Progress Energy

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MAY 08 2007

Ref: 10 CFR 50.54(f)
Serial: HNP-07-067

U.S. Nuclear Regulatory Commission
Attn: Document Control Desk
11555 Rockville Pike
Rockville, Maryland 20852

Subject: Shearon Harris Nuclear Power Plant, Unit 1
Docket No. 50-400/License No. NPF-63
90-Day Response to NRC Generic Letter 2007-01, "Inaccessible or Underground Power Cable Failures That Disable Accident Mitigation Systems or Cause Plant Transients"

Reference: Generic Letter 2007-01, "Inaccessible or Underground Power Cable Failures That Disable Accident Mitigation Systems or Cause Plant Transients," dated February 7, 2007

Ladies and Gentlemen:

On February 7, 2007, the Nuclear Regulatory Commission (NRC) issued Generic Letter (GL) 2007-01, "Inaccessible or Underground Power Cable Failures That Disable Accident Mitigation Systems or Cause Plant Transients," which requested licensees to provide information within 90 days of the date of the GL. Carolina Power and Light Company, now doing business as Progress Energy Carolinas, Inc., provides the attached requested 90-day response to GL 2007-01 for the Harris Nuclear Plant.

This letter contains no new regulatory commitments. If you have any questions regarding this submittal, please contact Mr. Dave Corlett, Supervisor, Licensing and Regulatory Programs at (919) 362-3137.

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I declare, under penalty of perjury, that the foregoing is true and correct.
(Executed on MAY 08 2007)

Sincerely,

Robert J. Duncan II
Vice President
Harris Nuclear Plant

RJD/sfm

Attachment: 90-Day Response to NRC Generic Letter 2007-01, "Inaccessible or Underground Power Cable Failures That Disable Accident Mitigation Systems or Cause Plant Transients"

cc: Mr. P.B. O'Bryan, NRC Sr. Resident Inspector
Ms. L.M. Regner, NRC Project Manager
Dr. W.D. Travers, NRC Regional Administrator

Attachment to HNP 07-067

Shearon Harris Nuclear Power Plant, Unit 1
Docket No. 50-400/ License No. NPF-63

90-Day Response to Generic Letter 2007-01,
"Inaccessible or Underground Power Cable Failures that Disable Accident Mitigation Systems or Cause Plant Transients"

On February 7, 2007, the Nuclear Regulatory Commission (NRC) issued Generic Letter (GL) 2007-01, "Inaccessible or Underground Power Cable Failures that Disable Accident Mitigation Systems or Cause Plant Transients." This GL requested each facility to provide a response to two questions within 90 days. The responses for the Harris Nuclear Plant (HNP) are provided below.

NRC Question 1:

Provide a history of inaccessible or underground power cable failures for all cables that are within the scope of 10 CFR 50.65 (the Maintenance Rule) and for all voltage levels. Indicate the type, manufacturer, date of failure, type of service, voltage class, years of service, and the root causes for the failure.

Harris Nuclear Plant Response 1:

References:

1. Letter dated March 16, 2007 from James H. Riley of the Nuclear Energy Institute (NEI) to Administrative Points of Contact regarding Guidance for Response to GL 2007-01, "Inaccessible or Underground Power Cable Failures that Disable Accident Mitigation Systems or Cause Plant Transients."
2. Letter dated April 13, 2007 from Michael J. Case, USNRC Director, Division of Policy and Rulemaking, Office of Nuclear Reactor Regulation to James H. Riley of the Nuclear Energy Institute (NEI) regarding Response to Nuclear Energy Institute (NEI) Letter Dated March 26, 2007.

The Nuclear Energy Institute provided guidance to the industry for responding to GL 2007-01 in Reference 1 above. The USNRC responded to the subject of Reference 1 in Reference 2 above. The preparation of the Harris Nuclear Plant's response to the GL is consistent with the information in Reference 2. Specifically, the guidance below was followed:

- Power cables only were considered
  - This includes distribution cables (bus, MCC, load center feeds).
  - This excludes cables for instrumentation, control, indication, etc.
- Voltage Range
  - All voltage levels were considered (AC and DC). Note: Power cables only, which excludes most DC cables, instrumentation, control and indication cables.
- Failure History
  - Failures are included which have been recorded in an electronic database, regardless of the actual date of failure.
  - In-service failures are included.

- Testing failures are included.

A review of the HNP history database for failures of these power cables routed in underground duct banks and conduits identified six related failures.

1. Cable 11525A – Motor Control Center (MCC) 1-4A101 Feeder Cable

   Failure Date
   - December 11, 2002
   - Years in Service – Approximately 16

   Voltage Class
   - Nominal Service Voltage – 6.9 kV
   - Cable Rating Voltage – 15 kV

   Cable Type
   - Manufacturer – Anaconda Company
   - HNP Bill of Material (BOM) D10-03
   - Specification CAR-SH-E-14A
   - Insulation Type - EPR
   - Shielded - Yes

   Type of Service
   - Normally Energized
   - Component Supported – MCC 1-4A101
   - Cable ID – 11525A

   Root Cause of Failure
   Apparent Cause of Failure – Water intrusion into the cable vault

   EBASCO design specification 211-73, Design Specification CAR-SH-E 14A Rev. 6, for 15KV Electric Cables designates a life expectancy of 40 years of normal operation. Contrary to this, the "C" phase cable feeding 1-4A101 failed after approximately 16 years of normal operation. Samples of the 1-4A101 feeder cable were sent to Cable Technology Laboratories, Inc. for a failure mode determination. The conclusion of that report stated:

   "The subject cables were obviously operated in a wet environment. Moisture permeated the insulation shield material due to dielectrophoretic forces carrying minerals and salts from the ground water and from the insulation shield.

This water permeation created pockets at the insulation shield-insulation interface where water collected. In time, during service, some of these moisture filled pockets dried out either partially or completely creating voids between the insulation shield and the insulation. Under certain conditions, depending on the shape and size of the void, partial discharge can develop. The discharges result in erosion of the surface of the void (i.e. insulation and insulation shield) creating regions of stress enhancement in the insulation and finally dielectric failure.

The cause of the problem is a combination of the installation conditions and the cable construction. The failure was not due to improper handling prior to or during installation."

- Document References – AR 79228, 6-B-060

2. Cable 11779C – MCC 1B32-SB Feeder Cable

Failure Date
- October 8, 1992
- Years in Service – Approximately 5

Voltage Class
- Nominal Service Voltage – 480 V
- Cable Rating Voltage – 600 V

Cable Type
- Manufacturer – Kerite Company
- HNP BOM D25-11
- Specification CAR-SH-E-14B
- Insulation Type – Kerite HTK Insulation (EPR)
- Shielded - No

Type of Service
- Normally Energized
- Component Supported – MCC 1B32-SB
- Cable ID – 11779C

Root Cause of Failure
- Apparent Cause of Failure – Unknown.

The C phase of the cable was found to have a phase to ground fault.

Time Domain Reflectometry testing did not provide a conclusive indication of the ground or the location of the ground. The cable was abandoned in place and replaced without further investigation. This fault was discovered during testing.

- Document References – PCR 6604, WR&A 92-APEA1, 92-APJC1, 6-B-060

3. Cable 14442R – MCC 1D13 Feeder Cable

Failure Date
- June 23, 2006
- Years in Service – Approximately 19

Voltage Class
- Nominal Service Voltage – 480 V
- Cable Rating Voltage – 600 V

Cable Type
- Manufacturer – Kerite Company
- HNP BOM D25-11
- Specification CAR-SH-E-14B
- Insulation Type – Kerite HTK Insulation (EPR)
- Shielded - No

Type of Service
- Normally De-energized
- Component Supported – MCC 1D13
- Cable ID – 14442R

Root Cause of Failure
- Apparent Cause of Failure – Unknown.

The C phase of the cable was found to have a low megger reading of 0.01 Meg-Ohms. No additional failure analysis was completed. This fault was discovered during testing.

- Document References – WO 626912-01, 875054-01, EC 64432, 6-B-060

4. Cable 11882A – 1&2X Cooling Tower Make-up (CTMU) Pump

Failure Date
- January 12, 2006
- Years in Service – Approximately 19

Voltage Class
- Nominal Service Voltage – 6.9 kV
- Cable Rating Voltage – 15 kV

Cable Type
- Manufacturer – Anaconda Company
- HNP BOM D10-03
- Specification CAR-SH-E-14A
- Insulation Type - EPR
- Shielded - Yes

Type of Service
- Normally Energized
- Component Supported – 1&2X CTMU Pump
- Cable ID – 11882A

Root Cause of Failure
- Apparent Cause of Failure – Minimum cable bend radius was exceeded resulting in water intrusion and insulation breakdown.

Samples of the failed cable, including the fault, were sent offsite for expert analysis by Cable Technology Laboratories. A series of tests were performed on samples of all three phases at the fault location, as well as, two additional samples remote from the fault location.

The report indicated that the fault occurred at the apex of an installed bend in the cable. Reasonable efforts were made to preserve the installed bend radius of the cable such that the installed condition could be evaluated by Cable Technologies. Cable Technologies found the bend radius on the failed phase was 3.6 times the cable diameter, whereas a cable of this type should typically be bent no more sharply than 6 times the cable diameter. The other phases marginally met the 6 times bend requirement.

On all three phases there was evidence that water pockets had formed between the insulation and the insulation shield. The water pockets were most heavily concentrated in the sharpest area of the bend. According to the Cable Technologies report, the water pockets form due to permeation of water through the cable jacket and the insulation shield. The presence of water causes the insulation shield to swell and ultimately separate from the insulation. The sharp bend in the cable provides additional mechanical force to aid the separation process.

When the water escapes from the pocket and is replaced by air (due to the cable drying out) additional damage to the cable insulation can occur. The void (air or vacuum) created between the insulation and the insulation shield is of a different dielectric constant than the EPR insulation. This condition creates a favorable site for partial discharges to occur. When the cable is energized, the partial discharges cause erosion of the insulation surface and eventually breakdown of the insulation (dielectric) between the conductor and the shield.

- Document References – WO 804540-01, AR 180844, 6-B-060

5. Cable 11556U – MCC 1-4A1012

Failure Date
- June 12, 2003
- Years in Service – Approximately 16

Voltage Class
- Nominal Service Voltage – 480 V
- Cable Rating Voltage – 600 V

Cable Type
- Manufacturer – Kerite Company
- HNP BOM D25-11
- Specification CAR-SH-E-14B
- Insulation Type – Kerite HTK Insulation (EPR)
- Shielded - No

Type of Service
- Normally Energized
- Component Supported – MCC 1-4A1012
- Cable ID – 11556U

Root Cause of Failure

- Apparent Cause of Failure – Unknown.

The B phase of the cable was found to have a low megger reading. No additional failure analysis was completed. This fault was discovered during testing.

- Document References – WO 420420, 6-B-060

6. Cable 11507A – Distribution Panel DP-1-4A 125 VDC NNS

Failure Date
- September 30, 2004
- Years in Service – Approximately 17

Voltage Class
- Nominal Service Voltage – 125 V
- Cable Rating Voltage – 600 V

Cable Type
- Manufacturer – Kerite Company
- HNP BOM D25-05
- Specification CAR-SH-E-14B
- Insulation Type – Kerite HTK Insulation (EPR)
- Shielded - No

Type of Service
- Normally Energized
- Component Supported – DP-1-4A 125 VDC NNS
- Cable ID – 11525A

Root Cause of Failure
- Apparent Cause of Failure – Unknown.

A 20 V negative ground was found at the distribution panel.

- Document References – WO 619373, 6-B-060

NRC Question 2:

Describe inspection, testing and monitoring programs to detect the degradation of inaccessible or underground power cables that support EDGs, offsite power, ESW, service water, component cooling water and other systems that are within the scope of 10 CFR 50.65 (the Maintenance Rule).

Harris Nuclear Plant Response 2

An evaluation identified a population of cables for which periodic electrical testing for degraded insulation properties will be performed. The cables within the population to be tested are associated with the A and B Emergency Service Water Motors, the A and B Emergency Diesel Generators, the A and B Normal Service Water Motors, the A, B, and C Circulating Water Pump Motors, the 1X and 1&2X Cooling Tower Make-up Pump Motors, and Motor Control Centers (MCC's) 1-4A4, 1-4B4, 1-4A6, 1-4A9, 1-4A8, and 1A4. The Preventive Maintenance (PM) tasks are currently under development.

In 2002/2003 HNP implemented a one-time inspection of the site electrical manholes. The inspections included a civil/structural inspection for the integrity of the manhole and the integrity of the cable support system in the manhole. The inspections also focused on the condition of the cabling in the manhole. A work order documented the completion of the inspections.

The Site Cable System (system #5259) was in Maintenance Rule a(1) status pending the satisfactory completion of the inspections. Following the completion of the inspections and review by the Maintenance Rule Expert Panel, the Site Cable System was returned to Maintenance Rule a(2) status.

HNP has created a PM program to periodically pump down manholes to maintain a drier environment. Six model work orders are used to accomplish the pump down of the manholes at least on a quarterly basis.

In November 2006, the Harris Nuclear Plant submitted an application for License Renewal which is currently under review. Section B.2.35 of the application addresses inaccessible medium voltage cables not subject to 10CFR 50.49 Environmental Qualification Program. The Harris Nuclear Plant application states, in part, that "in-scope medium-voltage cables exposed to significant moisture and significant voltage are tested once every 10 years to provide an indication of the condition of conductor insulation."