



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

SAFETY EVALUATION REPORT BY THE OFFICE OF SPECIAL PROJECTS

EMPLOYEE CONCERN ELEMENT REPORT EN 28303

"CABLE TRAY-WALL AND FLOOR PENETRATIONS OVERFILL"

TENNESSEE VALLEY AUTHORITY

SEQUOYAH NUCLEAR POWER PLANT, UNITS 1 AND 2

DOCKET NOS. 50-327 AND 50-328

1.0 SUBJECT

Category: Engineering (20000)
Subcategory: Raceway Overfills and Cable Pulling (23000)
Element: Cable Tray - Wall & Floor Penetrations Overfill (23803)

The basis for Element Report EN 23803, Revision 3, dated May 6, 1987, was the generic applicability determination resulting from Watts Bar Nuclear Plant (WBN) Employee Concerns. Specific SQN concerns have been identified by both the Employee Concern Task Group (ECTG) and the Generic Concern Task Force (GCTF) in Significant Condition Reports (SCR) and Nonconformance Reports (NCR).

Employee concerns: The following cable tray overfill and wall-floor penetration overfill are identified as follows:

OW-85-007-002	IN-85-186-003	WI-85-100-011	IN-85-798-004
IN-86-238-003	IN-86-232-002	IN-85-688-N05	IN-85-919-001
IN-85-432-002	IN-85-688-001	IN-85-856-003	PH-85-003-023
IN-86-028-002	IN-85-312-001	IN-85-734-001	IN-86-262-001
IN-85-832-001	IN-85-207-001	IN-85-519-001	WI-85-100-015

2.0 SUMMARY OF ISSUES

The overfill of wall penetrations and floor penetrations may cause cable damage when pulled through penetrations. Plant procedures have no requirement prohibiting overfill of cable trays. Overfill of cables through penetrations may cause inadequate pressure/fire barriers. Cable tray fill criteria for cables violate the National Electric Code (NEC) and industry practices. The overfill of cable trays, wall penetrations and floor penetrations may cause overheating of cables. The cable tray supports may be inadequate.

3.0 EVALUATION

The licensee reviewed documents of employee concerns, NCR investigative interviews, FSAR commitments, engineering and construction procedures for installation of cables in cable tray raceway systems. The licensee also

conducted walkdowns and interviewed personnel associated with design and construction of the cable tray raceway system including cable installation.

Cable Tray Fill Requirements

The FSAR commitments and the Design Criteria for cable tray fill are as follows:

- ° 6900 volt cable greater than 2/0 AWG: 3 phase grouped, spaced from other circuits by radius distance of larger cable.
- ° 6900 volt cable less than 2/0 AWG: may be laid random but may not touch grouped cables.
- ° 600 volt or less power cable: may be single layer or random filled to 30% of the cable tray cross section area.
- ° Control and instrument cables cross section area may be 60% of the tray cross section area.

Power facilities used to generate electricity are exempt from the provisions of the National Electrical Code (NEC).

A GCTF report stated that there was no design requirement that cable could not extend above the side rails of the cable tray. Maintenance and Action Item (M&AI-04) was revised to instruct maintenance and construction personnel to install jumper conduits to prevent cables from being installed above the cable tray side rails.

Observations & Site Interviews

The Nuclear Safety Review Staff (NSRS) observation and site interviews, regarding cable tray overfill, findings are as follows:

- ° The disorderly arrangement of cables in trays was the primary reason for the appearance of overfilled trays.
- ° Cables in safety-related trays had been installed in a more orderly fashion than in non-safety-related trays.
- ° Very few safety-related trays appeared to be full.
- ° Cable tray covers were properly installed on safety-related trays in the auxiliary instrument room and the cable spreading room. Other plant areas where tray covers could not be installed were either not required by divisional separation or were non-safety-related.

Analysis

The staff analysis is that a cable tray filled with either instrument or control cables with a total cross section area (CSA) not exceeding 60% of the tray cross sectional area could have cables extending above the side rails. If all cables were installed in a neat parallel configuration, the top layer of cables would be at the cable tray side rail height. However, during cable installation the neat parallel configuration appears not to be achieved and, therefore, the cable though acceptable by the percent fill criteria could extend above the side rails. Beyond the percent fill criterion, cable tray fill limitation maybe required for any or all of the following conditions:

- ° To limit maximum cable weight to meet requirements of the cable tray manufacturer.
- ° To meet total weight limits imposed upon the cable tray support system.
- ° To allow the installation of tray covers.
- ° To limit ampacity derating.

The observation that cables which extend above the side rails of cable trays does not necessarily indicate that the cable tray fill criteria have been violated. This determination can only be achieved by analysis.

The NEC Section 318.5(b) permits a 50% fill for ladder or ventilation through cable trays containing multi-conductor control and/or signal cables only. TVA's Division of Nuclear Engineering, Sequoyah Engineering Project Manual Procedure SQEP-06 Cable and Conduit Procedure approved December 1, 1987 indicates that the 60% (40.5 square inches) is reduced to 48% (32.4 square inches).

The staff reviewed the Detailed Design Criteria, SQN-DC-V-11.3, "Power, Control, and Signal Cables for use in Category I Structures," Revision 6, dated June 25, 1987. These criteria have not been revised in Section 5.2.2 Cable tray load to reduce the 60% fill requirement to 50%; this is not a restart item.

Cable Tray Supports

The licensee has issued a SCR to provide corrective action concerning the cable tray overfill which may affect the cable tray supports. This corrective action program is to identify 30 worst-case cable tray supports. This review has been completed and the adequacy of the tray supports verified. Additional analysis of cable tray supports is proposed, after restart, to provide a statistical bases for acceptability. The staff will review this cable tray support analysis program for adequacy and agree with TVA, that given the adequacy of the worst case reviews, this analysis program is not a restart item.

Ampacity-Cable Overheating

The employee concern relates to the overfill associated with instrumentation and control (I&C) cables. These I&C cables do not have ampacity consideration causing overheating which requires derating to prevent overheating.

The staff concurs that overheating is not a problem with I&C cables. The licensee has addressed adequately ampacity for 480V power cables which were installed in trays to the 30% fill criteria. In addition to overfill, the affect of coating compound (Flamemastic 77), and fire stop material at penetrations is addressed in Employee Concern EN 24000.

Fire Stop-Pressure Seal

The concern is that cable overfill through a wall or floor penetration may preclude an adequate seal. The evaluators indicated that the integrity of completed fire stops and pressure seals is not easily verifiable since they are covered with Ceroform boards and Flamemastic coating. The evaluators had no evidence that the cable fire and pressure barriers which were type tested for SQN had the same configuration presented by overfilled cable trays.

The staff has reviewed the following documents:

- ° Modification and Addition Instructions MAI-13, Electrical Pressure Seal, Fire Stop Barrier, Thermo-Leg 330, Fire Barrier System and Flame Retardant Cable Coating, Revision 8, dated July 24, 1987.
- ° Conduit and Grounding Cable Trays drawing. 45 E4-45 N880-23, Details-Sheet 1, Powerhouse Control Bay Units 1&2, Revision 11, dated July 30, 1982.
- ° Conduit and Grounding Cable Trays Fire Stop Penetrations Details, Sheet 13, drawing. 45E-45 N880-26, Revision 23, dated September 3, 1987.
- ° Telecopy from S. Mabie, Bechtel SQN to Accravotto/Igoa Bechtel SFO dated December 1987. Subject DNE EEB, list of overfilled tray, four worst case examples.
- ° Calculation B4487 1211 002 cable tray through penetration fire stop system analysis dated December 11, 1987.

The staff concludes from the review of the above documents and observations of selected cable fire stops at Sequoyah Unit 2 that the cable firestops are adequately designed and installed to meet their intended function.

Cable Damage

The concern about potential cable damage during cable installation is discussed in Employee Concern Elements CO 10900-SQN, "Cable Installation," CO 19201-SQN, "Conduit Installation," and EN 23801, "Conduit Overfills and Cable Damage."

Although specific concerns about cable damage due to overflow of wall and floor penetrations are not discussed in the above elements the concerns are the same and the corrective actions are discussed.

4.0 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 23803-SQN, Revision 3, is acceptable.