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U. S. Nuclear Regulatory Commission
Washington, DC 20555

Subject: License Renewal
Response to NRC Letter dated December 14, 1999
Oconee Nuclear Station
Docket Nos. 50-269, -270, -287

By letter dated July 6, 1998 Duke Energy Corporation (Duke) submitted an Application for Renewed Operating Licenses for Oconee Nuclear Station, Units 1, 2, and 3 (Application). Exhibit A of the Application contains the technical information required by 10 CFR Part 54. By letter dated June 16, 1999 the staff provided the Safety Evaluation Report (SER) Related to the License Renewal Application of Oconee Nuclear Station, Units 1, 2, and 3 (June 1999).

During the license renewal inspections at Oconee the staff identified an issue involving the aging management program for insulated cables and connections in a letter to Duke dated October 5, 1999. The staff designated the issue as SER Open Item 3.9.3-1. On November 5, 1999 Duke provided a proposed response to the staff's letter. The staff and Duke had a telephone call on November 10, 1999 to discuss the issue. In addition, the staff sent Duke a letter dated November 18, 1999 that provided the status of the Oconee SER open and confirmatory items. In the November 18, 1999 open item letter, the staff detailed its concerns with Duke's proposed response.

In response to the staff's comments on the initial proposed aging management program, Duke provided a revised program description on December 8, 1999. Additional discussion with the staff took place on December 9, 1999. The December 9, 1999 meeting culminated in a revised response to the SER open item. By letter dated December 17, 1999 Duke provided a description of the *Insulated Cables Aging Management Program* to address SER Open Item 3.9.3-1 that included specific responses to four staff comments. In its letter dated January 4, 2000 the staff concluded that three of four comment areas are resolved. The staff considered the response to Comment 3 open.

Comment 3 of SER Open Item 3.9.3-1 involves electrical measurements to detect aging of inaccessible medium-voltage cables exposed to moisture. Based on the staff's review of electrical transmission and distribution industry experience relative to aging degradation

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of electrical transmission and distribution industry experience relative to aging degradation associated with inaccessible or direct-buried cables and existing in-situ tests, the staff believes that some form of testing should be done on inaccessible and direct-buried cables at Oconee. The staff requested more information regarding the aging management program for inaccessible or direct-buried cables in order to resolve this remaining open item. Our comments on the industry operating experience and test methods described by the staff in its letter, as well as our response to the staff request for more information regarding the aging management program for inaccessible or direct-buried cables, are provided as follows:

(1) Industry experience identified by the staff may not be applicable to Oconee

The staff mentioned the recent failure of a 5kV cable in underground conduit at Davis-Besse. The root cause of this cable failure is not yet known. Although the staff theorizes specific failure causes in the January 4, 2000 letter, taking actions based on theories instead of the actual root cause could lead to inappropriate actions and may not prevent recurrence of the event. Enough physical differences exist between the construction of the Davis-Besse cable and Oconee medium-voltage cables that there is doubt on the applicability of the event to Oconee. In addition, the Davis-Besse, Diablo Canyon and Palisades cable failures mentioned in the letter involved cables installed in conduit, which is not applicable to Oconee direct-buried cables.

Enough differences exist between the construction, installation and maintenance practices of the electrical transmission and distribution (T&D) industry and those of the nuclear power plant industry that broad questions are raised regarding the applicability of the T&D operating experience to Oconee.

(2) Test methods identified by the staff have limitations and have not been demonstrated to be effective

The staff stated that it believes the electrical T&D industry, and to a lesser extent, the nuclear industry are using in-situ, non-destructive, electrical methods to detect aging degradation. The staff mentions Power Factor (Doble), partial discharge and very low frequency (VLF) tests as examples. Yet, these tests have limitations on their applicability, such as a test being useful only for relatively short lengths of cable, with no baseline data available for older cable installations there may be no clear acceptance criteria for evaluating test results, or the test only providing a measure of the overall condition of the conductor insulation and giving no specific information on localized defects or weak spots. At Oconee, the cables that may be potential candidates for these tests are all relatively long, with the two direct-buried cables being nearly a mile in length.

The staff also mentioned the list of tests in Table 5-2 of the report SAND96-0344. This report is an industry recognized source of information on cable aging and Duke agrees with the staff for citing it as a reference. Table 5-2 identifies four tests that are

non-destructive, remote, electrical, field techniques for condition monitoring. However, SAND96-0344 Table 5-4 identifies limitations of these tests such as, "may not reflect actual dielectric properties of insulation," "affected by temperature, humidity, and cable length," "may not always be effective," "Often not reflect dielectric aging" and "Not generally effective on extruded insulation."

The staff also specifically mentioned that PECO Energy uses VLF tests extensively. Industry contacts at PECO Energy confirmed that they do in fact perform VLF tests. However, these tests are only performed on their T&D side of the company on cables already suspected of being "bad." In addition, these tests are used as "proof" tests as opposed to "predictive tests."

Summary of comments on the NRC staff letter dated January 4, 2000
Overall, many of the statements made in the staff letter regarding testing and operating experience are made with no reference to the published materials that could give them substance, or a means of confirming the data, or its applicability to Oconee. Tests were implied as being used in the industry to detect aging degradation when in fact that is not the case. Experience and practices used in the electrical T&D industry are implied to be directly applicable to the nuclear power plant industry, when in fact they may not be applicable.

Duke continues to believe that in-situ, non-destructive, electrical methods are not currently available to effectively detect aging degradation of inaccessible or direct-buried cables.

Revised *Insulated Cables Aging Management Program*
In response to the staff request, Duke is providing the revised *Insulated Cables Aging Management Program*. The revised *Insulated Cables Aging Management Program* supercedes the version provided in Attachment 1 to Duke letter dated December 17, 1999. Significant changes to the *Insulated Cables Aging Management Program* provided in the December 17, 1999 letter are identified below.

As discussed in the conference calls on January 5, 2000 and January 10, 2000 the Scope description is changed to add "accessible and inaccessible" and "in conduit and direct-buried." At Oconee, inaccessible and direct-buried cables that may be potential candidates for this program include two direct-buried cables and three cables in conduit.

The Method, Frequency and Acceptance Criteria are changed to split descriptions of insulated cables that are accessible for visual inspection and medium-voltage cables that are inaccessible or direct-buried. The Method for inaccessible or direct-buried, medium-voltage cables subject to the applicable aging effect includes a test. The type of test to be used is not specified and references to the 13.8kV cable Technical Specification surveillance testing are removed.

Also added are definitions for "significant moisture exposure" and "significant voltage exposure." The definition for significant moisture exposure is based on the "normal rain and drain" concept. The definition for significant voltage exposure is based on reasonable judgement since no set time value was found in any literature of which Duke, or any of our industry contacts, are aware. These definitions apply to cables for which no specific design characteristics are known. The moisture and voltage exposures described as significant in these definitions are not significant for medium-voltage cables that are designed for these conditions (e.g., submarine cables).

The following is the revised *Insulated Cables Aging Management Program.*

Insulated Cables Aging Management Program

Purpose – The purpose of the *Insulated Cables Aging Management Program* is to provide reasonable assurance that the license renewal intended functions of insulated cables will be maintained consistent with the current licensing basis through the period of extended operation.

Scope – The *Insulated Cables Aging Management Program* includes accessible and inaccessible insulated cables within the scope of license renewal that are installed in adverse, localized environments in the Reactor Buildings, Auxiliary Buildings, Turbine Buildings, Standby Shutdown Facility, Keowee, in conduit and direct-buried, which could be subject to applicable aging effects from heat, radiation or moisture. This program does not include insulated cables that are in the Environmental Qualification program. An adverse, localized environment is defined as a condition in a limited plant area that is significantly more severe than the specified service condition for the equipment. An applicable aging effect is an aging effect that, if left unmanaged, could result in the loss of a component's license renewal intended function in the period of extended operation.

Aging Effects – Change in material properties of the conductor insulation is the applicable aging effect. The changes in material properties managed by this program are those caused by severe heat, radiation or moisture — conditions that establish an adverse, localized environment, which include energized medium-voltage cables exposed to significant moisture.

Method – The methods used are different for accessible insulated cables and for inaccessible or direct-buried medium-voltage cables, which cannot be visually inspected.

Accessible insulated cables installed in adverse, localized environments will be visually inspected for cable jacket surface anomalies such as embrittlement, discoloration, cracking or surface contamination. Surface anomalies are indications that can be visually

monitored to preclude the conductor insulation applicable aging effect. In addition, water collection in manholes containing in-scope, medium-voltage cables will be monitored to prevent the cables from being exposed to significant moisture.

Inaccessible or direct-buried, medium-voltage cables exposed to significant moisture and significant voltage will be tested. The specific type of test performed will be determined prior to each test. Significant moisture exposure is defined as periodic exposures to moisture that last more than a few days (e.g., cable in standing water). Periodic exposures to moisture that last less than a few days (i.e., normal rain and drain) are not significant. Significant voltage exposure is defined as being subjected to system voltage for more than twenty-five percent of the time. These definitions apply to cables for which no specific design characteristics are known. The moisture and voltage exposures described as significant in these definitions are not significant for medium-voltage cables that are designed for these conditions.

Sample Size – Samples may be used for this program. If used, an appropriate sample size will be determined prior to the inspection or test.

Industry Codes and Standards – EPRI TR-109619, *Guideline for the Management of Adverse Localized Equipment Environments* will be used as guidance in implementing this program.

Frequency – Accessible insulated cables installed in adverse, localized environments will be inspected at least once every 10 years. Water collection in manholes containing in-scope, medium-voltage cables will be monitored at a frequency adequate to prevent the cables from being exposed to significant moisture.

Inaccessible or direct-buried, medium-voltage cables exposed to significant moisture and significant voltage will be tested at least once every 10 years.

Acceptance Criteria or Standard – The acceptance criteria is different for accessible insulated cables and for inaccessible or direct-buried medium-voltage cables.

For accessible insulated cables installed in adverse, localized environments, the acceptance criteria is no unacceptable, visual indications of cable jacket surface anomalies, which suggest that conductor insulation applicable aging effect may exist, as determined by engineering evaluation. An unacceptable indication is defined as a noted condition or situation that, if left unmanaged, could lead to a loss of the cable's license renewal intended function. In-scope, medium-voltage cables in manholes found to be exposed to significant moisture will be tested as described for inaccessible cables under Method, Frequency and Acceptance Criteria of this program.

For inaccessible or direct-buried, medium-voltage cables exposed to significant moisture and significant voltage, the acceptance criteria for the test will be defined by the specific type of test to be performed and the specific cable to be tested.

Corrective Action – Further investigation by engineering will be performed on accessible and inaccessible insulated cables when the acceptance criteria is not met in order to ensure that the license renewal intended functions of the insulated cables will be maintained consistent with the current licensing basis. Corrective actions may include, but are not limited to, testing, shielding or otherwise changing the environment, relocating or replacement of the affected cable. Specific corrective actions will be implemented in accordance with the Problem Investigation Process. The Problem Investigation Process applies to all structures and components within the scope of the *Insulated Cables Aging Management Program.* When an unacceptable condition or situation is identified, a determination will be made as to whether this same condition or situation could be applicable to other accessible or inaccessible cables.

Timing of New Program or Activity – Following issuance of a renewed operating licenses for Oconee Nuclear Station, the initial inspections and tests will be completed by February 6, 2013 (the end of the initial license term for Oconee Unit 1).

Administrative Controls – The *Insulated Cables Aging Management Program* will be controlled by plant procedures. The responsible engineer may adjust the attributes of this program provided such changes do not adversely affect the capability of the program actions to manage the applicable aging effect such that the license renewal intended functions of the insulated cables will be maintained consistent with the current licensing basis.

Regulatory Basis – The *Insulated Cables Aging Management Program* has no current regulatory basis.

A summary description of the revised *Insulated Cables Aging Management Program* will be provided in the UFSAR Supplement required by §54.21(d).

If there are any questions regarding the contents of this submittal, please contact Bob Gill at 704-382-3339.

Very truly yours,

M. S. Tuckman

M. S. Tuckman, being duly sworn, states that he is Executive Vice President, Nuclear Generation Department, Duke Energy Corporation, that he is authorized on the part of said Company to sign and file with the U. S. Nuclear Regulatory Commission this response to the request for information contained in a staff letter dated January 4, 2000 and that all statements and matters set forth herein are true and correct to the best of his knowledge and belief. To the extent that these statements are not based on his personal knowledge, they are based on information provided by Duke employees and/or consultants. Such information has been reviewed in accordance with Duke Energy Corporation practice and is believed to be reliable.

M. S. Tuckman

M. S. Tuckman, Executive Vice president
Duke Energy Corporation

Subscribed and sworn to before me this 12TH day of JANUARY 2000.

Mary P. Nelms

Notary Public

My Commission Expires:

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