel and client engineering forces.

R. A. WOLTERS

Before working on the SSES project, Mr. Wolters was project engineer for the final completion work for the balance of plant and support services for the Fast Flux Test Facility (FFTF), a 400 MWe liquid metal fast breeder reactor (LMFBR) nuclear plant at the Department of Energy Hanford Reservation, Richland, Washington. Previously on the FFTF project, he was mechanical group supervisor for final stages of the detailed plant design, responsible for the production of design documents and coordination with field construction and client personnel. Mr. Wolters began on the FFTF project as a senior mechanical engineer.

Previously, Mr. Wolters was employed by Hallanger Engineers, a consulting engineering firm, as a project engineer involved in the design, construction, and startup of petroleum refinery and chemical process plants. He was also employed by Hercules Incorporated, a chemical manufacturer, as a project engineer.

Mr. Wolters began his engineering career at Bechtel Corporation, Refinery and Chemical Division, as a construction field engineer.

PROFESSIONAL DATA:

Registered professional mechanical engineer and control systems engineer, California
Member: American Society of Mechanical Engineers, Institute of Electrical and Electronic Engineers, National Society of Professional Engineers, and California Society of Professional Engineers.

APPENDIX C
SUBCATEGORY REPORT OVERVIEWS

This appendix summarizes the findings and corrective actions for the 27 subcategories of the Engineering category. The discussions also address the significance of the findings and the causes apparent at this level.

<u>**Subcategory 20400, Engineering Organization and Operating Procedures**</u>

This subcategory addresses 36 employee concerns about the engineering organization and its operating procedures. The 36 concerns were itemized into 123 original issues and one peripheral issue and were assessed in 27 separate evaluations. Of the 124 issues, 59 were found not to be valid, and 51 valid issues had corrective actions implemented before the ECTG evaluation. The one peripheral issue required corrective action to be taken as a result of ECTG evaluation. There were 13 valid issues whose consequences were acceptable and required no corrective actions.

In summary, the negative findings resulting from the evaluation related to:

- Fragmented organization of the Office of Engineering Design and Construction, poor communication and interface control, untimely engineering response, untimely filling of vacant positions, untimely delineation of organizational interfaces and lines of communication, engineering functions divided between plant site and central engineering (SQN, WBN, BFN, and BLN)

- Instances where design drawings were incomplete and contained errors that resulted from deficiencies in design reviews are defined in elements of subcategories 22000, 22300, 22600, 25000, and 26600 (SQN, WBN, BFN, and BLN)

- A recent NRC IDI of the SQN unit 2 ERCW system and its supporting structures, identified various instances in which TVA's design reviews and verifications did not detect all unacceptable errors and omissions in design (SQN)

- Certain procedures (examples are cited in Subcategory 24600) for calculations lack sufficient detail and some procedures were not properly implemented (SQN, WBN, BFN, and BLN)

- Some piping bill of material drawings originated and checked by the same person (BFN)

- Some earlier insufficient training in the use of engineering procedures (BFN)

- Inadequate ECN procedures resulting in poor coordination between disciplines and with the site construction organization, and untimely closure of ECNs because of the lack of an adequate tracking program (SQN, WBN, BFN, and BLN)
- Poor quality vendor drawings, untimely vendor manual revision distribution, procedures not fully implemented (SQN, BFN, and BLN)
- No procedure for review and approval of vendor manuals (WBN)
- Poor communication between the Engineering branches and between Engineering and the other divisions resulting in a lack of proper design integration (SQN, WBN, BFN, and BLN)

The corrective actions implemented to resolve the negative findings are:

- Consolidate all nuclear activities within the Office of Nuclear Power; reorganize headquarters and site personnel, locate design and system engineers at the sites but with central engineering guidance for uniformity of design requirements (SQN, WBN, BFN, and BLN)
- In instances where design deficiencies were identified, the evaluation team either acknowledged in its technical element reports that corrective processes were in place, or corrective action tracking documents (CATDs) were issued to start the corrective action process
- Open deficiency items from the recent NRC IDI do not require ECTG CATDs; TVA will track their resolution and closure on CCTS (SQN)
- EA to develop, issue, maintain, and control quality related nuclear engineering procedures (SQN, WBN, BFN, and BLN)
- Issue PIR to address design verification of bill of material drawings (BFN)
- Implement NEPs 6.3, 6.4, 6.5, 6.6, and 6.7 to initiate the plant modification package (PMP) program to relieve the ECN problems (SQN, WBN, BFN, and BLN)
- Implement the requirements of ID-QAP-6.2, "Vendor Manual Control," to resolve vendor manual problems (WBN)
- Implement SQEP-39, "Review and Approval of Vendor Manuals/Revisions" (SQN)
- Complete and implement PI 87-48 which describes drawing restoration program (BFN)

- Close SCR GENERIC 8602 pertaining to vendor print legibility and quality and complete CCTS Item NCO-84-0067-006, which tracks the vendor manual program, to resolve vendor document problem (BLN)

- Develop and issue the Office of Nuclear Power (ONP) standard procedures to control interfaces with support organizations and establish management interfaces (SQN, WBN, BFN, and BLN)

No major technical issues or broader issues were revealed by this subcategory evaluation.

Subcategory 20600, As-Built Reconciliation

This subcategory addresses eight employee concerns about as-built drawing inaccuracies. The concerns were itemized into 17 original and four peripheral issues and assessed in four separate element evaluations. Of the 21 issues, four were found not to be valid and eight valid issues had corrective actions implemented before the ECTG evaluation. Five valid issues and the four peripheral issues uncovered during the investigation required corrective actions to be taken as a result of the ECTG evaluation.

In summary, the negative findings resulting from the evaluation related to:

- Deficiencies indicated by TVA and investigations by others in as-built drawings, configuration control, and the management and control of plant changes and plant change documentation (SQN, WBN, BFN, and BLN)

- Lack of procedures that specify a time limit between the time a physical change authorized by Engineering is made to a critical structures, systems, and components (CSSC) system and the time a formal drawing revision is issued to show that change (SQN, WBN, BFN, and BLN)

- No indication of which drawings in the Technical Support Center will be revised to reflect the as-built configuration of the plant (SQN, WBN, BFN, and BLN)

- Progress in the planned changeout of ERCW piping material from carbon to stainless steel not being transmitted to the rigorous analysis group in accordance with standard quality assurance practices and procedures (unique to SQN)

The corrective actions implemented to resolve the negative findings are:

- Implement Design Baseline and Verification Programs which include field walkdowns to verify as-built plant configuration (SQN, WBN, and BFN). BLN is implementing a single drawing system prior to construction completion thus avoiding discrepant sets of drawings

- Update control room drawings to latest configuration control drawings (SQN, WBN, and BFN)

- Modify procedures to require a time limit not to exceed 90 days between the time a physical change authorized by Engineering is made to a CSSC system and the revised engineering drawing is formally issued to reflect the change (SQN)

- Specify in the plant modification package (PMP) procedures the time limits for updating affected drawings at the completion of each modification, reflecting the as-built configuration (WBN)

- Revise site procedures to state the time limits for updating drawings to reflect plant changes (BFN and BLN)

- Implement organizational changes, program changes, and corrective actions to direct adequate management attention to all phases of plant changes (SQN)

- Update configuration and change control programs before unit 1 fuel load (WBN)

- Issue modification control procedure to keep drawings current after the design baseline effort is complete (BFN)

- Evaluate ERCW system changes for effects on the analysis and revise drawings to reflect as-built condition (unique to SQN)

No major technical issues resulted from the subcategory investigation.

The subcategory-level evaluation identified the broader issues of fragmented organization, inadequate communication, and lack of management attention.

<u>Subcategory 20800, Human Factors</u>

This subcategory addresses eight employee concerns about the manner in which TVA was conducting the control room design review program mandated by the NRC in NUREG-0700 and the corrective actions that resulted. The eight concerns were expressed in a general manner but developed into 25 issues and assessed in five separate element evaluations. Of the 25 issues, nine were found not to be valid. Of the 16 valid issues, 15 had corrective actions in various stages of implementation before the ECTG evaluation. One valid issue required corrective actions to be taken as a result of the ECTG evaluation.

In summary, the negative findings resulting from the evaluation related to:

- Completion of the detailed control room design review (WBN and BLN)

- Compliance with NUREG-0700 (WBN and BLN)