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

December 6, 1990

Docket No. 50-390

LICENSEE: Tennessee Valley Authority (TVA)

FACILITY: Watts Bar Nuclear Plant, Unit 1

SUBJECT: SUMMARY OF NOVEMBER 16, 1990 MEETING TO DISCUSS BRAND REX CABLE PROBLEM AT WATTS BAR (TAC 71917)

REFERENCES: Meeting Notice by P. S. Tam (NRC), November 9, 1990

Upon the request of TVA (the applicant), the staff met with representatives from TVA to discuss the status of the Brand Rex cable problem. Enclosure 1 lists the names of attendees at this meeting. The applicant prepared slides for the discussion and these are included as Enclosure 2 of this summary.

TVA (Jim Hutson) stated that insulation material from sections of Brand Rex cable, which were removed from Watts Bar Unit 1 and Browns Ferry, have been shown by University of Connecticut researchers to contain inorganic particles. These particles, consisting mainly of antimony, titanium and silicon, are significantly larger in size at the fault locations than what should be present in the insulation material. (Fire retardant materials, consisting mainly of antimony, titanium and silicon were added to the insulation material in the form of fine grains specified to be below a certain size). The presence of these large, inorganic particles was believed to be the defect that caused the cables to fail the hi-pot (high potential) test. The researchers found that these particles are angular and rough in shape, indicating that they were not formed as a result of coalescing smaller particles during the pyrolysis (part of the analysis process) of the insulation material or during the actual hi-pot test. This leaves the cable manufacturing process as the only reasonable source of the large particles.

TVA proposed to perform some location-specific environmental qualification (EQ) tests on cable samples to evaluate aging and accident effects on Watts Bar, Browns Ferry and Sequoyah cables. According to TVA, the EQ test results will confirm cable qualification for these TVA plants. The staff indicated to TVA that the samples must contain the known defect for a meaningful assessment of the cable's ability to meet its EQ requirements. If cable samples pass an EQ test, and some samples contained the large particles of impurities, then this would demonstrate that cables with impurities are acceptable. However, based on TVA's presentation, TVA cannot identify cables by non-destructive methods that have the large particles of impurities and subject the same to the EQ test. The staff stated that TVA should concentrate on the root cause of the problem.

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TVA stated that based on present knowledge, the cable problem did not exceed the 10 CFR Part 21 reporting threshold as this problem is limited only to cables purchased by TVA in 1980. TVA has tested other Brand Rex cables which were purchased at other times and did not identify any similar defects. The staff is still assessing the generic applicability of this issue. There was no additional discussion of this aspect in the meeting. TVA stated that the Brand Rex cable problem does not pose any immediate operability concern. The staff agreed with this statement because the service voltage of these cables is substantially below the hi-pot test voltage at which the cable failed. The staff advised TVA to continue studying the problem in a timely and orderly manner.

Original signed by

Peter S. Tam, Senior Project Manager
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Office of Nuclear Reactor Regulation

Enclosures:
1. Attendance List
2. TVA Handbook

cc w/enclosures:
See next page

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ENCLOSURE 1

Watts Bar Unit 1: Cable Cap Meeting

November 16, 1990

Name	Organization	Phone
Peter S. Tam	NRC	301-492-1307
John E. Allen	TVA	615-632-6681
Brian E. Reagan	TVA	615-632-7073
Ed Wallace	TVA	615-751-2729
Jim Hutson	TVA	615-632-2441
Angelo Marinos	NRC	301-492-0911
Hukam Garg	NRC	301-492-0929
Scott Newberry	NRC	301-492-0821

Affiliation

TVA - Tennessee Valley Authority
NRC - Nuclear Regulatory Commission

ENCLOSURE 2

TENNESSEE VALLEY AUTHORITY

NRC MEETING ON BRAND-REX CABLE
NOVEMBER 16, 1990

ROCKVILLE, MD

BRAND-REX CABLE FAILURE ANALYSIS MEETING OBJECTIVES

- PROVIDE STATUS OF EVALUATION
- IDENTIFY RESOLUTION PLAN

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BRAND REX CABLE FAILURE ANALYSIS BACKGROUND

- 1980 CONTRACT 80K6-825419 – PURCHASED APPROX. 1 MILLION FEET
  - BFN/SQN/WBN EQ INSTALLED APPROX 100,000 FEET
  - CONTROL/INSTRUMENTATION APPLICATION
- AUGUST 1990 – CABLE FAILURE DURING BFN TESTS
  - 4.9KV DC BREAKDOWN
  - UNIQUE REEL
- AUGUST/SEPT 1990 – 5 FAILURES DURING WBN TESTS
  - 2.5KV TO 4.9KV DC BREAKDOWN
  - 3 CABLES FROM SAME REEL
- OCT 1990 – UCONN ANALYSIS – NOT INSTALLATION RELATED
- UCONN RESULTS – APPARENT CAUSE: LARGE INORGANIC PARTICLES (ANTIMONY, TITANIUM AND SILICON)
- OCT/NOV 1990 – WBN STORAGE REELS TESTED
  - 34 TESTED OUT OF 54
  - 12 FAILURES/ 3 RE-REELED PRIOR TO TEST
  - DISCUSSIONS WITH VENDOR

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★ Notes on this page by P. Tam.

BRAND REX CABLE FAILURE ANALYSIS
CONFIRMATORY TESTING

- OCT / NOV 1990 – ADDITIONAL UCONN TESTS
  - STEPPED PYROLYSIS (600°C, 700°C, ---- 1500°C)
    - ESTABLISH FUSION TEMPERATURE/PARTICLE CHARACTERISTICS
  - THERMOGRAVAMETRIC ANALYSIS (TGA)
    - EVALUATE UNIFORMITY OF FLAME RETARDENT CONCENTRATION
  - PLASMA ETCHING
    - LOW TEMPERATURE POLYMER BREAKDOWN
- RESULTS/STATUS
  - STEPPED PYROLYSIS
    - PARTICLES FORM AT 700 DEG. C
    - PHYSICAL STRUCTURE DISSIMILAR TO FAILED AREA PARTICLES
  - TGA
    - NO GROSS IRREGULARITIES IN FLAME RETARDENT CONCENTRATION
  - PLASMA ETCHING
    - INCOMPLETE (PROVIDE STATUS ON 11/21/90)
- CONCLUSION WILL PROVIDE CONFIRMATION ON LARGE PARTICLES

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BRAND REX CABLE FAILURES
RESOLUTION PLAN

- PERFORM LOCATION SPECIFIC EQ TESTING

- TESTS DESIGNED TO EVALUATE AGING AND ACCIDENT EFFECT
  - PROFILE BOUNDS SQN/WBN/BFN EXCEPT VALVE VAULTS

- TOTAL OF 20 SPECIMENS

- SELECTED SPECIMENS
  - CABLES THAT EXPERIENCED FAILURES
  - WBN "HIGH RISK" CONDUIT
  - SUSPECT STORAGE REELS

- IEEE-383 METHODOLOGY
  - CONFIRM TVA APPLICATIONS

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BRAND REX CABLE FAILURE – RESOLUTION

SELECTION AND TEST DETAILS

- SAMPLE SELECTION – 3 CABLES FROM REEL 1-99352
  2 CABLES FROM HI-RISK CONDUIT
  3 CABLES FROM REEL 1-000795
  2 CABLES FROM STORAGE REELS

- SAMPLE PREPARATION – JACKET STRIPPED TO EXPOSE INSULATION

- RADIATION AGING – APPROXIMATELY 150 MRADS
  2 STAGES, +10% ACCIDENT DOSE

- THERMAL AGING – SERVICE RQMNTS 40 YRS AT 50 C
  SIMULATION 100 HRS AT 89 C

- LOCA SIMULATION – ENERGIZE AT 120 VAC + 10%
  1 AMP NOMINAL LOAD
  SQN/WBN PROFILE 327F +15F
  30 DAY TEST

- ACCEPTANCE CRITERIA – HOLD VOLTAGE AND CURRENT
  EVALUATE LEAKAGE CURRENT

- TEST DURATION – APPROXIMATELY TWO MONTHS
  START DATE – NOV 26TH

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BRAND-REX CABLE FAILURE ANALYSIS CONCLUSION

- NO CURRENT OPERABILITY ISSUE
- EQ TEST WILL CONFIRM CABLE QUALIFICATION FOR TVA APPLICATIONS
- BFN/SQN/WBN - ISSUE RESOLVED if test results favorable
- BASED ON PRESENT KNOWLEDGE, PART 21 THRESHOLD NOT EXCEEDED
- TVA WILL CONTINUE TO INFORM NRC OF REMAINING ACTIVITIES

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Notes on this page by P. Tam.