IV. SPECIAL PROGRAMS

A number of areas have been identified and re-examined by the WBN Task Force as items to be addressed before licensing.

Special programs have been developed to deal with problems that have been identified at Watts Bar. Several of these involve breakdowns in quality assurance that occurred at Watts Bar. The special programs include completing the documentation and resolving environmental qualification questions; resolving a group of electrical issues including questions regarding cable bend radius, proximity of cable to high temperature piping and ampacity; updating of piping and hanger analysis to include topical issues; resolving an issue regarding increased temperature during main steam line breaks due to revised NSSS analysis; evaluation of a number of instrumentation line installation questions; assessing the adequacy of the welding program at WBN; resolving issues regarding the appropriate classification of components on the Q-List; resolving an issue regarding concrete strength; establishing a design base of required calculations; resolving soil liquefaction questions; resolving questions on containment isolation compliance; evaluating the effect of design changes on the seismic qualification of equipment; evaluating previously dispositioned nonconformances; developing a program to address commercial grade spare parts; assessing the adequacy of quality records at WBN; and developing a pre-startup test plan.

This section discusses the special programs developed in order to resolve these issues and/or problems. The following topics are included for each program as appropriate: a summary of the issues which are being addressed by the special program, a description of the intent and scope of the program, steps TVA has already taken to correct the specific issues and the status of the further corrective actions which TVA plans to take.

1.0 Environmental Qualification (EQ) Program

1.1 Introduction

The Code of Federal Regulations, Title 10 CFR Section 50.49 (10 CFR 50.49) requires the environmental qualification of electrical equipment which is required to perform a safety-related function during and following a design basis event to ensure reactor coolant pressure boundary integrity, to shut down the reactor, to maintain it in a safe shutdown condition, and to prevent or mitigate the consequences of accidents that could result in offsite exposures in excess of the 10 CFR Part 100 guidelines. It is further required that the evaluation of environmental qualification for equipment in a harsh environment be documented and maintained in auditable files. The extended date required by NRC for full compliance with 10 CFR 50.49 was November 30, 1985.

TVA conducted a management review of the environmental qualification programs of SQN, BFN, and WBN in July and August 1985. This review indicated that much of the required qualification documentation was not auditable and, in some cases, the documentation available did not demonstrate qualification.

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The cause for the failure to comply in a timely fashion with 10 CFR 50.49 requirements was a lack of management attention to the environmental qualification (EQ) program.

Subsequent to the voluntary shutdown of Sequoyah, a Watts Bar Environmental Qualification Project (EQP) was formed with the responsibility for development and implementation of an EQ program which fully complies with the technical requirements of 10 CFR 50.49. Responsibility for the environmental qualification program is assigned to DNE. Detailed responsibilities, scope, organization, specific project procedures, and the project training program are defined in the project manual, WBN-EQP-01, for the Watts Bar Environmental Qualification Project. Watts Bar Engineering Procedure WBEP-EP 43.06 is being prepared and Nuclear Engineering Branch interface document DI 125.01 is currently being revised to define detailed procedures to satisfy these responsibilities to reflect the transfer of functions to the Watts Bar Engineering Project (WBEP).

The EQ program for Watts Bar is described in the Summary Status Report of TVA's compliance with 10 CFR 50.49, Environmental Qualification of Electrical Equipment Important to Safety for Nuclear Power Plants provided to the NRC September 30, 1986.

Procedures have been issued at WBN which address site activities including maintenance, procurement, material storage, material issue, and design changes associated with the EQ program.

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In this section reference is made to two equipment listings. The first of these is the Watts Bar Equipment List (WBEL) which is a comprehensive listing of WBN equipment while the second is the 10 CFR 50.49 list which is a subset of the WBEL that only includes equipment requiring harsh environment qualification.

1.2 Scope

The EQ program being implemented includes the following major elements:

a. Plant harsh and mild environment areas are identified on environmental data drawings.

b. Class 1E devices in these harsh environment areas have been identified on the Watts Bar Equipment List (WBEL), as input into the Watts Bar Environmental Qualification evaluation process.

c. To assess equipment covered by 10 CFR 50.49 (b)(1), devices to be evaluated are assigned category and operating times to identify the accidents for which the devices must function and the operating times for each accident. Devices in the category and operating times are broken into two categories: (1) Category C equipment which is not required to mitigate an accident, and (2) Category A and B equipment which is required to operate or not fail during an accident. For this latter category, an evaluation is performed to determine that the equipment is within the scope of 10 CFR 50.49. For some equipment, it is determined that it need not be environmentally qualified per 10 CFR 50.49 (i.e., although located in a harsh area the equipment is located in an environment that is mild for those accidents that require its operability).

d. To assess equipment covered by 10 CFR 50.49 (b)(2), DNE evaluated system process interaction and electrical interaction (associated circuits) to identify any nonsafety-related electrical equipment whose failure under postulated environmental conditions could prevent satisfactory accomplishment of safety functions by safety-related equipment. This equipment is included in the WBEL. Calculations finalizing this specific activity will be completed in the EQ binder closure process prior to fuel load.

e. For equipment covered by 10 CFR 50.49 (b)(3), FSAR postaccident monitoring (PAM) components requiring qualification installed in the plant harsh environment areas and operational as PAM at the time of startup are included in the WBEL and in the 10 CFR 50.49 qualification process. The qualification is documented in EQ binders. Other PAM equipment requiring qualification will be addressed in accordance with TVA's schedule to address Regulatory Guide 1.97 and will be included on the 10 CFR 50.49 equipment list as a result of the design change control process.

f. Equipment requiring qualification is listed on the Watts Bar 10 CFR 50.49 List. The environmental qualification is evaluated and documented by the WBN EQP.

Although a number of supporting analyses are also required, EQP has issued two design output documents to satisfy 10 CFR 50.49 requirements: (1) The list of equipment representing the installed configuration of the plant required to meet 10 CFR 50.49, and (2) The qualification file (EQ binders) that provides the auditable record demonstrating qualification for each item on the 10 CFR 50.49 List.

1.3 Program Implementation

Documentation necessary to justify equipment qualification is either included or referenced in the individual EQ binders. Equipment in the scope of 10 CFR 50.49 is grouped in EQ binders with equipment of the same manufacturer and model(s). EQP has issued 72 equipment and cable binders. Also a binder which documents EQP positions on generic problem areas and includes other broad based information pertinent to the Watts Bar EQ program has been issued. This generic binder also includes an overall description of the WBN EQ program and addresses program-related NRC information notices, circulars, and bulletins.

The EQ binders were formatted by using examples from other plants and input from TVA's consultant, Westec. A detailed checklist was developed to assure uniform documentation of data used for the qualification evaluation of equipment in the scope of 10 CFR 50.49. The checklist was compared to the requirements of 10 CFR 50.49, IEEE-323-1974, and other standards to verify that pertinent requirements had been addressed.

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The following measures were included in the EQ program to ensure the quality of the EQ documentation:

- Field verification of installed 10 CFR 50.49 devices was performed. Field verification information included model number, vendor, location, and other pertinent information. When information was not available by field walkdown, sources such as receipt inspection reports, equipment history, maintenance records, and vendor documentation were utilized to supplement the actual field walkdown in order to establish equipment qualification.

  Cable information was based on records at the site, e.g., cable pull slips, cable reel records, and workplans. In certain cases, physical inspection of cable was used to identify or verify the required information.

- Management Review of EQ Binders
  In addition to the required independent review, the initial issue of EQ binders was subjected to a management review. The management review was an overall technical and programmatic review to verify quality, technical adequacy, and degree of standardization, including EQ documentation requirements necessary for 10 CFR 50.49 compliance.

  This review was conducted by a member of EQP management, staff, or a consultant designated by EQP management.

In addition to continuing QA surveillance of the field data acquisition phase of the EQ program, an engineering quality review was also performed on the WBN EQ program by Engineering Assurance (EA) personnel.

Deficiencies and items requiring additional investigation, identified during the process of preparing qualification documentation, were documented by EQP on TVA CAQ's or as Quality Information Requests/Release (QIR). Those items requiring field corrective action or further technical evaluation have open item statements included in the EQ binders. All deficiencies will be tracked in a closure process in WBEP.

The program is controlled by a Watts Bar Engineering Project Manual, EQP Manual, and site procedures (Standard Practices, Administrative Instructions, etc.). Certain activities associated with the implementation of the program requirements are in preparation and under review. These include:

- The WBN site maintenance groups are reviewing the new Qualification Maintenance Data Sheets (QMDS) requirements and comparing them to the existing maintenance program to ensure that qualification is maintained by performing the required EQ maintenance. Required EQ maintenance will be verified prior to fuel load.

- Open items in the issued EQ binders are to be closed before fuel load. EQ binders have been issued to the Site Director with a description of open items included. Open items will be tracked to completion. A Quality Information Release (QIR) will be initiated by the Site Director when field work is complete, and will serve as a basis for binder revision and update to reflect current plant configuration.

All items listed above are in the short-term program (to be resolved prior to fuel load). The long-term program requirements are contained in the WBEP Procedures and in Administrative Instruction AI-1.13 which provide the controls necessary to maintain compliance with 10 CFR 50.49. These include the review of design changes for impact on EQ utilizing a review checklist and the review of 10 CFR 50.49 equipment procurement documentation for proper specification of requirements.

1.4 Summary

In summary, the EQ program is an organized effort which is correcting deficiencies and documenting the acceptability of installed hardware to meet the equipment qualification defined by 10 CFR 50.49. The program will be complete prior to fuel load. Long term procedures will ensure that qualification is maintained as future plant modifications are made. Close coordination of the Watts Bar EQ and the Sequoyah EQ programs has been maintained. The Sequoyah EQ program was reviewed by NRC January 6 through January 17 and February 10 through February 14, 1986, June 23 through June 27, 1986 and December 8 through December 12, 1986. Feedback from these reviews has been incorporated into the WBN program.

2.0 Electrical Issues Program

TVA has identified a number of electrical items that originated as generic industry concerns, employee concerns, TVA NSRS investigations and reports, INPO reviews, and both site-specific and TVA generic issues. These issues include the following:

2.1 Electrical Items

- Cable Sidewall Bearing Pressure
- Cable Bend Radius
- Cable Ampacity
- Cable Splices
- Flexible Conduit
- Support of Conductors Inside Vertical Conduit Runs
- Cable Proximity to Hot Pipes
- Documentation of Class IE Cables

2.2 Resolution Approach

The resolution for each of these issues was specifically tailored to the issue. The methods included: testing, generic calculations, and specific calculations.

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2.3 Specific Issues

2.3.1 Sidewall Bearing Pressure

2.3.1.1 Determination

As a result of a TVA NSRS review (I-85-06-WBN) of WBN cable pulling practices, a deficiency was identified that concerns the installation of cable in conduit. There was no requirement in TVA installation procedures to calculate the sidewall bearing pressure of the cable. The sidewall pressure is the radial force exerted on the cable at a bend when the cable is being pulled around the bend. IEEE standards have included a recommendation to consider this pressure since the early 1980s.

An investigation of installation requirements and practices revealed that although there were certain conservative requirements, TVA's standards and specifications lacked the detail, clarity, and specificity necessary to ensure uniform implementation. Therefore, the potential existed to have installed cable in a degraded condition that would have compromised the life span of the cable and, therefore, its ability to perform its intended safety function was in question.

2.3.1.2 Approach to Resolution

To resolve the problem, DNE developed a calculation method to determine the magnitude of sidewall bearing pressures which were exerted on Class IE cables during installation in conduits. Class IE conduits were evaluated through preliminary screening, field inspection, and detailed calculations. The screening

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analysis developed a list of assumed worst-case configurations based on a vertical conduit with four 90° bends in the pulling end of the conduit with the cable pull assumed to be upward. Calculations were then performed to determine the allowable pulling tension to avoid exceeding sidewall bearing pressure limits. The length of conduit was then calculated that would correspond with allowable sidewall bearing pressure limits for all conduit sizes and number of cables in each conduit.

The conduit schedules were then screened for lengths exceeding these calculated allowable lengths. A large number of extremely short conduits were eliminated from further analysis because they were shorter than the length of four 90° bends. This screening process reduced the number of conduits to approximately 1914 requiring further evaluation. A sample size of 81 worst-case conduits was then selected for more detailed calculations (approximately 20 conduits per voltage level). The worst case sample conduits were selected by visual inspection of approximately 778 of the 1914 conduits using the criteria of multiple bends (greater than 360°), long lengths, elevation changes and conduit fill (greater than 30%).

The detailed calculations of the 81 worst-case conduits showed twelve conduits exceeding the sidewall bearing pressure limits of 300 lbs./ft. (for power cables), 100 lbs./ft. (for control and instrumentation cables), or vendor supplied data as applicable. The calculated values were based on the assumption that the cables were pulled in the direction that would cause sidewall bearing pressures to be greater.

As a result of these calculations, TVA, at its own laboratories, performed extensive testing which concluded that higher allowable sidewall bearing pressure limits are justified for all cable purchased by TVA, and that margin exists in cable installations with respect to the new requirements. The test results also are consistent with the EPRI report no. EL-3333 where allowable sidewall bearing pressures were determined to be 4 to 5 times higher than previous manufacturer's limits.

The results of the calculations and the testing are being reviewed by both TVA and NRC to determine if sidewall bearing pressures experienced at WBN could result in damage to the cable insulation. An independent third party (David A. Silvers & Associates, Inc.) has concluded that the TVA testing which justifies larger values than heretofore used is a reasonable basis for increased sidewall pressure values.

2.3.1.3 Summary

Based on an evaluation of the data, no rework is expected. To prevent recurrence, TVA now requires sidewall bearing pressure calculations be performed prior to installation of cable and that conduit bends between pull points be limited to a maximum of 360°.

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2.3.2 Bend Radius

2.3.2.1 Definition

An NSRS review and subsequent report I-85-06-WBN (July 1985) raised concern that neither manufacturer's documentation/justification/test data nor engineering basis was sufficient to substantiate the cable bending radius (RTMIN) for multi-conductor cables. The report also presented historical cable bend radius concerns raised in 1982-1983 by the NRC as well as TVA issued NCRs. That report considered the final disposition of these issues to be lacking sufficient justification.

TVA had always recognized that control of bend radius was an important design requirement. This criterion is necessary to ensure that cable insulation would not be elongated to the point that failures could be induced by cable bending during installation.

TVA requirements for cable bend radius have been an evolutionary development in engineering specifications. Present requirements are based on minimum values specified by cable manufacturers or by IPCEA standards. However, in some cases, installed cables do not meet the present TVA requirements.

2.3.2.2 Approach To Resolution

Calculations and testing were performed to determine the acceptability of existing cable installations. In order to do this, a bounding-case bending radius was determined that

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enveloped the installed conditions. Condulets are used to connect conduit when sharp changes in direction are required. Cable installations in condulets (within a conduit system) subject a cable to the smallest possible radius.

Achievable radius within each condulet size was analyzed. Condulet radius was then compared for each safety- related conduit installation at WBN. Out of approximately 10,500 conduits, all had achievable radius greater than 1.3 times the cable outside diameter (OD). To provide further conservatism and to account for the previously allowed minimum bend radius of multiconductor cables, this factor was reduced to 1.0.

A cable bent to a given radius produces an elongation stress on the outer surface of the insulation. Analyses were performed by DNE to show for the worst-case bending radius of one times cable OD, the 40-year cable insulation life's elongation properties were not significantly affected.

The analysis was appropriate for all WBN installed cables except shielded power cables and coax, twinax, and triax type cables. The cables effected and for which walkdown inspections will be performed are the following:

(1) Class 1E medium voltage power (6.9 kV) cables to assure cable furnished by Okonite Company is not bent with a bend

radius than 8 times cable OD. (Cable supplied by this manufacturer had previously been granted relief with regard to the required minimum bend radius.)

(2) Class 1E coax, twinax, and triax cable installations will be inspected to assure cables are not bent less than 8 times the cable OD.

(3) Class 1E 6.9 kV cable routed in conduits for identification of straight- through pull boxes or condulets. Conditions will be noted for evaluation of both temporary and permanent cable bend radii.

2.3.2.3 Summary

As a result of technical reviews of TVA cable design practices, concern was raised regarding the adequacy of the cable bend radius values used. Values were obtained from cable manufacturers and IPCEA (Insulated Power Conductors Engineer Association) standards and used to formulate new TVA standard values. An evaluation was conducted to determine the worst-case bend radius to envelope installed conditions and to analytically determine potential cable damage due to elongation stress on the outer surface of the insulation. Except for shielded power cables and coaxial, twinaxial, and triaxial type cables, thorough analysis showed the elongation properties are not significantly affected over the 40 year life. Walkdown inspections will be conducted to examine the remaining cables to assure they have been bent within allowable values.

...nd to have exceeded this factor will be documented as ...valuated for either rework to present day standards or ...ion to leave as installed.

...ndependent audits on Bellefonte by INPO and TVA's ... Electrical Evaluation Team identified that there were ... design calculations to demonstrate the adequacy of ...ities, provided in electrical design standards. As a ...lculations were developed which purportedly verified ...cy of the existing TVA standards.

...y employee concerns at Watts Bar, both the TVA ... design standards and the supporting calculations were ...eviewed by the Electrical Engineering Branch. This ...ated that the standards contained inaccuracies, were ... and also lacked definition and information required ... application. Supporting calculations did not ...these limitations. In general, the basis of the ...d not agree with TVA's normal installation ...or did the TVA standards properly apply industry ... which they were based. The TVA standards also ...nsider the derating effects of cable coatings, tray ... fire wraps. An attempt to review the application of ...rds for cable sizing on all projects revealed that ...documentation was not available. This was a ...n the QA program implementation.

In addition to the above, in 1985 during an evaluation of cable side wall bearing pressure, it was determined that cable outside diameters were not based on verified source data. Lower cable ampacity values might be required due to overfilled cable raceways and cable outside diameters which were larger than those previously used. However, the larger outside diameters would improve the allowable ampacity that a specific cable could carry.

2.3.3.2 Approach to Resolution

To insure that outside diameter sizes for cable was established and to insure that presently installed cables were appropriately evaluated, an investigation was conducted. This investigation established that :

- The values established for cable outside diameters are documented in a calculation based on vendor data and actual measured data.

- The basis for the new ampacity tables is taken from the IPCEA and National Electrical Code ampacity values and is documented in a supporting calculation.

o Evaluation of ampacity for cable at WBNP will be accomplished as follows:

  - All auxiliary and control power cables routed in Class 1E voltage levels V3, V4, and V5 raceways at WBNP will be

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identified and full load current values will be determined. As there are no power cables in V1 and V2 raceways, they have been excluded.

- Using bounding conditions for the installed configuration and the new ampacity design standard, the lowest possible ampacity values for the smallest cable size used in each voltage level will be established. Calculations will be performed for all cables that do not meet this screening criteria.

- The above calculation will be based on raceway fill limitations as given in the design standard. Final calculations may be based on the actual percent fill of raceways using the validated outside diameters previously mentioned.

- Any cables not meeting the above criteria will be identified per TVA's corrective action procedures. The entire evaluation will be documented in a calculation. Conservative allowances for derating are included in IPECA and manufacturers recommendations.

- The scope of work includes a total of approximately 15,000 cables. It is expected due to the actual full load current values, actual calculations will be required for approximately 2000 cables. The task is to be completed prior to fuel loading.

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2.3.3.3 **Summary**

All necessary evaluation to substantiate the current carrying capability of Class 1E cables, including raceway overfill conditions, will be completed prior to licensing for fuel loading. Necessary corrective actions including cable replacement if needed will be completed prior to licensing for fuel loading. To prevent recurrence during ongoing and future design, cable sizing calculations (e.g., ampacity) will be performed for all power cables in accordance with the new design standards.

2.3.4 Cable Splices

2.3.4.1 Definition

As a result of TVA's review of environmental qualification of electrical equipment, a deficiency was identified where nonqualified splice material, such as electrical tape, was used to splice cables in areas that could be exposed to a harsh environment in the event of an accident. Cable terminations at equipment must be qualified to the same safety classification for environmental qualifications as the equipment the cable serves. Cable splices must also be qualified for the environment in which they are installed. In addition to cable splices, certain cable terminations also require heat shrinkable products to ensure their integrity. TVA uses Raychem Heat Shrinkable Products to perform qualified splices in harsh environments.

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In early 1986, a condition was identified where cable splicing on terminations using Raychem Heat Shrinkable Products completed before December 2, 1985, might not meet current requirements as specified in standard design drawings, construction specifications, and the manufacturers application guide for Class IE terminations and splices in harsh environments.

2.3.4.2 Approach to Resolution

Applicable construction specifications and Design Standard drawings were revised to clarify and delineate the application to qualified splices and termination materials with respect to plant areas.

A field walkdown was conducted of splices located in harsh environments. Unqualified splices are being identified and will be reworked to conform to revised specifications as a portion of TVA's program to achieve environmental qualification compliance. However, an investigation of installed Raychem splices has determined that no major rework is necessary.

All future terminations and splices for Class IE applications will conform to revised specifications.

2.3.4.3 Summary

All nonqualified splices in harsh environments will be reworked prior to fuel load to conform to revised specifications. All future terminations and splices for Class IE applications will be made in accordance with construction specification G-38 and applicable Design Standard drawings which have been revised to clarify the application of qualified splices and materials.

2.3.5 Flexible Conduit

2.3.5.1 Definition

Sufficient length of flexible conduit was not installed in all cases to accommodate combined thermal/seismic movements.

Design drawings/documents did not address the requirements for combined thermal/seismic movements and minimum bend radii on flexible conduit connections to pipe-mounted equipment until May 1986. This was after the majority of WBN flexible conduit was installed. Detailed design requirements should have identified the pipe-mounted devices subject to combined thermal/seismic movements, the maximum movement, and minimum flexible conduit bend radius. Drawings did require a 1-inch displacement at seismically qualified, floor-mounted equipment for the Reactor Building and intake pumping station, thus preventing seismic nonconformance for these areas. However, seismic nonconformance exists as drawings did not require this displacement in other plant areas with Class IE equipment.

A review of installed flexible conduit revealed that there were three basic nonconforming conditions:

- Flexible conduit to Class IE pipe-mounted devices (such as motor-operated valves, solenoid-operated valves, and temperature switches) were not installed to adequately compensate for combined thermal/seismic movements. This condition was documented by ONC in a sample of flexible conduit installations inside the unit 1 Reactor Building where conduit displacements and lengths were found inadequate when compared to the thermal movement requirements in the TVA Construction Specification for electrical conduit systems.

- ONE and ONC identified during inspection a violation of the minimum bend radius of flexible conduit at connections to pipe-mounted devices. Minimum bend radii are given in Design Standards and in Construction Specifications.

- Flexible conduit to Class 1E floor-mounted equipment was not installed with adequate lateral displacement to compensate for seismic movements. The referenced sample also identified two installations in the unit 1 Auxiliary Building where conduit displacements were found inadequate when compared to the seismic movement requirements of the construction specification.

2.3.5.2 Approach to Resolution

Corrective action necessary to resolve these conditions included the following:

- Engineering reevaluated the requirements and specifications governing the relationship of flexible conduit to electrical pipe-mounted devices subject to combined thermal/seismic movements and to floor-mounted equipment subject to seismic movements. Revisions to the construction specifications G-40 were made and issued to clarify and further define the intent of these installations and the requirements for displacements, minimum length, and bend radius. Calculations will be performed for verification. Revisions to construction specifications provide the criteria necessary for reinspection.

- Engineering provided DNC/ONP lists (developed from computer printouts and verified by cross-reference to WBN drawings) of flexible conduit installations to Class IE pipe-mounted devices which must adequately compensate for combined thermal/seismic movements. These lists were replaced by drawings which also include conduits added since the original list was made. The Unit 1 drawing series and the Unit 2 drawing series required for Unit 1 safe operations and safe shutdown are completed.

- TVA issued a flexible conduit inspection walkdown procedure to provide Watts Bar personnel with instructions required for the inspection, documentation, evaluation, correction, rework, and tracking of flexible conduit installations for pipe-mounted Class IE electrical devices. This procedure is for Unit 1 and unit 2 and delineates the requirements and responsibilities of plant personnel for the collection, documentation, and submittal of field verification data.

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- Engineering has reviewed existing piping analysis for actual movements. These movements were documented on drawings that will be used along with the walkdown inspection data sheet to evaluate and disposition existing flexible conduits.

- A walkdown inspection by craft and QC inspectors, collecting and recording data on data sheets for engineering evaluation will be performed.

- Evaluation of data sheets is in process. All conduits where installed lengths are acceptable for actual movement but not the worst case 4-inch movement required by construction specification will be documented. Rework will be in accordance with the currently existing construction specification.

- All change to flexible conduit movements table analysis drawings will be coordinated for interface review purposes. The revisions will be compared to the applicable drawings to determine if any corrective action is required for conduits effected. When corrective action is required ,the electrical drawings will be revised and issued to the field for rework.

- Flexible conduit connected to Class IE equipmen: of sheet metal construction, such as motor-control centers and switchgear, and the cast or forged Class IE equipment, such as motors, are required to be at least 18 inches, except where shorter lengths have been approved on a case-by-case basis by Engineering. Field inspection per Quality Control procedure and Modifications and Additions Instruction as well as the corrective actions to identified nonconforming conditions will assure that existing installations meet the requirements. Acceptance of existing installations less than 18 inches in length are based upon the evaluation of effects due to seismic movements as documented by calculations and site inspections.

2.3.5.3 Summary

Corrective action onsite to resolve minimum flexible conduit length documentation and rework problems must be completed prior to licensing for fuel load.

The new provisions in specifications and drawings will prevent recurrence on future installations of flexible conduit. To assure that field inspections clearly reflect the changes to the construction specification, revisions will be made to Modifications and Additions Instructions and Quality Control Procedures. A generic review has been initiated to determine whether other TVA nuclear plants are affected.

2.3.6 Support of Conductors Inside Vertical Conduit Runs

2.3.6.1 Definition

As an element of the WBN implementation of EQ Project walkdowns, it was identified that cable in long vertical runs of conduit might not be appropriately supported. TVA's General Construction Specification, the National Electrical Code, section 300-19, and TVA's Electrical Design Guide specifies requirements for the support of conductors inside vertical conduit runs. During a survey performed on the support of conductors inside vertical conduit runs, it was discovered that the above requirements were not met. The apparent causes were (1) failure to include vertical cable support criteria for approximately four years after the revision to the design guide and (2) failure to adhere to the criteria during installation for a period of time after the Construction Specification was revised. This involved a deficiency in the Watts Bar QA program.

Unsupported vertical cable runs could potentially damage cable insulation or cable terminations resulting in the loss of safety-related circuits. If uncorrected, this could adversely affect the qualified life of cable.

2.3.6.2 Approach to Resolution

All installed vertical conduit runs containing Class 1E cables shall be identified and evaluated against the latest requirements of a TVA General Construction Specification for support of cables in vertical conduits.

TVA anticipates resolving this issue by the accomplishment of a walkdown in which approximately 4000 conduits will be reviewed. However, total resolution will rely heavily on the method now being developed in conjunction with the NRC and consultants at the Sequoyah Nuclear Plant. The walkdown will involve locating the conduit and measuring the vertical lengths. After all field data is gathered, an evaluation of each conduit will be performed to ensure:

- That the vertical cable weight does not, at any point in the run, exceed the maximum working load of the conductor.
- That the vertical cable weight does not result in excessive cable bearing pressure being exerted on the cable(s) as it passes around a raceway bend.
- That the vertical cable weight does not contribute any tension, beyond that inherent in the NEC (Article 300-19) limitations, to the termination point(s) of the cable(s).
- That the bend radius of cables in vertical conduit runs which have an L-shape or T-shape conduit body at the top has not been exceeded.

Conduit sections which meet the above criteria are acceptable. For sections that do not meet this criteria, engineering will specify the location of the new supports to achieve compliance with the above criteria.

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2.3.6.3 <u>Summary</u>

TVA will determine which conduits/cables fail to meet the above requirements and will complete any rework necessary prior to licensing for fuel loading.

To prevent recurrence, all future vertical conduit and cable installations containing class 1E designated cables will be in compliance with the National Electrical Code, section 300-19 unless engineering approval has been provided for specific installations. Conduit bodies (ELLs, TEEs, etc.) will not be used in future vertical drop installations unless verification is made showing that the minimum bending radius (as defined in a TVA General Construction Specification) will not be exceeded due to the cable weight.

2.3.7 <u>Cable Proximity to Hot Pipes</u>

2.3.7.1 <u>Definition</u>

TVA has not specifically determined minimum separation criteria between hot pipes and conduit/cable trays for thermal effect. Installations may exist where accelerated cable insulation degradation may occur because of exposure to thermally hot pipes during normal plant operations.

The problem was brought to TVA's attention through an INPO Operations and Maintenance Reminder bulletin (O&MR) Number 244, which identified violations of thermal separation criteria at another Nuclear Power Plant. TVA investigation resulted in concern that this condition could exist at Watts Bar Nuclear Plant (WBN).

2.3.7.2 Approach to Resolution

A walkdown inspection under hot plant conditions will identify Class IE raceway that experience a heat rise from nearby pipes. The cables in the raceway will then be identified, and their new ambient temperature will be established. New ampacity calculations or other corrective actions will be performed if no reinsulation is planned. For future installations, criteria for minimum distance will be issued by DNE.

2.3.8 Documentation of Class 1E Cables

2.3.8.1 Definition

Problem areas were identified during TVA's evaluation of environmental qualification of equipment listed in the Watts Bar Equipment List (WBEL). This review consisted of the comparison of the designed and installed configurations and cable characteristics obtained from procurement records. It disclosed a past deficiency in QA program implementation.

Specific problem areas were primarily in documentation. These exist for approximately 250 cables. These include:

- There is no installation documentation to reflect the design configuration.

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- Installation documentation is not in accordance with the design documentation and no evidence exists of a field change request.

- Reel number recorded on cable pull card does not correspond to required cable mark number.

- Installation sheets and pull slips were hand written or typed, instead of computer generated, and contain errors involving essential data.

- There was a failure to control cable revision levels.

- Cable test revision levels were not revised when computer generated holds were manually released.

- There was a failure to ensure printer alignment resulted in missing/ obliterated data.

- There was a failure to adequately check cable schedule resulted in miscellaneous data errors.

- There was a failure to adequately document "extension wiring" used to extend field cables.

- The Computerized Cable Routing System had no mechanism to monitor allowable cross-section area for each tray segment due to non-QA values for cable cross sectional area and weight.

- Cable routing data files/programs were not originally considered to require QA. When they were determined to require QA, no additional data/program protection was established.

- Procedures failed to require verification of conduit schedules before issue. Verification should have also included documenting in a QA record.

- Procedures failed to require verification of cable scheduling and routing prior to issuing pull slips to the field.

2.3.8.2 Approach to Resolution

A task force was formed on September 3, 1986 to resolve the documentation of the Class 1E cables. The resolution of the different problem areas requires the following actions:

- Cable installation evaluation and inspection to determine the as-installed configuration. Writing of Maintenance Requests (MRs) to inspect and document cables with erroneous or lost documentation. Review of returned MRs and initiation of any other required action(s) to complete documentation (i.e., FCRs, NCRs, or SCRs).

- Rework any identified hardware problems.

- Revise documentation as necessary.

The final resolution for approximately 31 cables requires changes in the design documentation. To adequately perform these changes, changes to the computer cable scheduling program are required. These cables will have open items until all documentation can be completed.

All hardware and documentation problems will be corrected prior to fuel loading.

The second phase of the task force involves the development and/or revision of the applicable procedures. This includes the implementation of new cable routing/installation methods or systems.

The verification of cable scheduling and routing will be established with the revision of procedures and in conjunction with the computer program modifications. These actions will all be completed prior to fuel loading.

TVA has resolved the remaining issues by the following actions:

- Verified values of cable cross-sectional areas are to be established and maximum allowable tray filled entered into the data file. Changes in these values which would violate the allowable tray fill will be prohibited unless a QA justification document is released.

  - Protection for data files/program will be provided. This will be accomplished by using computer security techniques such as password protection.

  - Revision of procedures for verification of conduit schedule data before issue. This verification will involve checking and documenting the conduit schedule against the issued conduit drawing.

Hardware problems identified as a result of these deficiencies indicate that these conditions have the potential to exist in other nonharsh environment areas. Corrective action plans are being developed for completion prior to licensing for fuel load.

3.0 Hanger and Analysis Update Program

3.1 Introduction

During the past several years, the NRC issued numerous I&E Bulletins, Notices, and Circulars on the subject of piping and/or pipe supports. Many of the issues raised by this correspondence were addressed individually by TVA as they were incorporated into the design process as good engineering practice items. There were many technical matters that were dispositioned routinely in a technically conservative manner. In 1984, TVA proposed to the NRC that two issues involving pipe support calculations and baseplate adequacy would be resolved after fuel load (AFL). In 1985, one additional issue involving Zero Period Acceleration (ZPA) was scheduled to be addressed before fuel load (BFL). During 1986, it was also determined that continuation of this approach of individual solution to unique issues might have the effect of minimizing their collective significance. Accordingly, an investigation into related piping and hanger issues was initiated.

3.2 Investigation

It was determined that a review of all open conditions adverse to quality (CAQ's) would be performed to scope piping and hanger issues. These CAQ's were being routinely evaluated and dispositioned. Some of them had formed the basis for a Hanger Calculation Update Program which was to be conducted after fuel load (AFL) of unit 1 in accordance with the previously mentioned TVA/NRC agreement.

In June 1986, NRC requested TVA to re-evaluate all of its AFL commitments. As an element of this re-evaluation, all open CAQ's pertaining to piping analysis and hanger design were reviewed. This review defined three major problem areas:

- Insufficient design documentation

- Ineffective design control
- Inappropriate identification and selection of design inputs

In order to most efficiently resolve all CAQ's and to allow appropriate management control of piping and hanger design, a single Hanger and Analysis Update Program (HAAUP) has been established.

3.3 Program Definition

The HAAUP includes in its scope all nuclear safety related system piping (including instrument line portions required to qualify the process piping and instrument line interface) and hangers, as well as those for seismic category I(L)A (pressure retention). The program has two distinct phases:

- Criteria development
- Verification

3.3.1 Criteria Development

During this activity, the design criteria for piping analysis and piping support design for Watts Bar will be reviewed and revisions prepared to incorporate necessary technical requirements. The WBN Criteria was established in the 1970's to address topical issues. WBN is designed to meet industry codes and standards as stated in the FSAR which are not 1987 standards but rather those in effect at the time the construction permit was issued for Watts Bar. In spite of the fact that industry technology evolved and new issues developed, the WBN Criteria were largely unchanged. This practice of not updating criteria to reflect

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industry changes was, and is, fully in accordance with NRC requirements. As technology has changed, much was learned that could have been applied to the WBN design. During the Criteria Development phase, the WBN Design Criteria will be reviewed for the need to accommodate appropriate advances in technology; there are 21 major subject areas of review:

- Support Flexibility

  Pipe supports are modeled rigidly in the piping analysis. Supports such as long cantilevers and large unbraced frames may experience some deflection under design loads and must be accommodated.
- Friction

  A static friction force is developed when a pipe bears against the pipe support and undergoes thermal movement. The support is to be designed to resist this force.

- Overlap Zone

  The termination of the analysis problem is done by using an anchor, lapping, decoupling, or flexhose. Previous methods included the usage of a 3-way restraint.

- Zero Period Acceleration (ZPA)

  The effects of ZPA are to be included in the rigorous piping analysis. The reanalysis can be done by either using conservative hand calculations or by the "missing mass" computer method.

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- Temperature Cutoff Requiring Thermal Evaluation

  Piping may not need to be analyzed for thermal conditions if the operating temperature change from ambient (70°F) is equal to or less than a minimum temperature differential.

- Environmental Temperature Effect on Pipe and Supports

  The environmental temperature condition due to the internal fluid temperature or the external exposure temperature is to be considered in the piping analysis for normal and upset system conditions. Pipe support structures that are thermally restrained may need to be evaluated for the effects of environmental temperature for various plant conditions.

- Operating Modes

  All piping operating modes are to be identified by the system engineer for input to piping analysis. Any enveloping of operating modes by the analyst is to be concurred with by the system engineer.

- Support Weight Effect on Piping

  The weight of a pipe support will impose additional mass into the piping analysis. The major contributors of the additional mass are pipe support component parts, such as clamps, structs, and snubbers. This additional mass needs to be included in the piping analysis.

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- Functionality

  Essential piping systems are required to function (deliver the fluid contents) during specified service conditions.

- Effect of Support Mass on Support Design

  Seismic acceleration of the pipe support mass may be a significant design consideration in the support design. The significance is primarily in the pipe support's unrestrained direction.

- Fluid Transients

  Systems which experience unbalanced fluid flow loads resulting from sources, such as pump starts, valve openings and closings, and check valve slam, are to be identified by the system engineer. When determined to be significant, these loads are to be considered in the piping analysis.

- Tolerances Used in Analysis

  The "as-built" piping configuration is to be in agreement with the analyzed configuration within the permitted tolerances. Accumulation of allowable pipe and pipe support location tolerances may result in an unconservative piping analysis.

- Load Rating of Supports

  The load factor used to normalize the analysis load for the faulted condition is different than the load factor used by the hanger component vendor. This can produce a conservative selection of standard hanger component.

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- **Equipment Flexibility**

  Floor-mounted equipment including pumps, tanks, heat exchangers, and miscellaneous vessels is considered rigid in the piping analysis. Some amount of flexibility may exist and will be appropriately considered.

- **Welds**

  Welds on piping and pipe supports are to meet ASME and AISC code requirements. The WBN welding program has identified discrepancies. These discrepancies will be reconciled with the code requirements.

- Lug-Location

  Integral welds, such as lugs, are to be located a sufficient distance from other pipe welds or discontinuities. New design controls on lug locations are to be conveyed via specifications or drawing notes.

- Uplift on Rod Hangers

  Rod hangers are not allowed to be subjected to bending or compressive loads. They are to be used in applications where the net vertical load (including seismic) is always downward.

- Line Contact

  Relatively thin-walled pipe may become locally overstressed due to being supported by a small bearing area or by using stiff clamps.

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- **Substitution of Components**

  Piping components such as valves may have been substituted without the appropriate approval or documentation. In addition, component standard parts for pipe supports were manufactured using vendor design documents. Because such onsite manufacturing was without design approval or quality control, an evaluation of the process will be conducted.

- Surface-Mounted Plates--Welded and Bolted

  Surface plates have been welded to embedded plates resulting in a mixed bolt and weld attachment. Equal sharing of loads by bolts and welds for all possible configurations may have been an erroneous assumption.

- ASME Compliance

  As a result of the above issues it may be necessary to adjust ASME documentation including design specifications and stress reports. A process and procedure will be developed consistent with ASME III code commitments and requirements to effect these adjustments.

During criteria development, TVA plans to use the services of outside consultants with wide industry experience. It is expected that these organizations will help TVA develop a sound forward looking criteria with which to perform the verification phase of the program as well as for use in later design changes during operations.

3.3.2 Verification

Upon issuance of the criteria, a full scale program will be initiated to reanalyze substantially all of Unit 1 nuclear safety related piping. The actual process will include:

- Review of installation drawings
- Verification of specific field attributes
- Review of other analysis input data
  - Component drawings
  - Component analysis
  - Procurement records
- Reanalysis
  - Utilizing current design inputs
  - Using revised design criteria
- Redesign
  - Local effects - lugs
  - Piping reroute, if necessary
  - Pipe supports - add/delete/revise functions
- Documentation revision
  - Pipe stress calculations
  - Pipe stress reports
  - Pipe support calculations
  - Piping analysis isometrics
  - Pipe support drawings

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Upon completion of this phase, appropriate documentation will be issued to support installed hardware.

3.4 Program Results

The net result of the program will be a revised set of piping analyses which attest to the adequacy of installed piping. In addition, the pipe support calculations and pipe support drawings, which similarly attest to the structural adequacy of installed hangers, will be appropriately revised.

An outcome of the program which is reasonably expected is a certain number of plant modifications. These modifications will primarily be pipe support revisions typically reinforcing a support to provide additional load carrying capacity. At this time, no accurate estimate of the number of such modifications can be forecast.

The program will be completed for all safety-related systems before licensing for fuel load.

3.5 Long Term Actions

To avoid recurrence, TVA is taking the following actions:

- Implementation of the Plant Modification Package Program.
- Revision of CEB and/or WBEP procedures including a revised design criteria to require clear delineation of authority, responsibility and interface.
- Indoctrination and training of personnel assigned to analysis and hanger tasks.

4.0 Main Steam Temperature Issue

4.1 Introduction

TVA designed the Watts Bar Nuclear Plant to withstand a break in a main steam line, either inside containment or in the main steam valve vaults located outside of containment, that cannot be isolated by closing of valves. Some electrical equipment needed to mitigate the event is required to operate in the high temperature environment generated by such a line break After the plant design was completed the information on which the design was based was changed by Westinghouse. The change resulted in increased peak temperatures in containment and the valve vaults. As a consequence, the design of equipment located in these areas has required reevaluation.

Although the information used in the Watts Bar design is generic to recirculating steam generators, this section addresses the approach TVA is taking to resolve increased peak temperatures at Watts Bar. During certain postulated main steam line break accidents portions of the steam generator tubes will be uncovered resulting in superheated steam being present in the steam generator rather than saturated steam. The initial design information provided by Westinghouse was based only on saturated steam being present in the steam generator. These higher temperatures during a main steam line break were addressed for both the breaks inside the containment and the valve vaults.

4.2 Main Steam Line Break In the Main Steam Valve Vault

A temperature of 325°F was originally used as the qualification temperature within the valve vault for electrical equipment needed to function during or after a main steam line break. This temperature was based upon data supplied by Westinghouse. Westinghouse subsequently informed TVA that energy added due to superheated steam as the steam generator tubes uncovered had not been considered in the original analysis. Preliminary estimates were made of the effects that the higher energy steam would have on the valve vault temperature indicated that the temperature would increase by 150°F to 200°F.

Subsequently, TVA made a submittal to the NRC (dated 04-10-86) to resolve this issue. The approach used in this submittal was as follows:

- TVA developed valve vault temperatures for the safety evaluation using computer models that meet current NRC requirements for modeling subcompartments and including superheated steam. Mass and energy releases provided by Westinghouse were used as input to the computer models. The results of these analyses produced a maximum temperature of 532°F in the valve vault.

- A safety evaluation was prepared addressing the effects of a main steam line break in the valve vault. The safety evaluation concluded that the MSLB could be mitigated for the entire spectrum of break sizes and a safe plant configuration could be maintained.

- Physical changes that were necessary to maintain acceptable reactor core parameters were identified in the safety evaluation. These modifications will be completed prior to initial criticality.

For SQN, TVA chose an approach based on analytical techniques that were not available when the Watts Bar evaluation was performed. However, the approach submitted for WBN is technically adequate for resolution of the issue.

4.3 Main Steam Line Break Inside Containment

In addressing the potential higher temperature inside containment, Westinghouse, on behalf of TVA (for SQN and WBN) and Duke Power, modified the LOTIC III computer code to include the cooling effects of the ice melt water spraying out of the ice condenser drains. A test program that included full scale modeling of the spray out of a drain was performed to support the changes made to the LOTIC code. A COBRA-NC code analysis was also performed to provide a very detailed analysis of the inside containment temperature transient. These analyses have been documented and submitted to NRC by two topical reports, WCAP-10986 and 10988.

These reports show that the spray effects of the ice melt water totally offset the energy addition due to the superheated steam generated after tube bundle uncovery. The peak temperature inside the Watts Bar containment was reduced from 327 to 315°F. Duke Power saw similar results for their Catawba plant. Pending NRC approval of these reports, this issue is resolved for Watts Bar and no additional plant modification is required.

5.0 Instrumentation

5.1 Introduction

In the past, various issues associated with instrumentation features at WBN were noted. These included: instrument line slope, pipe and tube bending, compression fittings, and hangers, including clamps and bolts. These issues were routinely addressed by responsible engineers without emphasis being placed on programmatic implications. In addition, issues were also identified by the Employee Concerns Program and the conditions adverse to quality (CAQ) process. The sum total of these issues was a complicated and interrelated set of concerns, including programmatic concerns. The issues also indicate past deficiencies in the QA program. Therefore, TVA elected to concentrate the resolution of these instrumentation issues in a project group which became known as the Instrument Project (IP).

5.2 Evaluation Approach

On October 25, 1985, the project group was established to evaluate instrumentation issues, identify root causes, identify corrective actions, and identify actions to prevent recurrence. At that time, an "administrative hold" was placed on installation, modification, and inspection activities to prevent continued work until measures could be established that would ensure acceptable installations.

The scope of the IP included: sensing, sampling, signal, control air and radiation monitoring lines, supports, and instrument installations. Its scope did not include electrical circuitry associated with instrumentation.

The specific areas evaluated are as follows:

- Engineering Design Output Documents and Construction Procedures
- Construction Engineering and Craft Practices
- Instrument Line Slope
- Instrumentation Hangers, Clamps and Bolts
- Instrument Pipe and Tube Bending
- Compression Fittings
- QC Training and Certification
- QC Practices
- Miscellaneous Concerns Related to Instrumentation

An investigation into the various areas of instrumentation was conducted to assess concerns. In areas where evaluation determined that adequate documentation was not available, the acceptability of a feature could not be determined. The project then identified features requiring rework and reinspection to determine that the features were acceptable "as is." The features that were deemed to be acceptable "as is" were justified through tests, inspections, and engineering evaluations. WBN's documentation of acceptable features include: the recorded results of these tests, sample inspections, and engineering evaluations. When the features were determined to be not acceptable "as is," the deficient features have been or are being reworked to achieve acceptability. The approach for unit 2 corrective action has typically been to rework features to conform to DNE requirements.

5.3 Instrumentation Issues

The major issues in the evaluation process centered on four key items.

5.3.1 Instrumentation Line Slope

5.3.1.1 Definition

A number of instrument sensing lines were found that did not conform to the minimum slope requirements specified by design output documents. This criterion is critical to avoid entrapped air in the line which may cause erroneous instrument readings.

5.3.1.2 Evaluation

A review was conducted of the design, construction, and inspection programs relating to instrument line slope. This review determined that the following items/actions were inadequately defined and implemented:

- Design requirements
- Installation practices
- Inspection techniques

5.3.1.3 Corrective Action

DNE has identified a list of safety related instruments including those that are particularly sensitive to entrapped air in their sensing lines. Lines for these instruments will be reworked to achieve a minimum slope value of 1/4 inch per foot or deviations will be requested and evaluated by DNE in accordance with Engineering Requirements (ER) specification ER-WBN-EEB-001.

5.3.2 Pipe and Tube Bending

5.3.2.1 Definition

Site procedures did not adequately control field bending operations.

5.3.2.2 Evaluation

The evaluation of this issue determined that:

- Design requirements were adequate
- Installation practices were adequate
- DNC procedures were not clear and the tube/pipe bending process for unit 1 modification work was not procedurally controlled
- Some discrepancies were noted on bend documentation.

5.3.2.3 Corrective Action

A detailed sample inspection program (200 bends) confirmed the acceptability of existing field installations. No rework of field bends was required. As the result of the inspection/

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evaluation, however, some documentation updates were necessary for resolution of this issue.

5.3.3 Compression Fittings

5.3.3.1 Definition

For compression fitting assembly vendor installation instructions were not being followed. In addition, the interchange of products from different vendors was not controlled.

5.3.3.2 Evaluation

A review of this issue determined that:

- A training program had been initiated for unit 1 personnel.
- DNE had not established design requirements for installation or inspection.
- Site installation and inspection procedures did not exist.
- DNC assembly practices did not follow vendor installation instructions.

5.3.3.3 Corrective Action

A testing program was conducted at TVA's Singleton Laboratory to determine the effect of fitting installation discrepancies. These tests included: tensile pull-out tests, vibration/fatigue

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tests, seismic event vibration tests, and flow rate measurements. Based on these tests, it was determined that the identified compression fitting installation discrepancies will either be detected by leaks during hydrostatic and pneumatic tests and corrected or will not render the associated fittings incapable of performing their designed function. Therefore, existing installations in systems that had, or will receive, pressure tests have been accepted "as is." Other fittings that have been installed on vent lines or on instrument panel drain lines which have a possibility of passing radioactive fluid have been inspected and reworked where fitting errors were found. Fittings in instrument panel tubing for safety related instruments will be pressure tested and examined for leakage, or receive an inservice leak check, or be disassembled and examined for fitting errors. Instrument panel tube fittings will then be reworked as necessary.

5.3.4 Supports, Clamps, and Bolting

5.3.4.1 Definition

There was a failure to adequately maintain unit 1 support documentation for instrument lines.

5.3.4.2 Evaluation

An evaluation of this issue determined that:

- Discrepancies existed on the instrumentation support documentation.

- Some documentation had been lost.

5.3.4.3 Corrective Action

The instrumentation typical support documentation problem was evaluated using a sample inspection of 60 installed unit 1 supports and subsequent DNE evaluation. DNE has determined that the supports are acceptable "as is," assuming no clamp or clamp bolting problems exist. In order to validate this assumption, all instrument lines are being reinspected and reworked to ensure proper clamp application and installation.

5.4 Stop Work Order

The IP report and transition plan was distributed on December 24, 1986, with incomplete action items identified and responsibility for tracking and managing these items assigned to the appropriate organizations. As new issues were raised, and based on information contained in the IP report, ONP management directed that a Stop Work Order (SWO) be issued. The SWO was issued on January 12, 1987, by DNQA to suspend all physical construction, fabrication, and installation activities including repair, nonroutine maintenance, and/or modifications.

The following actions are required to release the SWO:

- Establishment of an Engineering Requirements Specification for instrumentation installation and inspection requirements.

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- Establishing or revising installation and inspection procedures.

- Training personnel to the installation and inspection requirements.

NOTE: Partial release of the SWO is anticipated as actions are completed.

5.5 Actions Required to Prevent Recurrence

5.5.1 Engineering Requirements (ER) Specification

The basis for our actions to prevent recurrence is the development and issuance of ER specificati -WBN-EEB-001 "Instrument and Instrument Line Installation and Inspection." This specification establishes engineering and design requirements for the installation, modification, maintenance, and inspection of instruments, instrument lines, and instrument systems. It also establishes the basis for the preparation of procedures and instructions by the implementing organization. The requirements of this specification are applicable to all instrumentation work performed in seismic and nonseismic buildings, structures, and areas. Any deviation from the requirements of the ER specification must be approved by DNE prior to implementation of new work and be specifically listed as a variance to the specification with documented technical justification for the variance.

As the ER specification is developed, design input documents in the form of design criteria and/or calculations are being generated to ensure that the specification requirements are substantiated. When the requirements of the ER specification are different than the requirements that had been established previously, these differences are evaluated and will be documented and resolved as CAQs.

5.5.2 Implementing Procedures

DNC, DNQA, and the Plant Manager will revise the site implementing procedures to incorporate the ER specification requirements. DNE will review the site procedures that are associated with the installation, inspection, and maintenance of instrument features to confirm compliance with the ER specification requirements.

5.5.3 Training

Site organizations evaluated their procedure changes to define needed personnel training. Selected supervisors, engineers, inspectors, and craft required to perform the procedures will be trained prior to their participation in any instrumentation activity. DNE will also provide training to their personnel on the requirements of the ER specification.

5.6 Conclusion

Instrumentation issues had been identified through various CAQ's and Employee Concerns. A group was established to evaluate past

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instrumentation issues, identify corrective actions and actions to prevent recurrence, and ensure that these actions were being properly implemented. These actions required: documentation adjustments, revising field conditions (rework), providing design clarifications and additional requirements, revising site implementation and inspection procedures, and providing training for selected engineering, inspection, and craft personnel.

As new issues were raised and based on information contained in the instrumentation report, DNQA issued a SWO until they could be assured that instrumentation work would be performed in a carefully controlled manner. This SWO was necessary to allow time to assess the issues and implement the appropriate actions outlined in paragraph 5.5. Work will not be resumed until the preventive actions are in place. Based on this program, TVA is confident that the preventive actions initiated will provide a clear, more standardized approach that will result in high quality installations that are both functional and consistent with nuclear safety.

6.0 Plant Welding Program

6.1 Introduction/Background

A number of specific and general allegations/concerns have been made regarding the adequacy of TVA's welding program (reinspection of welds through carbozinc primer, welder recertification, etc.). On October 29, 1985, the NRC, in a letter requesting a meeting with TVA to discuss welding program concerns, supplied a listing of

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correspondence on TVA welding issues with a number of questions and comments. In addition, concerns were identified by the Nuclear Safety Review Staff (NSRS). Also, the Employee Concern Program (see Table IV-1 for categorization of employee concerns) instituted at Watts Bar Nuclear Plant (WBN) has brought out additional questions from TVA employees as to the adequacy of TVA's performance of welding activities.

After assessing the above issues, TVA concluded that additional reviews were needed to determine the adequacy of the overall TVA welding program and TVA weldments. As a result, the Welding Project (WP) was formed to resolve these issues and to determining the actions to be taken to ensure that future welding activities are in accordance with TVA commitments. To accomplish this task, two separate work phases are being performed:

a. Phase I--Ensure that the written TVA welding program (design documents, policies, and procedures) correctly reflects TVA's commitments and regulatory requirements, and to identify and categorize concerns/deficiencies in the program.

b. Phase II--Evaluate the implementation of the written welding program (design documents, policies, and procedures); verify weldments made by TVA meet the commitments and requirements; determine root cause; correct any problems; and implement any changes to prevent recurrence.