Tennessee Valley Authority, Post Office Box 2000, Spring City, Tennessee 37381-2000

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U.S. Nuclear Regulatory Commission
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Washington, D.C. 20555-0001

Gentlemen:

In the Matter of) Docket No. 50-391
Tennessee Valley Authority)

WATTS BAR NUCLEAR PLANT (WBN) - UNIT 2 – CABLE ISSUES CORRECTIVE ACTION PROGRAM FOR THE COMPLETION OF WBN UNIT 2

Reference: 1. TVA letter dated January 29, 2008, "Watts Bar Nuclear Plant (WBN) - Unit 2 – Regulatory Framework for the Completion of Construction and Licensing Activities for Unit 2"

This letter provides the program methods that TVA proposes to use to resolve those sub issues of the Cable Issues Corrective Action Program (CAP) which are different from that used for WBN Unit 1. In Reference 1, TVA committed to describe such differences and appropriate justifications for their use in Unit 2. Enclosure 1 provides the differences and their justification in each case which demonstrate equally effective alternate resolutions to these cable issues.

Additionally, this letter includes a discussion of the trending analysis performed for cable damage issues on Unit 1 and how trending will be addressed on Unit 2.

Finally, TVA identified one electrical sub issue pertaining to Physical Cable Separation and Electrical Isolation having to do with coil-to-contact and contact-to-contact, for which TVA planned to use a different approach than was used on Unit 1. Upon further consideration, TVA has decided to use the same approach as was used on Unit 1 to resolve this sub issue.

TVA requests NRC approval of the alternative program methods to address the Cable Issues CAP. This submittal contains no new open actions required by licensing.

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NRR

I declare under penalty of perjury that the foregoing is true and correct. Executed on the 29th day of May 2008. If you have any questions, please contact me at (423) 365-2351.

Sincerely,

M. Bajestani

Masoud Bajestani
Watts Bar Unit 2 Vice President

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Enclosure 1

Corrective Actions for Cable Issues

In the late 1980s, various concerns related to cable installation and routing were identified at Watts Bar Nuclear Plant (WBN) by the Tennessee Valley Authority (TVA) through Employee Concerns, Conditions Adverse to Quality (CAQ), and Nuclear Regulatory Commission (NRC) findings. The root cause of these concerns were primarily absence or incompleteness of specific guidelines in the development of design input or output documents, and in some instances, the lack of procedural details for the installation of cables.

For WBN Unit 1, the Cable Issues Corrective Action Plan (CAP) was implemented. This CAP defined the scope and provided the corrective actions to resolve the past issues and prevent their future recurrence. The following sub-issues were identified by the Cable Issues CAP:

1. Silicone rubber insulated cables
2. Cable jamming
3. Cable support in vertical conduits
4. Cable support in vertical trays
5. Cable proximity to hot pipes
6. Cable pullbys
7. Cable bend radius
8. Cable splices
9. Cable sidewall bearing pressure (SWBP)
10. Pulling cables through 90-degree condulets and mid-route flexible conduits
11. Computerized Cable Routing System (CCRS) software and data base verification and validation

The Cable Issues CAP was originally submitted to the NRC on December 16, 1988 (Reference 2). It was revised, and Revision 1 was submitted on June 27, 1989. Revision 2 was issued in a letter to the NRC on October 11, 1990 (Reference 3), where TVA specified the revisions to Revision 1 in response to NRC comments. The NRC endorsed the approach by issuing a Safety Evaluation Report (SER), dated April 25, 1991, as well as in Supplements 7 (dated April 27, 1992) and 9, Appendix Y (dated June 16, 1992) to NUREG-0847. Revision 3 of the CAP was submitted to the NRC on January 13, 1994 (Reference 4). NRC reviewed Revision 3 in a letter dated February 14, 1994. The TVA submittal dated November 1, 1995, notified NRC that the Cable Issues CAP (Reference 6) was complete.

TVA implemented the corrective actions for Class 1E cables (WBN Unit 1 and common equipment). This scope also included a subset of Unit 2 Class 1E cables that were required for Unit 1 operation/safe shutdown. NRC performed field inspections throughout TVA's implementation process and confirmed that TVA's implementation of the cable issues corrective actions was satisfactory before NRC granted an operating license for WBN Unit 1. NRC findings and conclusions are delineated in the following Inspection Reports:

- Inspection Report Nos: 50-390/94-53, 50-391/94-53
- Inspection Report Nos: 50-390/95-17, 50-391/95-17
- Inspection Report Nos: 50-390/95-57, 50-391/95-57

- Inspection Report Nos: 50-390/95-77, 50-391/95-77

In reference 1, TVA stated its plans to implement the Unit 1 approach on the remaining Unit 2 Class 1E cables with the exception of the following issues:

1. Cable jamming
2. Cable pullbys
3. Cable SWBP
4. Pulling cables through 90-degree condulets and mid-route flexible conduits
5. CCRS software and database verification and validation

The Unit 1 resolution and proposed Unit 2 resolution for each of the five (5) issues are delineated as follows:

1. Cable Jamming

Statement of the problem:

NRC issued a Technical Evaluation Report (TER) on January 30, 1987. The TER identified the potential for undetected cable damage since TVA-WBN documents did not address the cable jam ratio. Jam ratio is D/d, where d is the cable outside diameter and D is the conduit inside diameter. When three single conductors of the same size, with a jam ratio of 2.8 to 3.1 (IEEE 690-1984), are pulled into a conduit, the cable may align in a flat configuration with resultant jamming.

Resolution of this issue on Unit 1:

WBN implemented the following actions to resolve this issue:

- WBN evaluated Class 1E conduit segments to identify those segments most likely to have experienced jamming during installation. This population (Unit 1 and Unit 2 safety-related cables with a jam ratio between 2.8 and 3.1) was ranked according to their calculated percent of allowable SWBP, which is defined as the radial force exerted on cable insulation at a bend while the cable is being pulled in a raceway.
- Six of the 39 cables identified by the above process were to be replaced as a result of other issues. These cables were removed and inspected for evidence of cable damage due to jamming. Cables with the highest calculated SWBP of those removed and exhibiting no damage were considered the "bounding" configuration. Lower ranked configurations of the above identified population were considered enveloped by this inspection.

TVA's CAP closure report to the NRC for Unit 1, dated November 1, 1995, stated that "Class 1E conduits were evaluated to identify those segments most likely to have experienced jamming during installation. These segments were ranked according to their calculated percent sidewall bearing pressure. Cables were removed and inspected, and no evidence of damage due to jamming was identified. The inspected cables included those from the highest calculated SWBP and are considered to bound the lower ranked cables." Thus, there were no cables in the population that were at risk of jamming.

Corrective Action for Unit 2:

Calculation WBPEVAR8905050, Cable Jamming, which addressed both the Unit 1 and Unit 2 cable population, identified 77 conduits with potential for cable jamming. Such potential existed when conduit contained 3 cables of the same size and conductors greater than #10 AWG, jam ratio was between 2.8 and 3.1, and conduit length was greater than 10 feet. Calculation WBPEVAR9008003 documented the evaluation of these cables for the 76 conduits identified as remaining in this population, since one conduit was removed because the affected cable was no longer routed in the conduit. The population contained 39 Unit 1 and 37 Unit 2 conduits. This calculation documented the installed conduit configuration via walkdown. It also calculated the cable pull tension and SWBP and ranked the conduits based upon SWBP, with the highest ranked more likely to incur damage due to jamming. These cables were inspected to determine if there was any evidence of cable jamming damage. Calculation WBPEVAR9008003 documents that 24 conduits of the 76 total conduit population were inspected. These conduits were distributed through the entire ranking, including the worst case conduit, with 9 of the 24 being among the highest ranked conduits receiving inspection. The removal and inspection of these cables was controlled by Design Change Notice (DCN) to preclude damage to the cables during the cable removal process, and the DCN included data sheets to record inspection results. The results of the cable jamming inspection were submitted to NRC on December 21, 1993.

The cable numbers associated with the 24 conduits mentioned above and involved in the inspection were: 1PL4961A, IPL4975A, 1PL4982B, 1PL4985B, 2PL4975A and 2PL4978A, two of which are Unit 2 cables. Calculation WBPEVAR9008003 documented the results of this inspection. No damage indicative of jamming was found. Since the population of safety-related conduits with potential for jamming was extracted from CCRS on or before April 1989, those safety-related cables with a jam ratio between 2.8 and 3.1 irrespective of the unit designation were identified. This population included Class 1E cables with potential for jamming applicable to Unit 1 as well as Unit 2. Therefore, no additional corrective actions are required to resolve this issue for Unit 2.

As a recurrence control for future installations, TVA's General Construction Specification G-38, "Installing Insulated Cables Rated up to 15,000 Volts," was revised to require that the cable jamming ratio not be between 2.8 and 3.1 prior to pulling cables in conduits and duct banks without prior approval from Engineering.

NRC Inspections:

The NRC performed inspections involving each of the sub-issues discussed in this submittal. Each inspection identified was docketed for both units. While the inspections were focused primarily on Unit 1 and common activities, they included discussion of Unit 2 attributes which are relevant to this program. The following NRC Inspection Reports document the NRC review of the cable jamming sub-issue:

- Inspection Report Nos: 50-390, 391/92-01
- Inspection Report Nos: 50-390, 391/92-22
- Inspection Report Nos: 50-390, 391/92-26
- Inspection Report Nos: 50-390, 391/92-35
- Inspection Report Nos: 50-390, 391/94-53
- Inspection Report Nos: 50-390, 391/95-17

2. Cable Pullby Issue

Statement of the problem:

In response to an employee concern that a welding arc that struck the conduit during construction activities in the vicinity of the conduit may have damaged the cables in it, TVA removed the cables from a conduit in the reactor protection system of Unit 2. Upon removal of the cables, significant damage was found, resulting in the exposure of the conductors of five instrumentation cables. This damage was not attributed to a welding arc, but to the pulling stresses exerted during the cable installation process and specifically, cable pullby. The Electrical Insulation Research Center at the University of Connecticut confirmed this conclusion. Pullby is defined as pulling cable(s) in a conduit that has previously installed cables in it.

Resolution of this issue on Unit 1:

TVA performed a scope assessment by removing 358 cables consisting of approximately 33,500 linear feet in 28 conduits. These cables were inspected for damage, and exposed conductors were found on two of the cables removed from one of the conduits. The damage mechanism was attributed to the cable pullby process. To assess the adequacy of Class 1E cable installations at their nuclear plants, TVA developed the following approach. Based upon the conduit size, conduit length, percent fill and cable construction, pullcharts, with conservative assumptions, were developed to determine SWBP. These assumptions were:

1. Pullbys have always occurred.
2. As much as 50 percent of the final fill weight is assumed to have been involved in a pullby in small conduits with the proportion decreasing to 20 percent for 5-inch raceways.
3. A total of 360 degrees of bends distributed between pullpoints.
4. Within each length, the maximum footage has been utilized in the calculation. The expected SWBPs have been calculated for various ranges of conduit lengths.
5. A coefficient of friction of 0.75 was used in evaluating pullbys where the final fill was less than 45 percent. For greater fill percentages, the coefficient of friction was increased to as high as 1.0 in recognition of the difficulty of pulling into conduits where the pullby results in a substantial overfill.

Separate pullcharts were developed for voltage levels V1/V2, V3, and V4 for various ranges of conduit fill, where:

V4 – Consists of cables rated at 600 VAC that provide low voltage power at service voltages from 277 to 480 VAC. In addition, heavily loaded control power and direct current power cables are designated as V4 regardless of their service voltage. These cables are not shielded.

V3 - Consists of cables rated 600 VAC in control or control power applications with service voltages of 277 VAC/VDC or less. These cables are not shielded.

V2 - Consists predominately of shielded cables in medium-level signal applications such as transmitters, resistance temperature detectors (RTDs) (greater than 100mV), rotor eccentricity and vibration detectors, and annunciators. The cables are predominantly rated 300 VAC.

V1 - Consists of shielded cables predominantly rated 300 VAC in low-level instrumentation applications such as thermocouples, strain gauges, thermal converters, and RTDs that are 100 mV and less.

Using this approach, TVA identified three levels of potential for pullby damage to Class 1E conduits, namely low, moderate and high risk.

The low-risk category consisted of those combinations of parameters which yielded expected SWBP which were less than or equal to the values specified in TVA's General Construction Specification G-38. These values were based on testing performed for TVA and are discussed along with the SWBP issue later in this document. The moderate-risk category was defined as that group of Class 1E conduits in which the expected SWBP under the assumed conditions could have exceeded the TVA's permissible values. The high-risk category included those Class 1E conduits in which damage could potentially be found with considerable frequency as a result of the severity of the assumed configuration and installation.

Cables in the low-risk category were accepted "as is" based on successful completion of DC high potential withstand test or visual inspection of a worst-case sample from the low-risk category population. The testing and inspection validated the SWBP threshold between the moderate-risk and low-risk categories. The high potential testing was performed in accordance with a criteria agreed upon by the NRC staff utilizing the recommendation of IEEE 400-1980 for hi-pot testing and using negative polarity DC voltage. The testing sample consisted of 20 conduits from voltage levels V1 and V2 and 20 conduits from voltage levels V3 and V4.

Pull records for cables categorized as moderate-risk were reviewed to determine if any pullbys occurred during the cable installation process. If no pullbys occurred, the subject cables were accepted "as is." If a pullby occurred and the conduit was overfilled (40 percent actual inside area for conduits containing three or more cables), the subject cables were reclassified as high risk and replaced. If the conduit was not overfilled and a pullby occurred, walkdowns were performed to determine the presence and location of mid-run pullpoints. (The initial classification process assumed the absence of intermediate pullpoints.) If intermediate pullpoints existed, the length of the individual segments was determined, SWBPs recalculated and compared to their limitations, and those segments re-categorized. If any segments remained in the moderate category, the cables were classified as high risk and replaced, except for cables contained in five of these conduits, which were of short length and accepted "as is" based on inspections which found no cable damage. For the remaining conduits, pull records were reviewed to confirm that the largest pullby did not exceed SWBP limitations. If SWBP limitations were exceeded, the cables were classified as high risk and were replaced. If SWBP limitations were not exceeded, the cables were classified as low risk and accepted "as-is."

In the high-risk category, pull records were reviewed. If no pullby occurred, then the subject cables were accepted "as is." If a pullby occurred, then the cables were replaced, except for cables contained in three of the conduits, which were short and accepted "as is" based on inspections which found no cable damage.

Medium voltage cable (V5) routed in safety-related raceways and required for Unit 1 operation was reviewed separately to confirm the absence of pullbys or the performance of satisfactory post-pullby high potential tests on active cable so that these cables could be de-coupled from the pullby issue. This proved to be the case.

Corrective Action for Unit 2:

The risk categories established above will be used for Unit 2. The basis for utilizing the same risk categories on Unit 2 is that the worst case samples used in the hi-pot testing performed to validate the SWBP threshold between the moderate and low-risk categories on Unit 1 are representative of the Unit 2 cable population. Therefore, hi-pot testing will not be repeated for Unit 2. The Unit 2 Class 1E cables not evaluated under Unit 1 scope will be evaluated for the cable pullby issue using the same approach used on Unit 1, except those in the high-risk category. In this category, cable pull records will be reviewed to determine if a pullby occurred during the cable installation process. If no pullby occurred, then the cables will be accepted "as is". If pullby occurred and the conduit is overfilled, the cables in that conduit will be replaced. If a high-risk conduit is not overfilled, a walkdown will be performed to determine the presence and location of mid-run pullpoints. The length of the individual segments will be determined and SWBP recalculated to determine if the cable segment can be re-categorized. If any segment remains in this high risk category, the cables in that conduit will be replaced.

NRC Inspections:

As discussed previously, the NRC performed inspections involving each of the sub-issues discussed in this submittal. Each inspection identified was docketed for both units. While the inspections were focused primarily on Unit 1 and common activities, they included discussion of Unit 2 attributes which are relevant to this program. The following NRC Field Inspection Reports document the NRC review of the cable pullby sub-issue at WBN:

Inspection Report Nos: 50-390, 391/89-08
Inspection Report Nos: 50-390, 391/89-11
Inspection Report Nos: 50-390, 391/90-06
Inspection Report Nos: 50-390, 391/90-09
Inspection Report Nos: 50-390, 391/90-12
Inspection Report Nos: 50-390, 391/90-20
Inspection Report Nos: 50-390, 391/90-22
Inspection Report Nos: 50-390, 391/90-30
Inspection Report Nos: 50-390, 391/94-32

3. Cable SWBP Issue:

Statement of the problem:

As previously defined, SWBP is the radial force exerted on cable insulation at a bend while cable is being pulled in a raceway. At WBN, SWBP was not properly addressed in the design and installation process, and installations may have exceeded the allowable value.

Resolution of this issue on Unit 1:

To resolve this issue of SWBP, TVA performed the following:

- A walkdown was conducted to identify severe case conduit configurations.

- Calculations were prepared to determine the expected pulling tension and SWBP for those severe case conduits.
- Testing to determine increased allowable SWBP values, based on actual cables used at TVA nuclear plants was conducted at TVA Central Laboratory.
- An independent review by a third-party contractor to corroborate the results of TVA's SWBP tests was performed.

TVA revised construction specifications to require that SWBP be limited to the values determined by the above testing. WBN site installation procedures were revised to provide explicit restriction to cable pulling limits based on this testing and the relationship between pulling tension and SWBP.

TVA initiated resolution of the SWBP issue by developing design calculations to determine the magnitude of SWBPs exerted on Class 1E cables in existing conduit installations at WBN. Screening calculations were performed to reduce the number of conduits from approximately 10,400 to 1,914 (calculation WBPEVAR8603006) containing Class 1E cables which had the potential of having exceeded their allowable SWBP. This population of 1,914 conduits consisted of 926 Unit 1 conduits, 748 Unit 2 conduits, and 240 Unit 0 (common) conduits.

A field inspection team consisting of Engineering, Construction, and Quality Assurance (QA) personnel selected a severe case sample of 81 (42 of these were Unit 2 and 7 were common) conduits from the remaining 1,914 conduits and performed SWBP calculations for these conduits. This is included in calculation WBPEVAR8603006. The sample consisted of approximately 20 conduits each from voltage levels V2, V3, V4 and V5 (medium voltage cables–shielded cables rated 8000 VAC that provide power at 6900 VAC to boards and large motors). Isometric sketches were then prepared of the 81 conduits complete with field measurements, to define the conduit configuration. Conduits from voltage level V1 were reviewed, but were not included in this sampling because it was determined that none of the cables at this voltage level would exceed SWBP limits.

The calculated SWBP values were compared with 1986 typical manufacturer's limits of 300 lb/ft for power and control cables and 100 lb/ft for instrumentation cables which were in effect at the time. Cables in 12 of the conduits had calculated SWBPs which exceeded the limits. A cable SWBP test program was initiated to demonstrate the acceptability of these higher SWBPs.

This program addressed WBN as well as the other TVA nuclear plants and thus test specimens were representative of cables procured from many manufacturers and installed in the various voltage level raceways in all of TVA's nuclear plants. The test report was transmitted to the NRC by TVA's letter dated June 15, 1990, for WBN (Reference 7).

Representative samples of power, control, signal and instrument, and coaxial cables from TVA's nuclear power plants were pulled through the test conduits which contained four horizontal 90-degree bends. The applied tension was controlled and measured during each pull to achieve maximum SWBP. With the exception of power cables 2 AWG and larger, where ultimate breaking strength was much greater than could be achieved during testing or installation, each cable was tensioned to near its ultimate breaking strength.

After pulling, the cables were inspected and dimensioned, outer jacket was removed from the multi-conductor cable, and individual conductors were subjected to a dielectric breakdown test. AC dielectric breakdown values were compared to those of the virgin samples to determine the effect of higher SWBP.

The test results conclusively established allowable SWBP values as follows:

- 1,000 lb/ft for power and control cables (V5/V4/V3)
- 500 lb/ft for medium and low level signal cables (V2)
- 300 lb/ft for coaxial and tri-axial cables (V1)

TVA contracted with D. A. Silver and Associates, Inc., to independently review the SWBP test methodology, results, and conclusions. The review provided confirmation of the revised SWBP values. These are the values now in General Construction Specification G-38.

Of the 81 conduits that were evaluated, TVA identified one Unit 1 conduit that was not bounded by these higher limits. TVA replaced the cables in this conduit.

To provide further confidence, TVA selected an additional 40 conduits located in harsh environments which were not previously analyzed. This population included 28 Unit 1 conduits, 10 Unit 2 conduits, and 2 Unit 0 conduits. These conduits were walked down to develop isometric sketches reflecting the as-installed configurations. SWBPs and pulling tensions were then calculated considering this information. The SWBP calculation (WBPEVAR9010001) which documented the evaluation of these 40 randomly selected conduits was issued. The results of this calculation identified no case where the allowable SWBP limits were exceeded.

Corrective Action for Unit 2:

Based upon the extensive test program described above, SWBP limits were established. Analysis of the 81 severe case conduits against these limits revealed that the cable in one conduit may have exceeded these values. Given that these cases were representative of both units, this result, coupled with the positive results of the examination of an additional 40 conduits, provided a high level of confidence that cables required for WBN Units 1and 2 operation would not have experienced excessive SWBPs during installation, and therefore, no further corrective action is required for the remaining Class 1E cables that are installed in Unit 2.

NRC Inspections:

As discussed previously, the NRC performed inspections involving each of the sub-issues discussed in this submittal. Each inspection identified was docketed for both units. While the inspections were focused primarily on Unit 1 and common activities, they included discussion of Unit 2 attributes which are relevant to this program. The following NRC Field Inspection Reports document the NRC review of the SWBP sub-issue at WBN:

- Inspection Report Nos: 50-390, 391/94-18
- Inspection Report Nos: 50-390, 391/94-53
- Inspection Report Nos: 50-390, 391/95-64

4. Pulling Cables through 90-degree condulets and Mid-Route Flexible conduits:

Statement of the problem:

A concern was raised for the potential damage to cables in 90-degree condulets because of the small supporting surface the inside corners of condulets provide for cables under tension. The small radius inside corners can in time cut into the insulation, or the conductor can creep through the insulation, reducing the insulation level of the cables. Also, concerns were raised regarding flexible conduits used at WBN in the middle of a conduit run. Since the inside surface of a flexible conduit has overlapping corrugations, the entire surface of the cable pulled through a flexible conduit segment in a bend may be subjected to high frictional forces that might tear the cable jacket and insulation.

Resolution of this issue on Unit 1:

To address the concern of pulling cables around 90-degree condulets, the resolution method for silicone rubber insulated cables was used. Since silicone rubber insulation is more susceptible to damage than any other type of cable insulation, it envelops the other types of insulation used at WBN. Based on this, conduits containing silicone rubber insulated cable, with more than two 90-degree condulets within a conduit route, were used for this evaluation. This resulted in identification of ten potential critical case conduits (calculation WBPEVAR8806004 identified 3 conduits that were in Unit 2). To ensure that these cases would be acceptable after installation, these cables were removed and subjected to testing to qualify them for 40 years of radiation and thermal aging followed by a loss-of-cooling-accident event. As documented in NUREG 0847, SER supplement 7, Appendix P, the NRC reviewed TVA qualification of the silicone rubber insulated cables manufactured by Anaconda. The NRC staff concluded that based on additional calculations, TVA had demonstrated that the environmental conditions for WBN were enveloped by the environmental conditions under which cables were tested. Therefore, since the silicone rubber insulated cables were more susceptible to damage when pulling through 90-degree condulets than other types of cables, this resolution enveloped other types of cable insulation at WBN. There were no cases of cables actually being pulled through 90-degree conduits.

The concern for pulling through flexible conduits was addressed in conjunction with the cable pullby damage issue. Based upon the evaluation of the damaged cables pulled through a flexible conduit by the Electrical Insulation Research Center of the University of Connecticut and hi-pot testing of other cables, TVA concluded that the damage was not a result of pulling cables through mid-route flexible conduits, but of cable pullbys. Calculation WBPEVAR9103005 documents the evaluation. The cable installation procedures have been revised and require that cables shall not be pulled through flexible conduits unless it is a straight section of a flexible conduit or a flexible conduit with a maximum of 15-degree offset.

Corrective Action for Unit 2:

The silicone rubber cable test provides confidence that if cables were actually pulled through 90-degree condulets, damage would not have occurred. In addition, hi-pot testing of cables confirmed that no damage resulted from pulling cables through mid-route flexible conduit. Given this and the actions taken to prohibit cable pulling through 90-degree condulets and mid-route flexible conduits with greater than 15-degree offset, no additional corrective actions are necessary to resolve this issue for Unit 2.

NRC Inspections:

As discussed previously, the NRC performed inspections involving each of the sub-issues discussed in this submittal. Each inspection identified was docketed for both units. While the inspections were focused primarily on Unit 1 and common activities, they included discussion of Unit 2 attributes which are relevant to this program. The following NRC Inspection Reports document the NRC review of these sub-issues at WBN:

- Inspection Report Nos: 50-390, 391/94-53
- Inspection Report Nos: 50-390, 391/95-17

5. CCRS Software and Database Verification and Validation

Statement of the problem:

Concerns about the adequacy of the CCRS had been expressed and documented in corrective action documents, employee concerns, and an NRC Inspection Report associated with TVA's Sequoyah Nuclear Plant. The root cause for the CCRS concerns was the lack of adequate procedures to ensure a verified data base and the failure to follow procedures that existed when installations were made. These procedures were related to both the engineering /design processes and the use of the CCRS software and its output as used by construction.

Resolution of the Issue on Unit 1:

The following approach was used to resolve CCRS concerns at WBN:

- CCRS computer software was qualified.
- Existing data in CCRS was verified.
- Procedures for controlling data entry, data revision, and data utilization were revised.
- The CCRS software was verified and validated.

To verify the adequacy of the CCRS data base, data from the WBN review and evaluation of 4,595 cables out of a total population of approximately 15,000 Class 1E cables for both Units 1 and 2 was used. The total included existing documentation resulting from the review of Environmental Qualification and Appendix R cables for Unit 1. The evaluation established the basis for accepting the CCRS data base for Class 1E cable applications for both Units 1 and 2.

The CCRS computer software was validated and verified in accordance with TVA QA procedures.

Corrective Action for Unit 2:

The CCRS software has been replaced with a program called Integrated Cable and Raceway Design System (ICRDS). ICRDS is verified and validated software in accordance with QA procedures. The resident data for both WBN Unit 1 and Unit 2 was transferred from CCRS into ICRDS database. This data transfer from CCRS into ICRDS was also verified and validated for WBN. Thus, this issue is considered resolved.

NRC Inspections:

As discussed previously, the NRC performed inspections involving each of the sub-issues discussed in this submittal. Each inspection identified was docketed for both units. While the inspections were focused primarily on Unit 1 and common activities, they included discussion of Unit 2 attributes which are relevant to this program. The following NRC Inspection Reports document the NRC review of the CCRS data base and CCRS software verification and validation sub-issue at WBN:

- Inspection Report Nos: 50-390, 391/94-53
- Inspection Report Nos: 50-390, 391/95-77

Special Trend Report - Cable Issues

Background:

During the cable removal activities related to the cable damage issue, Nuclear Engineering personnel inspected cables that were removed for the presence of pullby damage. Very little damage was found that was attributable to the pullby issue. However, the following anomalies were discovered.

1. Cables routed in the wrong raceways (misrouted cables)
2. Undocumented splices
3. Unknown, misidentified, and misrouted spare and/or abandoned cables
4. Cable damage resulting from other than pullby

This special trend analysis is documented in the following reports:

- Special Trend Analysis, R0
- Special Trend Analysis, R1
- Special Trend Report, R2
- Special Trend Report, R3

After identifying these anomalies, TVA decided that further measures were required to obtain the data necessary to evaluate the above conditions. In order to achieve this, TVA collected data during field work on misrouted cables; undocumented splices; and unknown, misidentified, and misrouted spare and/or abandoned cables. Quality Control personnel inspected all cables that were removed for damage, and QA performed additional inspections of the typical installation and installation practices that were suspected to be additional source of cable damage. The data from these inspections was used to provide the above periodic trend reports. The acceptable Quality Level for identification of a potential adverse trend was set at 95 percent. All damage mechanisms which exceeded 5 percent were considered as potential adverse trend requiring corrective actions and recurrence control measures.

After analyzing the data collected over a four year period from 1990 to 1994, TVA concluded that an adverse trend did not exist with respect to the anomalies cited above because the acceptable quality level was met in all of the above categories except for the termination/splice damage category. TVA will inspect Class 1E splice terminations, and if required, rework them. TVA will also replace all EQ splices for Unit 2 and those Class 1E splices that are subject to moisture intrusion (see Reference 1).

TVA has a mature CAP already in use on Unit 1, and this program is being implemented for Unit 2. The program includes trending and the capability to trend specific attributes, such as the above anomalies. For Unit 2, such anomalies will be flagged and trending accomplished utilizing the existing CAP. Based on the capabilities of this program and how it is implemented, there is no need for special trending of the above issues on Unit 2.

References

1. TVA letter dated September 11, 1985, "Watts Bar Nuclear Plant Units 1 and 2 – Incorrect Equipment in Harsh Environments" (L44 850911 809)
2. TVA letter dated December 16, 1988, "Watts Bar Nuclear Plant Units 1 and 2 – Corrective Action Program (CAP) Plan for Cable Issues" (L44 881216 807)
3. TVA letter dated June 27, 1989, "Watts Bar Nuclear Plant Units 1 and 2 – Revision to Corrective Action Program (CAP) Plan for Cable Issues" (L44 890627 805)
4. TVA letter dated October 11, 1990, "TVA Responses to NRC Comments Resulting from August 1 -3, 1990 Meeting" (L44 901011 801)
5. TVA letter dated January 13, 1994, "Cable Issues Corrective Action Program Plan, Revision 3" (T04 940113 823)
6. TVA letter dated November 1, 1995, "Watts Bar Nuclear Plant (WBN) – Completion of Cable Issues Corrective Action Program (CAP)" (T04 951101 254)
7. TVA letter dated June 15, 1990, "Watts Bar Nuclear Plant (WBN) Unit 1 – Supplemental Information on WBN Cable Issues – Ampacity and Large Low Voltage Power Cables in Standard Conduit Bodies" (L44 900615 802)