



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

SAFETY EVALUATION BY THE OFFICE OF SPECIAL PROJECTS

EMPLOYEE CONCERN ELEMENT REPORT EN 23801

CONDUIT OVERFILLS AND CABLE DAMAGE

TENNESSEE VALLEY AUTHORITY

SEQUOYAH NUCLEAR PLANT UNITS 1 AND 2

DOCKET NOS. 50-327 AND 50-328

I. SUBJECT

Category: Engineering (20000)
Subcategory: Raceway Overfills and Cable Pulling (23000)
Element: Conduit Overfills and Cable Damage (23001)

The basis for Element Report EN 23801, Rev. 3, dated May 12, 1987 was the generic applicability determination resulting from Watts Bar Nuclear Plant (WBN) Employee Concerns

Employee Concern: The following conduit overfills and cable damage concerns are identified as follows:

IN-85-432-001	IN-85-036-001	IN-86-310-001	IN-85-313-001
IN-85-506-001	IN-85-622-001	IN-85-685-001	IN-85-743-008
IN-86-034-001	IN-86-226-003	IN-85-642-001	IN-85-856-003
IN-86-028-002	IN-86-262-001	IN-85-832-001	IN-86-312-001
IN-85-734-001	IN-85-367-001	IN-86-262-004	IN-86-254-009
IN-86-206-001	OW-85-007-003		

II. SUMMARY OF ISSUE

The overfilling of conduits may cause cable damage during installation, overheating of cables, and is not in accordance with the National Electric Code (NEC).

III. EVALUATION

TVA reviewed documents of employee concerns, NRC investigative interviews, FSAR commitments, engineering and construction procedures for conduit overfill problems and interviewed personnel associated with scheduling and installation of the conduit raceway system.

The TVA review indicated that the FSAR and the Design Criteria are in agreement. Conduits shall not have a cable fill where the cross section area of the cable exceeds 40% of the cross section area of the inside of the conduit. However, the TVA Electrical Design Standard and the NEC allow 53% for conduits having one cable and 31% for conduits having two cables. Cables were manually routed in conduits by designers and documented in the computer cable schedule. The designer performing the cable routing was responsible for determining the total cross section area (CSA) of the cables in the conduit.

The evaluation revealed that accurate conduit fill information is not readily available and, therefore, compliance with FSAR commitment for conduit fill is not verifiable through QA documentation. After September 1986 a procedure was issued to require a checker to verify the manual cable routing and check CSA prior to releasing the cable pull slips for cable installation. Further, additional concerns of CSA were raised because the cable diameters used by the designers were not from an approved QA list, therefore, causing overfill and overheating. The employee concerns for WBN cited some specific locations, but the implied generic concerns for SQN are general in nature. The SQN concern addresses overall problems related to conduit overfill and cable damage with a specific concern related to conduit fill which exceeded that established in the Electrical Design Standard, SCR SQNEEB 8529 R0. The concerns associated with conduit overfill discussed in the TVA report are as follows:

- Cable ampacity may not be valid because the cable diameters used by the designers were not from an approved QA list. These cable diameters used, if less than actual, could cause conduit overfill and thus overheating.
- Cable supports may not be adequate, because cable weight were not used from a QA list.
- The cable fill criteria in the FSAR and Design Criteria are not in agreement with neither the Electrical Design Standard nor the National Electrical Code for one and two cables in a conduit.
- Cable damage could have occurred because the manufacturers recommend side wall pressure may have been exceeded from excessive bends, pullbys, and jamming.

TVA determined that the cable OD differences would have no effect on the cable ampacities and derating. Cable ampacities in conduit are a function of the number of cables in a conduit and not the physical conduit fill.

TVA determined that there was no program to verify adequacy of conduit supports for overfill conduits. TVA has retained the services of United Engineers and Construction (UE&C) to conduct a full systematic analysis of the SQN cable and conduit scheduling program. UE&C will identify any necessary corrective actions required to establish the accuracy of the conduit and cable schedules.

The UE&C effort will include a review of the practices and procedures utilized for routing, installing, and abandoning cables in conduit during SQN's design, construction, and modification phases up to present. All corrective actions

required to resolve problems identified by the UE&C review will be evaluated per restart criteria. The review will also determine conduit support adequacy. Those items meeting the criteria will be corrected before Unit 2 restart. The remaining items will be completed as part of a long-term program after restart. The details of staff evaluation with regard to the structural/support adequacy is addressed elsewhere (CEB-16 Calculation Review Inspection Open Item).

The staff concurs with this effort to determine potential root causes for discrepancies and to correct any identified problem areas resulting from these root causes.

Electric utilities are exempt from the requirements of the National Electrical Code (NEC) for those facilities which are used for electrical power generation. However, the licensee, TVA, will revise both the FSAR and the Design Criteria to agree with the Electrical Design Standard and NEC concerning conduit fill requirements.

The staff concurs that TVA should follow the industry standards concerning allowable conduit fill.

Cable damage associated with pullbys and jamming is addressed in Employee Concern Element Report CO 10900-SQN and TVA's cable test program submitted for staff review on July 31, 1987. Other Employee Concerns for conduit design and installation are addressed in Element Report CO 19201-SQN.

IV. CONCLUSION

The NRC staff concludes that the licensee's investigation of the concerns were adequate and their resolution of the concerns described in Element Report EN 23801-SQN, Revision 3, is acceptable except for identification of cable damage.

However, the staff concludes that the cable test program has adequately addressed the cable damage concern for purposes of restart.