

EMPLOYEE CONCERNS SPECIAL PROGRAM

**VOLUME 5
WELDING CATEGORY
SUMMARY AND CONCLUSIONS**

**TVA
NUCLEAR POWER**



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EXECUTIVE SUMMARY

This report is a summary of the major findings, collective analysis of those findings, and corrective actions resulting from the evaluation of 453 employee concerns (430 safety related, 23 nonsafety related) assigned to the Employee Concerns Task Group Welding Category. The information presented herein is based on the issues evaluated as a result of these employee concerns and is not intended to address all aspects of the TVA nuclear welding program.

The employee concerns dealt with the adequacy of welding procedures and practices, the qualifications of welders and inspectors, and general and specific hardware discrepancies. These concerns addressed activities occurring prior to February 1986. The concerns were formed into elements (groups of related concerns that deal with a single or similar issue) for evaluation. The resulting issues were then grouped by their applicability to each TVA nuclear plant and are addressed by a plant-specific subcategory report for each nuclear plant.

The evaluations of the issues included reviews of applicable construction codes, TVA specifications and site implementing procedures, audit and evaluation reports, process control documents, and the concern descriptions. Interviews were conducted with cognizant personnel at the sites and at the division level. The evaluations were also based in part on the results of reinspection efforts at each of the plants.

Evaluations of welding issues have not identified any deficiencies that would have affected plant operability or threatened the health or safety of the public. Some welds were found not to meet specifications and required engineering evaluation to confirm their suitability for service. All welds that required evaluation were determined to be suitable for service.

The Welding Category Evaluation Group found that approximately 90 percent of the issues raised by the welding concerns either did not identify a problem that required corrective action, or had already been identified and corrected by TVA prior to their review by the Employee Concerns Special Program. Corrective actions have been identified to resolve remaining substantiated issues.

Assessment of the cumulative findings identified four areas of programmatic weakness; specifications and procedures, inspector performance monitoring, documentation of welder qualification, and communication between individuals and supervisors. Although these weaknesses did not appear to have caused specific welding deficiencies, their elimination

will significantly enhance the overall welding program. Actions to address these weaknesses were either already planned or implemented or were initiated in response to employee concerns evaluations.

The Welding Category Evaluation Group is confident that the concerns within its scope have been adequately evaluated, and that corrective actions completed, underway, or planned should eliminate any deficiencies identified as a result of evaluating the welding-related employee concerns.

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PREFACE

This report is one of a series prepared under the Employee Concerns Special Program (ECSP) of the Tennessee Valley Authority (TVA). The ECSP and the organization which carried out the program, the Employee Concerns Task Group (ECTG), were established by TVA's Manager of Nuclear Power to evaluate and respond to those Office of Nuclear Power (ONP) employee concerns filed before February 1, 1986 that related to TVA's nuclear power program. Concerns filed after that date are handled by the ongoing ONP Employee Concerns Program (ECP).

The ECSP addressed more than 5,800 employee concerns. Each of the concerns was a formal, written description of a circumstance or circumstances that an employee cited as inappropriate, inefficient, unjust, or unsafe. The scope of the ECSP was to thoroughly evaluate all alleged problems (issues) presented in the concerns and to report the results of those evaluations in a form accessible to ONP employees, the Nuclear Regulatory Commission (NRC), and the general public.

This preface contains background information on how the ECSP was initiated, descriptions of the categories to which concerns were assigned for evaluation, profiles of the Senior Review Panel members who provided independent oversight of the program, and information on feedback of program results to employees.

A HISTORY OF THE EMPLOYEE CONCERNS SPECIAL PROGRAM

In early 1985, a gap in communications between management and non-management employees at Watts Bar Nuclear Plant was recognized. After consultation with the NRC about this situation, the TVA Board of Directors directed that a far-reaching employee concerns program be implemented at Watts Bar. The Employee Concerns Special Program was established to thoroughly review employee concerns. To ensure that employees felt free to express their concerns without fear of retaliation, an independent contractor was selected to interview employees then assigned to Watts Bar.

Precautions were taken throughout the program to protect the identities of those who expressed concerns. The original records of the interviews remain in the custody of the interviewing contractor; the only other copies of these records are held by the NRC. Only the contractor and the NRC have had access to these files. The information provided to TVA was screened to maintain employee confidentiality.

Upon completion of the interview phase on February 1, 1986, 5,876 employees had been interviewed. Approximately one third of the employees (1,850) had expressed one or more concerns, resulting in approximately 5,000 individual employee concerns. Although TVA extended the program to employees at all Office of Nuclear Power sites through the use of mailers and a toll free telephone number, most of the concerns were from Watts Bar employees.

An Employee Concerns Task Group was established to carry out the program. The Task Group's concentration of qualified personnel and its comprehensive approach to problem resolution also made it the logical organization to resolve concerns and items gathered from several other sources. Therefore, the Task Group's responsibilities included the following:

- Concerns expressed during the contractor interviews.
- Concerns generated by earlier employee concern programs.
- Additional concerns identified from the interview files by the contractor and the NRC.
- Additional items identified by Task Group evaluators.
- Concerns received by the NRC before February 1, 1986, and referred to TVA.
- Concerns identified by TVA's former Nuclear Safety Review Staff.
- Open items identified from reviews of TVA incoming correspondence.

CATEGORIZATION OF CONCERNS

The concerns were grouped into nine categories to provide for consistent evaluation of related concerns. This also aided in identifying and developing corrective actions that addressed identified deficiencies specifically and programmatically to prevent recurrence. The responsibility for each category was assigned to a designated Category Evaluation Group. This responsibility included identification of the issues raised by the concerns, thorough investigation, determination of generic applicability and root causes of deficiencies, evaluation of Corrective Action Plans (CAPs) developed by the line organizations, and preparation of the program reports. In addition, the line organizations evaluated identified deficiencies for potential reportability to the NRC under Title 10 to the Code of Federal Regulations, Parts 50.55(e), 50.72, 50.73 and 21.

The concerns were grouped into the following categories:

- **Construction** - Concerns about the adequacy of construction practices, the quality of as-constructed facilities (excluding welding and as-designed features), in-storage and installed maintenance prior to turnover to operations, measuring and test equipment and handling of equipment used during construction, and construction testing activities. TVA personnel evaluated the concerns in this category.

- **Engineering** - Concerns about the adequacy of the design process and the as-designed plant features. The design process consists of the technical and management processes that commence with the identification of design inputs and lead to and include the issuance of design output documents. These concerns were evaluated by Bechtel Western Power Corporation.
- **Operations** - Concerns about operational activities, including operator qualifications, maintenance or equipment needs, security, health physics, and ALARA (as low as reasonably achievable) implementation, and concerns about preoperational and surveillance testing. Personnel from TVA and from Impell Corporation performed the evaluations in this category.
- **Material Control** - Concerns about the adequacy of material, including its procurement, receipt, handling, storage, and installation, and the adequacy of procedures governing material control. TVA personnel evaluated the concerns in this category.
- **Welding** - Concerns about any aspect of welding, including welder or weld procedure qualification, weld inspection/nondestructive examination, heat treatment, weld quality, filler material quality, and weld documentation. The welding concerns were evaluated by personnel from TVA and the EG&G Idaho Corporation.
- **Intimidation, Harassment, Wrongdoing, or Misconduct** - Concerns about personnel conduct that interferes with the ability of employees to fulfill their assigned responsibilities, unauthorized actions taken against employees for fulfilling their assigned responsibilities, and illegal activities or violations of TVA policies and regulations. Concerns in this category were transmitted by the Task Group to the Office of the Inspector General for evaluation.
- **Management and Personnel** - Concerns about the adequacy of policies, management attitude and effectiveness, organization structures, personnel management, and personnel training and qualification, except training and qualification covered by the Quality Assurance/Quality Control Category. These concerns were evaluated by TVA personnel and contracted consultants.
- **Quality Assurance/Quality Control** - Concerns about the adequacy of Quality Assurance/Quality Control programs and procedures (e.g., auditing; document control; records; deficiency reporting and corrective action; and inspection, except nondestructive examination and welding inspection) and the training, qualification, and certification of Quality Assurance/Quality Control personnel. The concerns in this category were evaluated by Stone & Webster Engineering Corporation.

- **Industrial Safety** - Concerns about the working environment and controls which protect the health and safety of employees in the workplace (excluding health physics and ALARA). TVA personnel and the DuPont Company - Safety Management Services evaluated these concerns.

Concerns that affected more than one category were assigned to multiple categories. In such cases, each category evaluated the concern from its specific point of view.

Each Category Evaluation Group sorted its assigned concerns into subcategories, according to the subject matter of the concerns, then into elements. An element is a group of related concerns that raise the same or similar issues. An issue is an alleged problem cited or implied, as interpreted by an evaluator, in one or more concerns. Concerns were evaluated according to the issues they raised. A comprehensive explanation of the evaluation and reporting process is contained in the introduction section of each category report and in the program summary report.

PROGRAM OVERSIGHT

The ECSP has been reviewed, audited, and inspected by the NRC, the TVA Office of the Inspector General, and the TVA Nuclear Quality Assurance Division. To provide additional independent and objective oversight, the TVA Manager of Nuclear Power established a Senior Review Panel of recognized experts within the nuclear power industry. Those selected had extensive backgrounds with experience in the design, construction, operation, quality assurance and safety evaluation of nuclear power plants.

The Senior Review Panel provided oversight to ensure that (1) the scope and depth of the evaluation effort was adequate, (2) the evaluation findings and conclusions were logically derived from the evidence, (3) the proposed CAPs adequately addressed identified deficiencies, and (4) the reports adequately described the evaluation effort, the evaluation findings and conclusions, and the measures taken to resolve the identified deficiencies.

Profiles of the Senior Review Panelists

Myer Bender

Querytech Associates Inc., Knoxville, Tennessee. Consultant on engineering practices for nuclear and advanced technology programs. More than 40 years of experience with complex technological activities including the Manhattan Project, and advanced nuclear fuel processing and waste management installations. Former Director of Engineering at the Oak Ridge National Laboratory and, for ten years, a Member of the NRC Advisory Committee on Reactor Safeguards (Chairman in 1977). Known for his work in standards, quality assurance, and system failure assessment.

James M. Dunford

Former startup readiness consultant for Three Mile Island. Former manager in the Naval Reactor Program. Former Vice President for Naval Reactor Plant Construction for New York Shipbuilding Corporation. Former Professor of Mechanical Engineering at the University of Pennsylvania. Nearly 50 years of experience in engineering management, material procurement, quality control, radiological control, construction, and training related to nuclear facilities.

Richard E. Kosiba*

Former Vice President for Quality and Technology, Babcock and Wilcox Company. Former manager in the Naval Reactor Program. Former Assistant Director (Plant Engineering) for the Atomic Energy Commission. Forty years of experience in the design, manufacturing, research and development, testing, operation, and maintenance of nuclear plants.

Joseph C. LaVallee, Jr.

Former Nuclear Project Manager for Sargent and Lundy. Twenty-five years experience in project management, licensing, construction, design, and operation of nuclear power facilities.

Daniel L. Garland*

Former Manager, Nuclear Quality Assurance Program Office for Westinghouse Hanford Company. While at Westinghouse, assisted Department of Energy in developing Quality Assurance standards and programs. Thirty years of experience in the quality assurance of nuclear plants, including preparation of plans, procedures, and manuals; indoctrination and training of personnel; and participation in more than 400 quality assurance audits, frequently as audit team leader.

James R. McGuffey* (Deceased)

Over 40 years experience in ASME Code fabrication work, specialty welding practices, materials technology, and quality assurance methodology. Former Director of Quality Assurance and Inspection for the Oak Ridge National Laboratory.

*These members served on the panel for part of the duration of the program.

QUESTIONS ABOUT CONCERNS

How to Find a Concern

These category reports and their appendices are intended to inform the concerned individual as to how his or her concerns were addressed. These reports summarize the Employee Concerns Task Group's investigations, findings, and line management identified corrective actions. In most cases the concerned individual should be able to identify the resolution of the issue associated with his/her concern using the following steps:

1. Determine which category would contain the concern. A list of the categories begins on page ii of this preface.

2. Review the category report identified in step 1, above. In particular, review the "Category Assessment" and "Conclusions" sections and the appendix titled "Subcategory Report Overviews."

A process has been developed which will permit employees to obtain additional information concerning their specific concern. As has been the case throughout this program, this will be done in a manner that ensures the confidentiality of the individual. Details of this process will be made available coincident with the release of these category reports.

What to Do If You Believe Your Concern Has Not Been Adequately Addressed

The Employee Concerns Task Group has made an intensive effort to thoroughly evaluate and report on all the issues raised by the concerns. In some cases, adequate information may not have been available to properly evaluate your concern or the concern may have been misinterpreted by the Task Group. Any employee who believes that his/her concern has not been adequately addressed by the ECSP is requested to bring this to TVA's attention by taking the question to the Employee Concerns Program site representative.

1.0 INTRODUCTION

The Welding Category of the Employee Concerns Special Program evaluated 453 employee concerns (430 safety-related, 23 non-safety related). These concerns raised 179 issues related to the adequacy of welding procedures and practices, qualifications of welders and inspectors, and general and specific hardware discrepancies.

This category report represents the cumulative results of the welding-related employee concerns evaluations. It summarizes the evaluations in each subcategory and assesses the collective findings for their impact on the welding program and the welded hardware.

Because most of the concerns were potentially applicable to more than one site, 266 separate evaluations were conducted among the four TVA nuclear sites (Browns Ferry Nuclear Plant, Bellefonte Nuclear Plant, Sequoyah Nuclear Plant, and Watts Bar Nuclear Plant). Detailed results of these evaluations appear in four site-specific subcategory reports and in a series of supporting evaluation reports. These reports are listed in Appendix A, Welding Category Table of Reports.

The weaknesses in the welding program identified through the investigation of the concerns within this category and those actions, either planned or taken, to correct these weaknesses are presented within this report.

It should be noted that this report is not intended to serve as a detailed evaluation of all aspects of the TVA welding program. The findings presented herein are based solely on the 453 employee concerns assigned to the Welding Category Evaluation Group.

1.1 Background

To fully understand this report, it is important for the reader to understand the relationship of the Welding Category of the ECSP to the other ongoing TVA welding evaluation programs.

1.1.1 TVA Welding Project

During the course of TVA's construction work on its nuclear plants, conditions involving TVA's welding program which did not meet industry and/or regulatory standards were identified. On October 29, 1985, the Nuclear Regulatory Commission (NRC), in a letter requesting a meeting with TVA to discuss welding program concerns, supplied a listing of correspondence that contained a number of questions and comments about TVA welding issues.

In addition, the Employee Concerns Special Program instituted at Watts Bar in early 1985 brought out questions from TVA employees as to the adequacy of TVA's welding activities.

After assessing the above matters, TVA concluded that additional reviews were needed to determine the adequacy of the overall TVA welding program. As a result, the Welding Project was formed within the Division of Nuclear Engineering. Its function was to resolve these welding issues and determine the actions necessary to ensure that future welding activities are in accordance with TVA commitments.

The Welding Project had the responsibility to verify that existing welds in structures, piping systems, and components are adequate to meet TVA commitments, appropriate codes, and regulatory requirements. The Welding Project was to examine TVA's welding program and determine if any remedial actions are needed.

The overall Welding Project results will be reported in a series of reports for each TVA nuclear site. This study is scheduled for completion in December 1988.

1.1.2 U. S. Department of Energy/Weld Evaluation Project (Watts Bar)

To provide greater assurance of the integrity of the Watts Bar plant, TVA initiated a separate program to review its welds. The U. S. Department of Energy/Weld Evaluation Project (DOE/WEP) was formed in December 1985 as the result of an interagency agreement between the U. S. Department of Energy and TVA. This project was assigned by the U. S. Department of Energy in conjunction with TVA to EG&G Idaho, Inc., for implementation. The DOE/WEP was asked to perform an independent evaluation of the TVA welding program and the as-constructed weld quality of safety-related welds at Watts Bar Nuclear Plant Unit 1.

1.1.3 Employee Concerns Special Program (ECSP) Welding Category Evaluation Group

The Weld Task Group at Watts Bar was responsible for both the ECSP Welding Category evaluations and the DOE/WEP activities. The ECSP Welding Category Evaluation Group functioned as part of the Weld Task Group. This arrangement permitted the evaluation of employee concerns in conjunction with the overall TVA Welding Project.

1.2 Evaluator Qualifications

Employee concern evaluations and subsequent analyses of findings in the Welding Category were performed by a team of qualified evaluators under the direction of the Welding Category Evaluation Group Head.

The Welding Category Evaluation Group Head, who has a B.S. in Mechanical Engineering, is a Senior Materials Engineer in the TVA Mechanical and Nuclear Steam Supply Source Surveillance Group, and has 16 years experience in the Nuclear industry.

Evaluations were performed principally by a team that included welding quality engineers and mechanical/welding quality supervisors provided by an outside contractor (Fluor Daniel). The team also included individually selected TVA managers from the Engineering and Construction Divisions.

A brief profile of the education and experience of each member of the Welding Category Evaluation Group may be found in Appendix B to this report.

1.3 Evaluation Process

1.3.1 General Methodology

The starting point for the evaluations in the Welding Category was a review of the 453 welding related employee concerns. Prior to beginning the investigations, the concerns were divided by subject matter into groups of related issues or elements. Each group of issues formed one of the elements, to be addressed separately for each of the four TVA nuclear plants.

Though most of the concerns were related to the Watts Bar Nuclear Site, the questions raised by these concerns were largely programmatic. Thus, a potential for generic applicability to plants other than the plant of origin existed for most of the issues. In such cases, issue evaluations were performed at each site.

The results of the issue evaluations were reported in a series of four subcategory reports, one for each nuclear site. The subcategory findings were then combined and evaluated to produce the overall evaluation of the employee concerns within the Welding Category. The results are presented in this category report. Each step of the evaluation process is explained below.

1.3.2 Element Evaluation Process

At the element level, the concerns were evaluated by Employee Concerns Special Program personnel assigned to the Weld Task Group. The text of each of the employee concerns was reviewed to determine the issue or issues it contained. Similar issues were combined into elements.

The evaluators reviewed the applicable construction codes, TVA specifications and site implementing procedures, audit reports, deficiency reporting documents, and the regulatory enforcement history. Where applicable, process control documents and personnel qualification records pertinent to the issues were also reviewed.

Interviews were conducted with personnel who had knowledge of or responsibility for the items being evaluated. In some cases, the Welding Project Phase II reinspection results related to the issues and were considered in the evaluations. The results of previous investigations by the Quality Technology Company and/or the Nuclear Safety Review Staff were also used.

Findings requiring corrective action were forwarded to the responsible line managers. Corrective Action Plans (CAPs) were developed by the line and submitted to the Welding Category Evaluation Group Head for concurrence.

1.3.3 Subcategory Evaluation Process

Subcategory reports were prepared for each of the four TVA nuclear sites. These reports contain the results of the site element investigations, including element-level corrective actions where required. Each concern assigned to the Welding Category is addressed as part of an element evaluation in one or more of the four subcategory reports.

Problems identified through the element evaluations were systematically analyzed on the subcategory level to detect recurring symptoms of broader problems and their underlying root causes not evident at the element level.

1.3.4 Category Evaluation Process

At the category level, the cumulative findings were assessed for indications of programmatic weaknesses and their root causes. Identified weaknesses and causes were referred to appropriate management for resolution.

2.0 SUBCATEGORY DESCRIPTIONS AND NOTABLE ISSUES

This section presents a summary of the results of the evaluations at each TVA nuclear site. As a result of generic applicability, many of the concerns were evaluated at more than one nuclear plant. Also, the most significant issues and highly publicized issues are briefly discussed to provide a background for the category assessment provided in Section 3.0. A more detailed summary of the findings and corrective actions resulting from the evaluation of the employee concerns may be found in Appendix C, Subcategory Report Overviews.

2.1 Subcategory Descriptions

2.1.1 Subcategory 50100, Browns Ferry Nuclear Plant

This subcategory addressed 30 issues raised by 63 employee concerns dealing with the adequacy of welding procedures and practices, the qualification of welders and inspectors, and the quality of welding at Browns Ferry. Twenty of the 30 issues were unsubstantiated. Seven of the 30 issues were factual but did not represent a problem because the practice in question was in accordance with TVA's commitments and appropriate criteria. Two issues were factual, but appropriate action had been taken by TVA management prior to the employee concerns evaluation. The remaining issue, which questioned the adequacy of instrument piping support welds if they were inspected to today's criteria, was factual and required corrective action.

2.1.2 Subcategory 50200, Bellefonte Nuclear Plant

This subcategory addressed 37 issues raised by 79 employee concerns dealing with the adequacy of welding procedures and practices, the qualification of welders and inspectors, and the quality of welding at Bellefonte. Twenty-six of the 37 issues were unsubstantiated. Eight of the 37 issues were factual but did not represent a problem because the practice in question was in accordance with TVA's commitments and appropriate criteria.

The last three issues were factual but corrective action had been taken by TVA management prior to the employee concerns evaluation.

2.1.3 Subcategory 50300, Sequoyah Nuclear Plant

This subcategory addressed 57 issues raised by 146 employee concerns dealing with the adequacy of welding procedures and practices, the qualification of welders and inspectors, and the quality of welding at Sequoyah. Thirty-five of the 57 issues were unsubstantiated. Eleven of

the 57 issues were factual but did not represent a problem because the practice in question was in accordance with TVA's commitments and appropriate criteria. Two of the 57 issues were factual but corrective action had been taken by TVA management prior to the employee concerns evaluation.

Nine of the 57 issues were factual and required action to be taken. One additional action was required to address a peripheral issue identified by evaluators.

2.1.4 Subcategory 50430, Watts Bar Nuclear Plant

This subcategory addressed 142 issues raised by 390 employee concerns dealing with the adequacy of welding procedures and practices, the qualification of welders and inspectors, and the quality of welding at Watts Bar. Sixty-six of the 142 issues were unsubstantiated. Thirty-one of the 142 issues were factual but did not represent a problem because the practice in question was in accordance with TVA's commitments and appropriate criteria. Twenty-two of the 142 issues were factual but corrective action had been taken by TVA management prior to the employee concerns evaluation.

Twenty-three of the issues were factual and required action to be taken. Twenty of these require hardware inspections in unit 2, which will be performed in conjunction with the Welding Project Unit 2 Reinspection. Corrective Action Tracking Documents (CATDs) have been initiated to ensure that the inspections are performed, the inspection results are evaluated, and any necessary corrective action is accomplished.

One additional issue (welds which appear to be undersized) was identified through observation by an evaluator while performing an investigation of an unrelated issue. The CAP provides for inspection of the suspect welds.

2.2 Notable Issues

Five major well-known issues were initially perceived to identify significant deficiencies in the TVA welding program. The five major issues evolved from 180, or 40 percent, of the total 453 welding related concerns. These issues were evaluated at each of the four sites.

2.2.1 Performance of Pre-Welding Inspections on Structural Steel

A total of 24 Employee Concerns addressed the pre-weld fitup inspections on structural steel. The basis of this issue is the TVA practice of allowing weld foremen, who are responsible for production, to verify that structural steel members are correctly fitted prior to welding.

As the Process Specification changes were instituted at each TVA nuclear site, the proper communications did not precede or accompany these changes to the site procedures. This lack of adequate communication resulted in some individuals erroneously believed that the changes were a violation of TVA's commitments.

The changes to the TVA Process Specification that allowed weld foremen to perform pre-weld fitup verification and the Quality Inspectors to verify pre-weld fitup inspections on an in-process surveillance basis was initially challenged at the Bellefonte Nuclear Plant through audit finding BN-W-80-80 in 1980. The audit finding was determined to be significant and was reported to the NRC as a potential 10 CFR 50.55(e) condition.

In response to the above audit finding, an extensive investigation and evaluation of the governing codes and standards was performed by TVA's Quality Assurance Group to determine what corrective action, if any, was required. The investigation determined that TVA's practices were in accordance with governing codes and standards.

2.2.2 Inspection of Welded Structural Connections Coated with Primer

A total of 14 Employee Concerns addressed the inspection of structural steel welded connections that were coated with primer (carbo-zinc). The issue evolved from a process specification unique to Watts Bar that allowed certain reinspections for weld size, length and location to be performed on welds which had been primer coated. This issue was initially questioned by the TVA Nuclear Safety Review Staff. Upon completion of an investigation, the practice was found to be acceptable because the original quality inspection of weld attributes was done prior to coating with primer.

The process specification that allowed the inspection of welds through carbo-zinc was issued in January 1982 and was deleted in September 1983. The weld inspection performed under this process specification was a reinspection of welds that had been previously inspected for the quality attributes required by the governing codes. The reinspections were to measure weld size, length, and location and were performed as part of sampling plans to resolve Nonconformance Reports.

The Process Specification that allowed reinspection of primed welds was poorly written. Consequently, the specification was interpreted by some concerned individuals as allowing initial inspections to be performed on coated welds. However, the specification was intended, and used, only for specific reinspection programs.

2.2.3 Welding Electrode Control

A total of 38 Employee Concerns addressed welding electrode control. The principal issues were the traceability of the electrodes to ensure that only the specified welding materials were used and the requirement for the protection of coated electrodes to prevent the absorption of moisture from the atmosphere.

The traceability of welding filler material in TVA's nuclear program has been and continues to be in compliance with TVA's stated commitments. The American Society of Mechanical Engineers code rules allow filler material traceability through the use of heat or lot numbers or the use of a control procedure to ensure that only the specified welding filler material is used. Bellefonte Nuclear Plant maintains traceability through the use of heat or lot numbers, and the remaining TVA nuclear plants used a control procedure to ensure that only the specified welding filler material was used. The concerns that raised this issue resulted from differences between the Bellefonte practice and that of the other plants.

The American Welding Society revised the Structural Welding Code in 1979 to allow alternative atmospheric exposure time periods for coated electrodes, provided the user established the maximum atmospheric exposure time by performing qualification tests prescribed by the American Welding Society. TVA incorporated these changes into the General Construction Specification G-29 Process Specification 1.M.3.1. Each site in turn revised its procedures to provide maximum atmospheric exposure times (based on qualification tests) for coated electrodes. Employees questioned the process when the procedures were changed and the welding electrodes were issued without portable ovens. It is apparent that many of the individuals who asked the questions about the validity of the procedural change were not satisfied. Some people did not receive accurate information or, in some cases, chose not to believe the information provided by the project and elected to voice their concerns through the Employee Concerns Program.

The issue level evaluations and the subcategory analyses determined that welding electrode control is in accordance with the applicable construction codes at all TVA nuclear plants.

2.2.4 Inspector Qualification

A total of 35 Employee Concerns addressed the Welding Inspector Qualification at WBN. Several employees expressed concerns that the structural weld inspectors had insufficient training and/or experience.

Prior to 1981, the TVA program did not recognize visual weld inspection as a separate area of certification. Rather, the inspections were performed by personnel with other certifications, principally by those certified for the surface nondestructive examination processes. Inspectors were required to qualify to individual site implementing procedures.

In 1981, the Division of Nuclear Construction established visual weld inspection as a separate area of certification. Education, training, experience and examination requirements were established using the American Society of Nondestructive Testing Recommended Practice SNT-TC-1A as a guide.

As personnel were trained and certified specifically for visual weld inspection, some concerned individuals erroneously concluded that previous visual inspections had been performed by untrained and uncertified inspectors. Also, changes to the training program may have contributed to perceptions that the inspector qualification program was inadequate.

Nevertheless, from the beginning of construction the training and qualification of welding inspectors meets the TVA commitment to NRC Regulatory Guide 1.58, Revision 1, as reflected by the Quality Assurance Topical Report TVA-TR75-1A.

2.2.5 Welder Qualification Continuity

A total of 69 Employee Concerns addressed the Welder Qualification Continuity Program. At issue were the methods used to verify that welders had actually used the processes in which they were qualified within the time limits mandated by the construction codes.

Many of the Employee Concerns within this issue originated from the stop work order issued in August 1985 that stopped all safety related welding at Watts Bar as a result of a NRC investigation. Subsequent investigations identified problems in the implementation of the Welder Continuity Program. Problems involved from a large number of welders who held welder performance qualifications but were not actively welding, misinterpretation of timeframe requirements for updating qualifications,

and updating the continuity records with the date the record was presented rather than the date of the last verified use of the welding process.

TVA acknowledged that a problem existed in the implementation of the Welder Qualification Continuity Program. This was addressed through a stop work order that curtailed all welding at Watts Bar, and subsequently through Nonconforming Condition Reports. Problems in this area at Watts Bar Nuclear Plant had been previously addressed and corrected prior to this investigation. The site procedures were revised to strengthen the requirements for control and documentation of welder qualification continuity activities. The revision to the site procedure required witnessing the welding process, life of plant documentation of process usage, and correct timeframe requirements for updating qualifications.

Training was conducted to ensure that all personnel involved with the welder qualification program were thoroughly familiar with the requirements for maintenance and understood the importance of accurate documentation of all quality functions.

Due to the impact of the stop work order on the project and the ensuing efforts to reestablish the welder's continuity, (through the administration of 1,080 tests performed by 533 welders) virtually all employees at Watts Bar became aware of the problems concerning the Welder Qualification Continuity Program. Some people did not receive accurate information or, in some cases, chose not to believe the information provided by the project and elected to voice their concerns through the Employee Concerns Program.

Sequoyah is in the process of changing the Final Safety Analysis Report to reflect the actual practices, which are and were in accordance with the 1971 Edition of the American Society of Mechanical Engineers. The Welder Qualification Continuity Program at Sequoyah is and was in compliance with the American Society of Mechanical Engineers and the American Welding Society Codes.

3.0 CATEGORY ASSESSMENT

The cumulative results of evaluations of welding issues were assessed for indications of programmatic weaknesses and root causes. Weaknesses and causes identified by the category assessment were further evaluated to determine the extent to which they were being addressed by improvement programs already in progress and whether additional action was needed. Items judged to require additional action were referred to appropriate management for resolution.

3.1 Specifications and Procedures

The system of general construction specifications, with their attached process specifications, and the site implementing procedures are cumbersome and often difficult to follow. Site procedures often make reference to the upper-tier process specifications rather than providing specific instructions for task performance. It is often difficult to determine which process specification should be used in a given application. In some cases, several procedures are required to perform a single activity.

Another aspect of the specification and procedure difficulties was a lack of clarity of upper-tier requirements. The extent of commitment to national standards and regulatory guides has in some cases been unclear, due to ambiguously worded exceptions in the Quality Assurance Topical Report TVA-TR75-1A. These ambiguities were ultimately reflected in specifications and procedures derived from upper-tier requirements documents.

The extent of commitment to the various national standards and regulatory guides related to welding has been clarified in the Quality Assurance Topical Report TVA-TR75-1A Revision 9. The Nuclear Performance Plan, Volume 1, Section VI.C establishes the improvement and standardization of procedures within the Office of Nuclear Power as a performance improvement objective. Action is underway to restructure the procedure system to provide clearly defined lines of responsibility and to provide the detail necessary to perform specific tasks. The upper-tier standards that define the welding program for the Division of Nuclear Construction are nearing completion. When these standards are issued the Nuclear Procedures Branch will assist the line organizations in developing the associated implementing procedures.

3.2 Welding Inspector Performance Monitoring

There was no uniform system for monitoring welding inspector performance at all TVA nuclear sites. A system is needed to provide a documented, continuing high level of confidence in the performance of welding inspectors and to provide early identification of adverse trends.

In response to this finding, TVA is instituting a system, under which randomly selected and previously accepted welding as well as NDE inspections/examinations are reinspected by certified Level III NDE engineers for adequacy. TVA is modifying its existing Preservice and Inservice Inspection Level III surveillance program Quality Methods Instruction (QMI) 555, "Surveillance of Nondestructive Examination (NDE) Personnel," to include welding in addition to NDE inspection/examinations. The new system will monitor the performance of inspection activities on a sampling basis to ensure that welding inspection/examinations are being performed to established requirements and acceptance criteria are being met. This practice will improve TVA programs for ongoing inspections.

3.3 Documentation of Welder Qualification

A review of past deficiency reports shows recurring problems with welder qualification and qualification continuity. These instances were, in most cases, traced to documentation errors and misplaced files. The welders in question were actually qualified for the work being performed, although the current records did not show this

The Division of Nuclear Construction is developing methods to standardize various elements of the welding program. Among the program elements to be standardized is the program for maintenance and documentation of welder qualification continuity. This program will be described through the issuance of an Office of Nuclear Power Standard on welding which is sponsored by the Division of Nuclear Construction.

3.4 Communication Between Individuals and Supervisors

A problem is indicated in communication between individuals and their supervisors. This communication problem is especially apparent where program changes constitute a significant departure from past practices or procedures. Individuals had apparently been instructed in the letter, but not the intent or reason for various welding-related practices and procedures.

Many of the employee concerns appear to have stemmed partly from employee uncertainty as to what procedures and practices were acceptable or required. Employees often received conflicting interpretations of requirements, giving an erroneous impression that commitments were not being met.

This subject is addressed in Section II of the Site Nuclear Performance Plans. These plans stress open communication between supervisors and employees, and the importance of employees providing feedback of their questions, concerns, and ideas. Implementation of the Nuclear Performance Plan at each of the sites will resolve this weakness.

4.0 CONCLUSION

The Welding Category evaluated 453 employee concerns at one or more of the four TVA nuclear sites. Because many of the 179 issues raised by these employee concerns were determined to be potentially applicable to multiple sites, the actual number of issue evaluations conducted was 266. Actions were identified to correct specific deficiencies and to improve several programs. The responsible organizations have provided acceptable corrective action plans for each of the identified deficiencies.

Evaluations of welding issues have not identified any deficiencies that would have affected plant operability or threatened the health or safety of the public. Some welds were found not to meet specifications and required engineering evaluations to confirm their suitability for service. All welds that required evaluation were determined to be suitable for service.

Assessment of the cumulative findings resulted in the identification of four programmatic weaknesses. These weaknesses were related to:

- Specifications and Procedures
- Inspector Performance Monitoring
- Documentation of Welder Qualification
- Communication Between Individuals and Supervisors

Adequate actions to address these weaknesses were either already planned or implemented or were initiated in response to these findings.

During the ECSP effort, the Welding Project reinspections were being performed by the U.S. Department of Energy/Weld Evaluation Project at Watts Bar, and by TVA at the other three sites. In addition, the DOE/WEP specifically addressed a number of the hardware related issues evolving from the ECSP. The results of the DOE/WEP evaluations, as they relate specifically to the employee concerns program, have been included in the element level investigations and the subcategory reports of this program.

The DOE/WEP report states in part: "The DOE/WEP ... evaluated the 472 ECs that involved the TVA-performed safety-related weld issues at WBNP-1 and determined that 451 (95.6%) could not be specifically confirmed. Three out of twenty-one confirmed ECs had been previously identified and resolved, or included in the TVA quality assurance nonconformance system for resolution. Three ECs (HVAC ductwork inspection) are part of a TVA corrective action plan for the HVAC systems and one (thermocouple lugs) is part of a TVA corrective action plan for documentation on installation and/or removal of temporary attachments. The remaining welds identified

by 14 ECs are in compliance with the applicable code and required no corrective action. Although the EC welding issues were numerous and potentially significant, upon evaluation, they did not identify any specific unsuitable for service components in the plant."

Although the Welding Category evaluated 453 employee concerns and DOE/WEP evaluated 472 employee concerns, all 472 concerns were evaluated by the Employee Concerns Special Program. The employee concerns not evaluated by the Welding Category were evaluated by other appropriate categories. These included welding-related issues that dealt with QA/QC practices, intimidation and harassment, engineering practices and design, and management and personnel.

The Welding Category Evaluation Group is confident that the issues raised by the concerns within its scope have been adequately evaluated and that the corrective actions identified should eliminate any deficiencies.

APPENDIX A
WELDING CATEGORY TABLE OF REPORTS

Volume 5, Welding Category, consists of 97 separate reports: one category report; four subcategory reports; 41 ECSP element reports specific to Sequoyah; and 51 Welding Project Evaluation Reports specific to Bellefonte, Browns Ferry, and Watts Bar. Each report within Volume 5 is identified below.

PART	REPORT TYPE AND NUMBER	TITLE
50000	Category Report 50000	Category Summary and Conclusions
50100	Subcategory Report 50100	Browns Ferry Nuclear Plant

Welding Project Evaluation Reports

50101	WP-01-BFN	Control of Welding Filler Material
50102	WP-02-BFN	Inspection of Welds Through Carbo-Zinc
50103	WP-03-BFN	Welder Qualification and Continuity
50104	WP-04-BFN	Inspection Tools
50106	WP-06-BFN	Inspector Training and Certification
50107	WP-07-BFN	Welder Training and Experience
50111	WP-11-BFN	Surface Grinding of Welds
50113	WP-13-BFN	Welding Equipment
50116	WP-16-BFN	Structural Steel Preweld Inspection
50124	WP-24-BFN	Welder Qualification
50125	WP-25-BFN	Weld Repairs Not Meeting ASME Code Requirements
50132	WP-32-BFN	Adequacy of Structural Support Welds
50135	WP-35-BFN	Weld Inspection Procedures
50200	Subcategory Report 50200	Bellefonte Nuclear Plant

Welding Project Evaluation Reports

50201	WP-01-BLN	Control of Welding Filler Material
50202	WP-02-BLN	Inspection of Welds Through Carbo-Zinc Primer
50203	WP-03-BLN	Welder Qualification Continuity

50204	WP-04-BLN	Inspection Tools
50206	WP-06-BLN	Inspector Qualification
50207	WP-07-BLN	Welder Training/Experience
50210	WP-10-BLN	Implementation of QAE-2
50213	WP-13-BLN	Welding Equipment and Bottled Gases
50216	WP-16-BLN	Structural Steel Preweld Inspections
50234	WP-34-BLN	Weld Quality
50235	WP-35-BLN	Weld Inspection Procedures
50236	WP-36-BLN	Weld Repairs
50243	WP-43-BLN	Adequacy of Procedures
50300	Subcategory Report 50300	Sequoyah Nuclear Plant

Welding Project Evaluation Reports

50301	WP-01-SQN	ASME Welding Material Control, Traceability, Accountability, and Conditioning
50302	WP-02-SQN	Inspection of Welds Through Paint
50303	WP-03-SQN	Welder Performance Qualification Continuity
50304	WP-04-SQN	Availability of Weld Inspection Tools
50305	WP-05-SQN	Duct Installation and Documentation Requirements
50306	WP-06-SQN	Training and Certification of Construction and Nuclear Operations
50307	WP-07-SQN	Welder Training Program for Construction and Nuclear Operations
50308	WP-08-SQN	Painting Requirements Related to Welds
50309	WP-09-SQN	Weld Inspection Criteria Used for SQN Construction
50310	WP-10-SQN	SQN Implementation of QAE-2
50311	WP-11-SQN	Surface Grinding of Welds
50312	WP-12-SQN	Welding Electrode Quality
50313	WP-13-SQN	Suitability of Welding Equipment for Construction & Modifications Welding Activities
50314	WP-14-SQN	Administrative Policy
50315	WP-15-SQN	Design Consideration on Box Anchors
50316	WP-16-SQN	Performance of Preweld Inspections
50317	WP-17-SQN	Vendor Weld Quality
50318	WP-18-SQN	Effects of Laminations on Weld Quality

50319	WP-19-SQN	WBN Concerns with no Generic Applicability to SQN
50320	WP-20-SQN	Undersized Socket Welds on the Safety Injection System
50321	WP-21-SQN	Weld Material Substitution and Quality
50322	WP-22-SQN	Inadequate Weld Procedure
50323	WP-23-SQN	Control of Unused Weld Material
50324	WP-24-SQN	Improper Welding Certification
50325	WP-25-SQN	Effect of Weld Repairs Not Meeting ASME Codes

The following are investigative reports that were performed to evaluate employee concerns prior to the formation of the Employee Concerns Special Project. The Welding Category has evaluated and adopted these reports as a part of this effort:

I-86-115-SQN	Craft Welder Incapable of Making Proper Welds
I-85-135-SQN	Welder Certification Updated Without Meeting Requirements
I-85-346-SQN	QC Holdpoint Signoff Violation
I-85-373-NPS	Documentation of Required On The Job Training for Nondestructive Personnel Certification
I-85-560-SQN	Box Hanger Weld Design Deficiency
I-85-636-SQN	TVA Manufacture of a Dravo ASME-Class Spool Piece
I-85-652-SQN	Sequoyah Weld Inspections Not As Strict As Watts Bar
I-85-735-SQN	NDE Inspectors Cannot Write Notice of Indication for Preservice-Related Defects
I-85-738-SQN	Acceptance of Previously Rejected NDE Items
I-85-750-SQN	Performance of Remote Visual Inspections of Rigid Pipe Support
I-85-756-SQN	Improper Weld Rod Used in D/G Building
I-85-776-SQN	Socket Welds Not Inspected
XX-85-013-00	Weld Rod Was Used to Weld 316 Stainless Steel Pipe
XX-85-088-003	Altered Welding Certification
XX-85-100-001	Welds May Have Been Repaired Improperly
XX-85-101-006	Welder Performed Welds Without Having the Proper Certification

50400

Subcategory Report 50400

Watts Bar Nuclear Plant

Welding Project Evaluation Reports

50401	WP-01-WBN	Control of Welding Filler Material
50402	WP-02-WBN	Inspection of Welds Through Carbo-Zinc Primer
50403	WP-03-WBN	Welder Performance Qualification Continuity
50404	WP-04-WBN	Availability of Weld Inspection Tools
50405	WP-05-WBN	Safety Related Duct Installation and Documentation Requirements
50406	WP-06-WBN	Inspector Qualification and Training
50407	WP-07-WBN	Welder Training Program for Construction and Nuclear Operations
50412	WP-12-WBN	Quality of Welding Filler Material
50413	WP-13-WBN	Suitability of Welding Equipment
50414	WP-14-WBN	Administrative Policy
50416	WP-16-WBN	Structural Steel Preweld Inspections
50422	WP-22-WBN	Improper Welding of Dissimilar Metals
50424	WP-24-WBN	Welders Performance Qualification
50425	WP-25-WBN	Weld Repairs Not In Accordance With the ASME Code
50426	WP-25-WBN	Inaccurate/Inadequate Documentation
50430	WP-30-WBN	Base Metal Damage
50432	WP-32-WBN	General Welding Concerns Related to Unit 2
50433	WP-33-WBN	Adequacy of TVA Performed Radiographic Examinations
50434	WP-34-WBN	Structural Welding in the Main Steam Valve Rooms
50441	WP-41-WBN	Weld Sampling Program
50442	WP-42-WBN	Use of E6010 Electrodes
50443	WP-43-WBN	Welding Inspection Programs and Procedures
50444	WP-44-WBN	Weld Joints Slugged or Improperly Beveled
50445	WP-45-WBN	Nuclear Steam Supply System Support Welds
50446	WP-46-WBN	General Welding Concerns Related to Unit 1, Units 1 and 2, and Common Areas

APPENDIX B EVALUATOR PROFILES

James Lewis, Category Evaluation Group Head

Senior Materials Engineer, TVA Mechanical and NSSS Section, Source Surveillance Group, Division of Nuclear Quality Assurance. B.S. in Mechanical Engineering, Tennessee State University. Over fifteen years experience in Quality Assurance, Quality Engineering and Quality Inspection related to mechanical and nuclear steam supply system components.

Richard Schofield, Evaluator

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Ira James, Evaluator

Senior Quality Supervisor, Mechanical and Welding, Fluor Daniel Corp. Associate Degree in Applied Science, Enterprise State Junior College. Over 37 years maintenance management and inspection experience. Over 12 years nuclear experience in Quality Inspection, Quality Assurance, and Quality Engineering.

Lamar Thompson, Evaluator

Senior Quality Supervisor, Mechanical and Welding, Fluor Daniel Corp. Over 30 years experience in maintenance management and inspection activities. Over 11 years nuclear experience in Quality Inspection, Quality Assurance, and Quality Engineering.

Ed Shevlin, Evaluator

Senior Quality Supervisor, Mechanical and Welding, Fluor Daniel Corp. Over 30 years experience working in mechanical maintenance and welding related areas. Over ten years nuclear experience in Quality Inspection, Quality Assurance, and Quality Engineering. AWS Certified Welding Inspector.

Bobby Pate, Evaluator

Quality Supervisor, Mechanical and Welding, Fluor Daniel Corp. Over 25 years experience working in mechanical maintenance and welding related areas. Over 5 years nuclear experience in Quality Inspection, Quality Assurance, and Quality Engineering.

Albert Z. Napier, Evaluator

Quality Supervisor, Welding, Fluor Daniel Corp. Over 20 years experience in Quality Inspection. Over 13 years nuclear experience in Nondestructive Examination, Quality Inspection, Quality Assurance, and Quality Engineering. AWS certified Welding Inspector.

Charles E. Hackney, Evaluator

Construction Quality Engineer, Fluor Daniel Corp. Associate Degree in Science, Welding Engineering Technology. Over fourteen years nuclear experience in Quality Assurance, Quality Inspection, and Quality Engineering.

Gary Pitzl, Evaluator

Assistant Branch Chief, Materials Technology Branch, TVA. M. S. Degree in Metallurgical Engineering. Over 16 years in Nuclear Engineering and Operations Support.

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Acting Manager of the Weld Engineering Group, Field Services Branch, Division of Nuclear Construction, TVA. B. S. in Civil Engineering. Over 18 years experience in Engineering, Quality Assurance and Construction.

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