December 27, 2001

LICENSEE : Duke Energy Corporation

FACILITIES: McGuire, Units 1 and 2, and Catawba, Units 1 and 2

SUBJECT: TELECOMMUNICATION WITH DUKE ENERGY CORPORATION TO DISCUSS INFORMATION IN THEIR LICENSE RENEWAL APPLICATION ON SCOPING AND AGING MANAGEMENT OF ELECTRICAL COMPONENTS, SECTIONS 2.5, 3.6 AND B.3.19

On November 13, 2001, after the staff reviewed information provided in Sections 2.5, 3.6 and B.3.19 of the license renewal application (LRA), a conference call was conducted between the NRC and Duke Energy Corporation to clarify information presented in the application pertaining to scoping and aging management of electrical components. Participants in the conference call are provided in an attachment.

The questions asked by the staff, as well as the responses provided by the applicant, are as follows:

2.5 Scoping and Screening Results: Electrical and Instrumentation and Controls

2.5-1 Section 2.5 of the LRA indicates that the switchyard systems (i.e., switchyard bus, transmission conductors, and high-voltage insulators) do not meet any of the scoping criteria of Title 10 of the Code of Federal Regulations (10 CFR), Section 54.4(a). Section 54.4(a)(3) requires all systems, structures, and components to be included in the scope of license renewal that are relied on in safety analyses or plant evaluations to perform a function that demonstrates compliance with the Commission's regulations for station blackout (Section 50.63). Section 50.63(a)(1) requires that the nuclear power plant be able to recover from a station blackout. Clarify why switchyard systems are not relied on in safety analyses or plant evaluations to perform a function in the recovery from a station blackout.

The applicant indicated switchyard components were not required to mitigate a station blackout event and, as such, are not within the scope of license renewal. The staff will consider this response but may request additional information to complete its review of this issue.

2.5-2 Section 2.5 of the LRA indicates that the Unit Main Power System and Nonsegregated-phase bus in the 6.9 kV Normal Auxiliary Power System were found not to meet any of the scoping criteria of Section 54.4(a). Clarify why the Unit Main Power System and the Nonsegregated-phase bus in the 6.9 kV Normal Auxiliary Power System are not relied on in safety analyses or plant evaluations to perform a function in the recovery from a station blackout.
The applicant indicated Unit Main Power System and the Nonsegregated-Phase bus in the 6.9 kV Normal Auxiliary Power System were not required to mitigate a station

blackout event and, as such, are not within the scope of license renewal. The staff will consider this response but may request additional information to complete its review of this issue.

2.5-3 Section 2.5 of the LRA indicates that non-insulated ground conductors were found not to meet any of the scoping criteria of Section 54.4(a). Non-insulated ground conductors provide safety-related electrical systems with the capability to withstand transient conditions (e.g., electrical faults). Clarify why this function does not meet the scoping criteria of Section 54.4(a)(1) and Section 54.4(a)(2).

The applicant indicated that the non-insulated ground conductors do not meet any of the scoping criteria specified in Section 54.4. These components are not safety-related per Section 54.4(a)(1) and are not credited for mitigation of regulated events listed in Section 54.4(a)(3). Regarding the scoping criteria of Section 54.4(a)(2) (i.e., all nonsafety-related systems, structures, and components whose failure could prevent satisfactory accomplishment of any of the functions identified in paragraphs (a)(1)(i), (ii), or (iii) of this section), uninsulated ground conductor failures are hypothetical as discussed in Section 2.1.3.1.2 of the Standard Review Plan for License Renewal [and Section III.c.(iii) of the SOC (60FR22467)] and are not required to be considered. The staff will consider the information provided but may request additional information to complete its review.

3.6.1 Aging Effects Caused by Heat and Radiation

1. Exposure of electrical cables to localized environments caused by heat or radiation can result in reduced insulation resistance (IR). Reduced IR causes an increase in leakage currents between conductors and from individual conductors to ground. A reduction in IR is a concern for circuits with sensitive, low-level signals such as radiation monitoring and nuclear instrumentation since it may contribute to inaccuracies in instrument loop. The applicant states that the Non-EQ Insulated Cables and Connections Aging Management Program includes non-EQ cables used in low-level signal application that are sensitive to reduction in insulation resistance such as radiation monitoring and nuclear instrumentation. Further, the applicant states that the accessible non-EQ insulated cables installed in reactor buildings, auxiliary buildings and turbine buildings are visually inspected for cable jacket surface anomalies such as embrittlement, discoloration, cracking or surface contamination. Visual inspection may not be sufficient to detect aging degradation from heat and radiation in the instrumentation circuits with sensitive, low-level signal. Because low-level signal instrumentation circuits may operate with signals that are normally in the milliamp range or less, they can be affected by extremely low levels of leakage current. These low levels of leakage current may affect instrument loop accuracy before the adverse localized environment that caused them to produce changes that are visually detectable. Routine calibration test performed as part of the plant surveillance test program can be used to identify the potential existence of this aging degradation. Provide a description of your plant calibration test program that will be relied upon as the aging management activity used to detect this aging degradation in sensitive, low-level signal circuits, or provide the technical basis of excluding it.
The applicant referred the staff to the Generic Aging Lessons Learned (GALL) Report program XI.E2, “Electrical Cables Not Subject to 10 CFR 50.49 Environmental Qualification Requirements Used in Instrumentation Circuits,” which uses routine

calibration tests performed as part of the plant surveillance test program to identify the potential existence of aging degradation of cables and connections used in low-level signal applications that are sensitive to reduction in IR such as radiation monitoring and nuclear instrumentation. Program XI.E2 is based on the program implemented at Calvert Cliffs as documented in Section 3.12.3.2.3 of NUREG-1705, the Calvert Cliffs license renewal safety evaluation report (SER). Implementation of this program basically consists of flagging the specific plant calibration procedures.

The applicant stated that the GALL Report program XI.E2 pertains to instrumentation circuits that are sensitive to reductions in IR. These are a subset of the cables covered by inspection program XI.E1 since both programs (XI.E1 and XI.E2) are identified in GALL Report Table VI.A (pages VI A-3 and A-4) as managing aging effects caused by heat and radiation that can lead to reduced IR. According to GALL Report Table VI.A (page VI A-3), program XI.E1 manages "Aging Effects/Mechanisms" that lead to "reduced insulation resistance" with "Further Evaluation" not required. Although credited during the Calvert Cliffs license renewal application review, other plants since have not credited this program for managing the effects of aging of circuits sensitive to a reduction in IR. This is likely due to the fact that inspection program XI.E1, which addresses mechanical and physical properties, is much more able to detect early material degradation than testing program XI.E2, which addresses electrical properties. The applicant referred the staff to Section 5.2.2 of SAND96-0344, Aging Management Guideline for Commercial Nuclear Power Plants - Electrical Cable and Terminations (issued by the Department of Energy), which states that significant changes in mechanical and physical properties (such as elongation-at-break and density) occur as a result of thermal- and radiation-induced aging. For low-voltage cables, these changes precede changes to the electrical performance of the dielectric (i.e., the mechanical properties must change to the point of embrittlement and cracking before significant electrical changes are observed).

Visual inspection can detect aging degradation early in the aging process whereas embrittlement and cracking must occur before significant electrical property changes, such as reduced insulation resistance, would be detected through circuit calibration.

With regard to the potential for moisture intrusion as identified by the staff as a concern for low-voltage cables, embrittlement and significant cracking of the cable jacket and conductor insulation would have to occur before moisture could possibly be an issue. According to GALL Report Table VI.A (pages VI A-3 and A-4) moisture intrusion is an aging effect that is adequately managed by each program XI.E1 and X1.E2. The GALL Report does not indicate that both of these programs are needed to manage aging for the possibility of moisture intrusion. Each program is indicated as individually managing this possibility. The GALL Report program XI.E1 is able to detect aging degradation sooner than program XI.E2 by monitoring mechanical physical property changes.

The applicant indicated that the two GALL report programs (XI.E1 and XI.E2) manage the same aging effects for the same cables in different ways. As such, an applicant may choose the program that best fits the needs identified at the plant, but both programs would not be required to adequately manage aging of plant cables. This was illustrated by the first two applicants where Calvert Cliffs committed to the calibration program (XI.E2) but not to the inspection program and where Oconee committed to the inspection program (XI.E1) but not to the calibration program. This was the pattern or

precedent that the industry saw and understood as being included in the GALL Report - two programs that cover the same cables using different methods to manage aging with the applicant able to choose a program that best fits the plant aging management needs.

The staff will consider the information provided by the applicant and review the documents referenced, but may request additional information to complete its review of this issue.

B.3.19-1 Inaccessible Non-EQ Medium-Voltage Cables Aging Management Program

1. Periodic actions are taken to prevent cable from being exposed to significant moisture, such as inspecting for water collection in cable manholes and conduit, and draining water. These actions are considered as preventive actions. Section B.3.19 of the LRA under topic heading "Preventive Actions" indicates no preventive actions are required as part of the Inaccessible Non-EQ Medium-Voltage Cables Aging Management Program (AMP). Explain why no preventive actions are required as part of the AMP.

   The applicant responded to this and the following question together (see the response to the second question).

2. Section B.3.19 of the LRA under topic heading "Scope" defines significant moisture as exposure to long-term (over a long period such as a few years), continuous standing water. Other LRAs (including Oconee LRA) and the staff's GALL report define significant moisture as exposure to moisture that lasts more than a few days. Additionally, the GALL report goes on to state that periodic exposures to moisture that last less than few days (i.e., normal rain and drain) are not significant. Explain the inconsistency between McGuire/Catawba LRAs and the GALL report.

   The applicant responded that GALL report program XI.E3 identifies and tests medium-voltage cables that could be susceptible to aging effects caused by moisture and voltage stress. Program XI.E3 is based on the program implemented at Oconee as documented in Section 3.9.3.2.1 of NUREG-1723, the Oconee license renewal SER. A practical way to implement this program and to provide the plant medium-voltage with the best assurance of uninterrupted function is to take rudimentary, preventive actions to ensure that the cables are not exposed to long-term, continuous standing water (as stated in SAND96-0344, Aging Management Guideline). Although it is difficult to determine if the cables are exposed to standing water for some installations (such as some conduit configurations), the effort is worthwhile when compared to the alternative of having a cable fail at an inopportune time.

   "Long-term" is not defined in SAND96-0344, Aging Management Guideline. The GALL Report program XI.E3 uses "periodic exposures to moisture that last more than a few days (e.g., cable in standing water)." The basis for defining significant moisture in terms of "a few days" is based in the Oconee LRA review as described below.

   To resolve issues identified during the Oconee LRA review, an AMP was proposed for medium-voltage cables installed in conduit or directly buried that are exposed to significant voltage and significant moisture. Rather than leave the "significant" criteria undefined, which would be an implementation problem at the station, a search for

quantitative criteria was performed. All available industry literature was reviewed, including *Effects of Moisture on the Life of Power Plant Cables, Part 1: Medium-Voltage Cables, Part 2: Low-Voltage Cables* (EPRI [Electrical Power Research Institute] report TR-103834 P1-2, August 1994), and industry experts were consulted. This research revealed only subjective criteria. The industry literature provided the basis that medium-voltage cables could probably be exposed to standing water for several years without any problems. The primary NRC staff concern at Oconee was an outside cable trench that had a low point in the plant where water would collect after every rain. For the current operating period, the water collection had been checked daily during operator rounds and drained if needed. The program was written to reflect ongoing efforts to mitigate rain and drain exposure at Oconee.

Current LRAs being reviewed define long-term as “over a long period such as a few years.” The industry data tends to validate that cables exposed for “a few years” should be fine. However, the amount of time mentioned in most documents is indeterminate on length of time. The current application for McGuire and Catawba uses “a few years” for practical, implementation reasons more than anything else.

Many medium-voltage cable installations that are possibly exposed to moisture are installed in safety-related trenches and manholes. In order to inspect portions of these trenches for water collection it is necessary to have a crane lift the covers due to their weight. Defining “long-term” as “a few days” would make it impossible to monitor water collection frequently enough to meet the program requirements. The cable engineer would have to go out a few days after each rainfall in order to know if the cables are exposed to significant moisture. From the practical standpoint of implementing the program, defining long-term as “a few years” is a reasonable length of time that makes it possible to implement. This would be workable from an inspection standpoint and still well within the bounds of industry estimates on how long it takes for water trees to propagate to failure.

The applicant stated that their aging management program does not imply that it is acceptable for medium-voltage cables to be immersed in water for several years. The applicant believes that a program that requires inspection every few years is more likely to prevent the medium-voltage cables from being exposed to standing water for any appreciable length of time, since the alternative (which is proposed by the GALL report) is to test the cable every 10 years. Defining “long-term” as “a few days” is not an achievable frequency. As such, the alternative of testing the cable every 10 years would be the preferred, more cost-effective (although it is less conservative) method for identifying medium-voltage cables exposed to standing water.

A possible enhancement of the proposed McGuire and Catawba program would be to add language in the corrective actions that, when inspections reveal medium-voltage cables in standing water, the problem is either fixed (i.e., fix the sump pump, fix the drains, etc.) or the inspection frequency is increased. This provides direct incentive for the plant to correct any water collection problems since the alternative is to test the cables, which is the least attractive alternative for the plant as this requires disconnection and re-termination of the equipment. The staff will consider this possible enhancement but may request additional information to complete its review of this issue.

A draft of this telecommunication summary was provided to the applicant to allow them the opportunity to comment prior to the summary being issued.

/***RA***/

Rani L. Franovich, Project Manager
License Renewal Project Directorate
Division of Regulatory Improvement Programs
Office of Nuclear Reactor Regulation

Docket Nos. 50-369, 50-370, 50-413, and 50-414

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Rani L. Franovich, Project Manager
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|---|---|---|---|
| NAME | E Hylton | R Franovich | C Grimes |
| DATE | 12/26/01 | 12/27/01 | 12/27/01 |

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R. Weisman
M. Mayfield
A. Murphy
W. McDowell
S. Droggitis
N. Dudley
RLSB Staff
---

R. Martin
C. Patel
C. Julian (RII)
R. Haag (RII)
A. Fernandez (OGC)
J. Wilson
M. Khanna
R. Elliott
D. Nguyen
J. Lazevnick
J. Knox

Mr. Gary Gilbert
Regulatory Compliance Manager
Duke Energy Corporation
4800 Concord Road
York, South Carolina 29745

Ms. Lisa F. Vaughn
Duke Energy Corporation
422 South Church Street
Charlotte, North Carolina 28201-1006

Anne Cottington, Esquire
Winston and Strawn
1400 L Street, NW
Washington, DC 20005

North Carolina Municipal Power
Agency Number 1
1427 Meadowwood Boulevard
P. O. Box 29513
Raleigh, North Carolina 27626

County Manager of York County
York County Courthouse
York, South Carolina 29745

Piedmont Municipal Power Agency
121 Village Drive
Greer, South Carolina 29651

Ms. Karen E. Long
Assistant Attorney General
North Carolina Department of Justice
P. O. Box 629
Raleigh, North Carolina 27602

Ms. Elaine Wathen, Lead REP Planner
Division of Emergency Management
116 West Jones Street
Raleigh, North Carolina 27603-1335

Mr. Robert L. Gill, Jr.
Duke Energy Corporation
Mail Stop EC-12R
P. O. Box 1006
Charlotte, North Carolina 28201-1006

Mr. Alan Nelson
Nuclear Energy Institute
1776 I Street, N.W., Suite 400
Washington, DC 20006-3708

North Carolina Electric Membership
Corporation
P. O. Box 27306
Raleigh, North Carolina 27611

Senior Resident Inspector
U.S. Nuclear Regulatory Commission
4830 Concord Road
York, South Carolina 29745

Mr. Virgil R. Autry, Director
Dept of Health and Envir Control
2600 Bull Street
Columbia, South Carolina 29201-1708

Mr. C. Jeffrey Thomas
Manager - Nuclear Regulatory Licensing
Duke Energy Corporation
526 South Church Street
Charlotte, North Carolina 28201-1006

Mr. L. A. Keller
Duke Energy Corporation
526 South Church Street
Charlotte, North Carolina 28201-1006

Saluda River Electric
P. O. Box 929
Laurens, South Carolina 29360

Mr. Peter R. Harden, IV
VP-Customer Relations and Sales
Westinghouse Electric Company
5929 Carnegie Blvd.
Suite 500
Charlotte, North Carolina 28209

Mr. T. Richard Puryear
Owners Group (NCEMC)
Duke Energy Corporation
4800 Concord Road
York, South Carolina 29745

Mr. Richard M. Fry, Director
North Carolina Dept of Env, Health, and
Natural Resources
3825 Barrett Drive
Raleigh, North Carolina 27609-7721

County Manager of
Mecklenburg County
720 East Fourth Street
Charlotte, North Carolina 28202

Michael T. Cash

Regulatory Compliance Manager
Duke Energy Corporation
McGuire Nuclear Site
12700 Hagers Ferry Road
Huntersville, North Carolina 28078

Senior Resident Inspector
U.S. Nuclear Regulatory Commission
12700 Hagers Ferry Road
Huntersville, North Carolina 28078

Dr. John M. Barry
Mecklenburg County
Department of Environmental Protection
700 N. Tryon Street
Charlotte, North Carolina 28202

Mr. Gregory D. Robison
Duke Energy Corporation
Mail Stop EC-12R
526 S. Church Street
Charlotte, NC 28201-1006

**TELECOMMUNICATION PARTICIPANTS**
**NOVEMBER 13, 2001**

**Staff Participants**

Rani Franovich

Duc Nguyen

Paul Shemanski

Jim Lazevnick

John Knox

**Duke Energy Corporation Participants**

Bob Gill

Paul Colaianni

Attachment