50-269/270/287

UNITED STATES
NUCLEAR REGULATORY COMMISSION
WASHINGTON, D.C. 20555-0001

November 18, 1999

LICENSEE: Duke Energy Corporation (Duke)

FACILITY: Oconee Nuclear Station, Units 1, 2, and 3

SUBJECT: SUMMARY OF DISCUSSIONS BETWEEN THE U.S. NUCLEAR REGULATORY COMMISSION (NRC) STAFF AND DUKE REPRESENTATIVES REGARDING CONTAINMENT TENDON TREND LINES FOR THE OCONEE LICENSE RENEWAL APPLICATION (LRA)

In the safety evaluation report (SER) for the Oconee LRA the staff created open item 4.2.2.3-1 regarding the trend lines for the containment tendons. In order to support resolution of the issue the staff and Duke exchanged several proposed revisions to the SER open item response and comments on the proposed revision.

Enclosure 1 contains Duke's original proposed response that was provided to the staff on September 9, 1999. On September 24, 1999, the staff provided feedback to Duke on its proposed response in the form of Enclosure 2. Enclosure 2 contains the staff's feedback as well as a proposed response from Baltimore Gas and Electric for the Calvert Cliffs LRA regarding the same issue.

Duke provided its response to all the SER open items in a letter dated October 15, 1999. The staff provided feedback to Duke on SER open item 4.2.2.3-1 in a October 27, 1999, phone call. The Duke participants in the call were Debbie Ramsey, Robert Gill and Mark Ferlisi. The staff participants were Hans Ashar, Kamal Manoly, and Joe Sebrosky. During the phone call the staff stated that Duke's October 15, 1999, response needed to be revised in the area of purpose, scope, frequency, corrective action, and acceptance criteria. The phone call led to Duke revising its response. Enclosure 3, contains Duke's revised response. Enclosure 4 contains the staff's comments on the revised response.

The staff and Duke had a phone call on November 10, 1999, to discuss the staff's comments contained in Enclosure 4. The Duke participants were Debbie Ramsey and Robert Gill. The staff participants were Hans Ashar, Kamal Manoly, and Joe Sebrosky. The staff stated that it believes that Duke needed to explicitly state that the time limited aging analysis (TLAA) for the post-tensioning system loss of prestress aging management program was done in accordance with 10 CFR 54.21(c)(1)(iii). Duke stated that it would adopt the staff's proposal in Enclosure 4 in its response. Regarding the staff comments for frequency contained in Enclosure 4, Duke stated that they did not believe it was appropriate to reference a relief request that was made in accordance with its inservice inspection program. Duke did believe it was appropriate because the relief request was only for a particular 10 year interval and not for the period of extended operation. The staff agreed with Duke, but requested that Duke reference Section 4.8 of its LRA in order to clarify the frequency for the containment tendons. Duke provided Enclosure 5 to address the TLAA and the frequency concern. The staff agrees that the amended response to SER open item 4.2.2.3-1 contained in Enclosure 5 will resolve the issue.

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Duke's stated that it will submit its response contained in Enclosure 5 in a separate letter in order to resolve the issue. The staff stated that it will consider the item to be confirmatory until Duke submits its response.

Original Signed By

Joseph M. Sebrosky, Project Manager
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Division of Regulatory Improvement Programs
Office of Nuclear Reactor Regulation

Docket Nos. 50-269, 50-270,
and 50-287

Enclosure: As stated (5)

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FAX FROM DUKE TO THE STAFF 9/9/99

SER Open Item 4.2.2.3-1

In Figures 1, 2, and 3 of Appendix 16.6-2 to Chapter 16 of the UFSAR Supplement for License Renewal, the applicant shows the PLL lines and MRVs for the 60-year period for each group of tendons in the ONS containments. However, the applicant does not show the trend lines that would demonstrate the adequacy of the existing prestressing forces in the containment tendons for the period of extended operation.

Duke Response to SER Open Item 4.2.2.3-1

Prior to 1996, Oconee conducted tendon testing on the same set of pre-selected tendons. Subsequent inspections were performed using a Regulatory Guide 1.35 type surveillance. The inspections will be implemented in the future in accordance with requirements of 10 CFR §50.55a (61 *Federal Register* 41303, dated August 8, 1996) and the 1992 Edition with the 1992 Addenda of Subsection IWL, "Requirements for Class CC Concrete Components of Light-Water Cooled Power Plants." Therefore, as provided for in Part 54, TLAA of containment tendon forces can be conducted in accordance with Part 54.21(c)(iii) by relying on the tendon surveillance program required by Part 50.55a(b)(ix).

The *Containment Inservice Inspection Plan* is discussed in Section 4.8.2 of Exhibit A of the Application with additional discussion provided in Duke responses to RAIs 4.8-3, 5.3.2-1, and 5.3.2-2 transmitted in a February 8, 1999 letter. The *Containment Inservice Inspection Plan* includes testing, evaluation, trending and reporting. The documentation of the program and trending of the loss of prestress are maintained on site and available for staff review. The attributes of an effective aging management program are provided in Section 4.8.2 and while the program addresses additional aging effects, only those attributes associated with managing loss of prestress are restated here.

Purpose – The purpose of the ASME Section XI, Subsection IWL examinations is to identify and correct degradation of the post-tensioning system prior to a loss of prestress that does not meet the required minimum value.

Scope – The scope of the ASME Section XI Subsection IWL inservice inspection covers the reinforced concrete and the post-tensioning systems of concrete containments.

Aging Effects or Relevant Conditions – Loss of prestress of the post-tensioning system.

Method – Tendon force and elongation are required to be measured to evaluate the prestressing force of the system.

Sample Size – Not applicable for an existing program. Note: the sample size is specified in IWL-2520.

Industry Codes or Standard – ASME Code Section XI, Subsection IWL provides requirements for inservice inspection, trending, and repair or replacement activities of the post-tensioning systems of concrete containments.

Frequency – The frequency of inspection is specified in IWL-2400. The inspection intervals are not restricted by the Code to the current term of operation and are valid for any period of extended operation.

Acceptance Criteria or Standard – Acceptance standards are specified in IWL-3000.

Corrective Action – Requirements for repair or replacement activities, including but not limited to retensioning, are specified in IWL-4000 and IWL-7000. Specific corrective actions will be taken in accordance with the *Duke Quality Assurance Program.*

Administrative Controls – The Oconee *Containment Inservice Inspection Plan* is implemented by procedures that are developed and maintained in accordance with the Duke *Quality Assurance Program.*

Regulatory Basis – The Oconee *Containment Inservice Inspection Plan* will implement the requirements of 10 CFR §50.55a (61 *Federal Register* 41303, dated August 8, 1996) and the 1992 Edition with the 1992 Addenda of Subsection IWL, "Requirements for Class CC Concrete Components of Light-Water Cooled Power Plants."

Operating experience which demonstrates the effectiveness of the *Containment Inservice Inspection Plan* applicable to the tendon force monitoring is provided in Section 4.8.2 of Exhibit A of the Application and in response to RAI 4.8-3 contained in Duke letter dated February 8, 1999.

STAFF REVIEW OF RESPONSE TO OPEN ITEM 4.2.2.3-1
OCONEE LICENSE RENEWAL SER

Ref. Duke's Draft Proposal (Fax) to Joe Sebroski, September 9, 1999.

The containment prestressing force TLAA in accordance with 10 CFR 54.21(c)(iii) is acceptable. However, the associated aging management program should properly address the ten evaluation elements. In the Reference, Duke does not properly address these elements. The most relevant elements are (the phrases in *italics* are suggested to avoid another round of questions):

Parameters Monitored/Inspected: *Prestressing force in accordance with* --------

Monitoring and Trending: *Prestressing forces trending as per 10 CFR 50.55a(b)(2)(ix)(B), extended to EPO.*

Acceptance Criteria: *Prestress force trending stay above the PLL lines.*

Corrective Actions:

Operating Experience:

BGE's proposed response regarding
CONTAINMENT TENDONS

3.10.3.2.1 and 4.1.3-2 (tendons TLAA)

As stated in NRC letter dated August 12, 1999, "the staff understands that BGE intends to manage the tendon prestress force TLAA as an aging management program under 54.21(c)(1)(iii)." NRC requested information in four areas, which is provided below:

1) The parameters monitored or inspected per 10 CFR 50.55a(b)(2)(ix)(b).

There is a discussion of BGE's current surveillance program in UFSAR section 15.6 (part of the "Technical Requirements Manual".) Key areas are as follows:

- Normalized tendon liftoff forces.
- Wire sample
- Visual inspections

Although paragraph 10 CFR 50.55a(b)(2)(ix)(B) is limited to evaluation of prestressing forces in consecutive surveillances, we plan to inspect all of the parameters listed in (ix).

2) The acceptance criteria such that projected tendon force trending remains above the predicted lower limit.

ASME Code Section XI, IWL-3221 gives the requirements for acceptance by examination, including the provision that "the prestressing forces for each type of tendon ... and the measurement from the previous examination indicate a prestress loss such that predicted tendon forces meet the minimum design prestress forces at the next scheduled examination." If we would not meet this criterion, the options are acceptance by evaluation (IWL-3222) and acceptance by repair / replacement activity (IWL-3223).

3) Corrective actions that include systematic retensioning of tendon population to ensure the adequacy of prestressing force.

Potential actions include:

- "Bootstrapping," or increasing the tension in all or part of the tendons.
- Replacing selected tendons with new tendons.
- Reanalysis

4) Operating experience as applicable to tendon force monitoring.

Other plants have observed prestressing wire corrosion, end anchorage failures, water in the vertical tendons, and greater than expected relaxation due to solar heating.

BGE found broken wires in the 1997 inspection, and submitted reports to the NRC dated August 28, 1997, October 28, 1997, and May 14, 1998. At that time, we thought it prudent to replace a number of tendons.

3.10.3.2.1 and 4.1.3-2 (tendons TLAA) (continued)

Since 1997, we researched tendon sheathing material ("grease";) ran tests on grease replacement methods; wrote a specification for and received bids for tendon replacement. We also contracted a specialty consulting firm for additional analyses to verify and/or refine the UFSAR values for containment strength.

In addition, we performed visual inspections on over half of the vertical tendons in 1999, including all previously categorized as having "severe corrosion." We found a few more broken wires. Since this is a low number, we have another specialty consulting firm reevaluating the wire break projections for future years. We are reevaluating our position, and expect to submit additional information to the NRC later this year.

In conclusion, BGE feels this adequately addresses the issues and demonstrates BGE's ability to effectively manage this TLAA.

Duke's revised response to SER OI 4.2.2.3-1

SER Open Item 4.2.2.3-1 – In Figures 1, 2, and 3 of Appendix 16.6-2 to Chapter 16 of the UFSAR Supplement for License Renewal, the applicant shows the PLL lines and MRVs for the 60-year period for each group of tendons in the ONS containments. However, the applicant does not show the trend lines that would demonstrate the adequacy of the existing prestressing forces in the containment tendons for the period of extended operation.

Revised Duke Response to SER Open Item 4.2.2.3-1

Prior to 1996, Oconee conducted tendon testing on the same set of pre-selected tendons. Subsequent inspections were performed using a Regulatory Guide 1.35 type surveillance. The inspections will be implemented in the future in accordance with requirements of 10 CFR §50.55a (61 *Federal Register* 41303, dated August 8, 1996) and the 1992 Edition with the 1992 Addenda of Subsection IWL, "Requirements for Class CC Concrete Components of Light-Water Cooled Power Plants." Therefore, as provided for in Part 54, TLAA of containment tendon forces can be conducted in accordance with Part 54.21(c)(iii) by relying on the tendon surveillance ~~pro~~gram required by Part 50.55a(b)(ix).

The *Containment Inservice Inspection Plan* is discussed in Section 4.8.2 of Exhibit A of the Application with additional discussion provided in Duke responses to RAIs 4.8-3, 5.3.2-1, and 5.3.2-2 transmitted in a February 8, 1999 letter. The *Containment Inservice Inspection Plan* includes testing, evaluation, trending and reporting. The documentation of the program and trending of the loss of prestress are maintained on site and available for staff review. An activity within the *Containment Inservice Inspection Plan* is the "Post-Tensioning System Loss of Prestress Aging Management Program". ~~The attributes of an effective aging management program are provided in Section 4.8.2 and while the program addresses additional aging effects, only those attributes associated with managing loss of prestress are restated here. Minor revisions to the initial program description have been made to address staff concerns.~~The "Post-Tensioning System Loss of Prestress Aging Management Program" is discussed below using the elements of an effective aging management program which are provided in Section 4.8.2 of Exhibit A of the Application.

Purpose – The purpose of the ~~ASME Section XI, Subsection IWL examinations~~ "Post-Tensioning System Loss of Prestress Aging Management Program" is to identify and correct degradation of the post-tensioning system prior to a loss of prestress that does not meet the required minimum value.

Scope – The scope of the ~~ASME Section XI Subsection IWL inservice inspection~~ "Post-Tensioning System Loss of Prestress Aging Management Program" covers ~~the reinforced concrete and~~ the loss of prestress of ~~-~~post-tensioning systems of concrete containments.

Aging Effects – Loss of prestress of the post-tensioning system.

Enclosure 3

10/27/99 Version

Method – Tendon prestress force and elongation are required to be measured to evaluate the prestressing force of the system. Prestress forces are trended in accordance with the requirements of 10 CFR 50.55a(b)(2)(ix)(B).

Sample Size – Not applicable for an existing program. Note: the sample size is specified in IWL-2520.

Industry Codes or Standard – ASME Code Section XI, Subsection IWL provides requirements for inservice inspection, trending, and repair or replacement activities of the post-tensioning systems of concrete containments.

Frequency – The frequency of inspection of the post-tensioning system is specified in Table IWL-2500-1, Examination Category L-B, Unbonded Post-Tensioning System. ~~IWL-2400.~~ The inspection intervals are not restricted by the Code to the current term of operation and are valid for any period of extended operation.

Acceptance Criteria or Standard – Acceptance standards for the post-tensioning system are specified in Oconee UFSAR, Chapter 16, SLC 16.6.2. Oconee UFSAR, Chapter 16, SLC 16.6.2 contains the minimum required value (MRV) and prescribed lower limit (PLL) for each group of tendons.

Corrective Action ~~– Requirements for repair or replacement activities, including but not limited to retensioning, are specified in IWL-4000 and IWL-7000.~~ Where tendon forces fall below the acceptance standards, corrective actions may include retensioning, replacement of selected tendons with new tendons, or reanalysis. Specific corrective actions will be taken in accordance with the *Duke Quality Assurance Program.*

Administrative Controls – The Oconee "Post-Tensioning System Loss of Prestress Aging Management Program," which is an activity within the *Containment Inservice Inspection Plan*, is implemented by procedures that are developed and maintained in accordance with the Duke *Quality Assurance Program.*

Regulatory Basis – The Oconee "Post-Tensioning System Loss of Prestress Aging Management Program," which is an activity within the *Containment Inservice Inspection Plan*, will implement the requirements of 10 CFR §50.55a (61 *Federal Register* 41303, dated August 8, 1996) and the 1992 Edition with the 1992 Addenda of Subsection IWL, "Requirements for Class CC Concrete Components of Light-Water Cooled Power Plants."

Operating experience which demonstrates the effectiveness of the *Containment Inservice Inspection Plan* applicable to the tendon force monitoring is provided in Section 4.8.2 of Exhibit A of the Application and in response to RAI 4.8-3 contained in Duke letter dated February 8, 1999.

STAFF'S COMMENTS ON 10/27 VERSION

SER Open Item 4.2.2.3-1 – In Figures 1, 2, and 3 of Appendix 16.6-2 to Chapter 16 of the UFSAR Supplement for License Renewal, the applicant shows the PLL lines and MRVs for the 60-year period for each group of tendons in the ONS containments. However, the applicant does not show the trend lines that would demonstrate the adequacy of the existing prestressing forces in the containment tendons for the period of extended operation.

Revised Duke Response to SER Open Item 4.2.2.3-1
Prior to 1996, Oconee conducted tendon testing on the same set of pre-selected tendons. Subsequent inspections were performed using a Regulatory Guide 1.35 type surveillance. The inspections will be implemented in the future in accordance with requirements of 10 CFR §50.55a (61 *Federal Register* 41303, dated August 8, 1996) and the 1992 Edition with the 1992 Addenda of Subsection IWL, "Requirements for Class CC Concrete Components of Light-Water Cooled Power Plants." Therefore, as provided for in Part 54, TLAA of containment tendon forces can be conducted in accordance with Part 54.21(c)(iii) by relying on the tendon surveillance program required by Part 50.55a(b)(ix).

The *Containment Inservice Inspection Plan* is discussed in Section 4.8.2 of Exhibit A of the Application with additional discussion provided in Duke responses to RAIs 4.8-3, 5.3.2-1, and 5.3.2-2 transmitted in a February 8, 1999 letter. The *Containment Inservice Inspection Plan* includes testing, evaluation, trending and reporting. The documentation of the program and trending of the loss of prestress are maintained on site and available for staff review. An activity within the *Containment Inservice Inspection Plan* is the "Post-Tensioning System Loss of Prestress Aging Management Program". ~~The attributes of an effective aging management program are provided in Section 4.8.2 and while the program addresses additional aging effects, only those attributes associated with managing loss of prestress are restated here. Minor revisions to the initial program description have been made to address staff concerns.~~ The "Post-Tensioning System Loss of Prestress Aging Management Program" is discussed below using the elements of an effective aging management program which are provided in Section 4.8.2 of Exhibit A of the Application.

NRC comment ↓
In accordance with the requirements of 10 CFR 54.21 (c)(1)(iii) the TLAA related to the

Purpose – The purpose of the ~~ASME Section XI, Subsection IWL examinations~~ "Post-Tensioning System Loss of Prestress Aging Management Program" is to identify and correct degradation of the post-tensioning system prior to a loss of prestress that does not meet the required minimum value.

Scope – The scope of the ~~ASME Section XI Subsection IWL inservice inspection~~ "Post-Tensioning System Loss of Prestress Aging Management Program" covers ~~the reinforced concrete and~~ the loss of prestress of ~~post-tensioning~~ systems of concrete containments.

Aging Effects – Loss of prestress of the post-tensioning system.

The note below pertains to Duke's proposed response to SEROI 4.2.2.3-1 dated 10/27/99 & applies to the description under the "Frequency" element.

in Subsection IWL is

Frequency of Inspection ~~for each Unit of Oconee 3-Unit Plant as~~ not directly applicable to Oconee three unit plant. The applicant had requested the NRC to approve an alternative to the IWL requirement for frequency of inspection. The staff had approved the alternative & this should be reflected in the write-up for frequency.

NOTE: Hans believes the above request was made in 1998 & approved by the NRC in 1999

SER Open Item 4.2.2.3-1 – In Figures 1, 2, and 3 of Appendix 16.6-2 to Chapter 16 of the UFSAR Supplement for License Renewal, the applicant shows the PLL lines and MRVs for the 60-year period for each group of tendons in the ONS containments. However, the applicant does not show the trend lines that would demonstrate the adequacy of the existing prestressing forces in the containment tendons for the period of extended operation.

Amended Duke Response to SER Open Item 4.2.2.3-1

The initial response to SER Open Item 4.2.2.3-1 was provided by Duke letter dated October 15, 1999. Subsequent discussions were held between Duke and the staff on the initial response. The result of these discussions was a commitment by Duke to provide an Amended Response to SER Open Item 4.2.2.3-1.

Prior to 1996, Oconee conducted tendon testing on the same set of pre-selected tendons. Subsequent inspections were performed using a Regulatory Guide 1.35 type surveillance. The inspections will be implemented in the future in accordance with requirements of 10 CFR §50.55a (61 *Federal Register* 41303, dated August 8, 1996) and the 1992 Edition with the 1992 Addenda of Subsection IWL, "Requirements for Class CC Concrete Components of Light-Water Cooled Power Plants." Therefore, as provided for in Part 54, TLAA of containment tendon forces can be conducted in accordance with Part 54.21(c)(1)(iii) by relying on the tendon surveillance program required by Part 50.55a(b)(ix).

The *Containment Inservice Inspection Plan* is discussed in Section 4.8.2 of Exhibit A of the Application with additional discussion provided in Duke responses to RAIs 4.8-3, 5.3.2-1, and 5.3.2-2 transmitted in a February 8, 1999 letter. The *Containment Inservice Inspection Plan* includes testing, evaluation, trending and reporting. The documentation of the program and trending of the loss of prestress are maintained on site and available for staff review. An activity within the *Containment Inservice Inspection Plan* is the "Post-Tensioning System Loss of Prestress Aging Management Program". In accordance with the requirements of 10 CFR 54.21(c)(1)(iii), the TLAA related to the "Post-Tensioning System Loss of Prestress Aging Management Program" is discussed below using the elements of an effective aging management program which are provided in Section 4.8.2 of Exhibit A of the Application.

Purpose – The purpose of the "Post-Tensioning System Loss of Prestress Aging Management Program" is to identify and correct degradation of the post-tensioning system prior to a loss of prestress that does not meet the required minimum value.

Scope – The scope of the "Post-Tensioning System Loss of Prestress Aging Management Program" covers the loss of prestress of post-tensioning systems of concrete containments.

Aging Effects – Loss of prestress of the post-tensioning system.

Method – Tendon prestress force and elongation are required to be measured to evaluate the prestressing force of the system. Prestress forces are trended in accordance with the requirements of 10 CFR 50.55a(b)(2)(ix)(B).

Sample Size – Not applicable for an existing program. Note: the sample size is specified in IWL-2520.

Industry Codes or Standard – ASME Code Section XI, Subsection IWL provides requirements for inservice inspection, trending, and repair or replacement activities of the post-tensioning systems of concrete containments.

Frequency – The frequency of inspection of the post-tensioning system is specified in the Oconee *Containment Inservice Inspection Plan* which is addressed in Section 4.8 of Exhibit A of the Application.

Acceptance Criteria or Standard – Acceptance standards for the post-tensioning system are specified in Oconee UFSAR, Chapter 16, SLC 16.6.2. Oconee UFSAR, Chapter 16, SLC 16.6.2 contains the minimum required value (MRV) and prescribed lower limit (PLL) for each group of tendons.

Corrective Action –Where tendon forces fall below the acceptance standards, corrective actions may include retensioning, replacement of selected tendons with new tendons, or reanalysis. Specific corrective actions will be taken in accordance with the *Duke Quality Assurance Program.*

Administrative Controls – The Oconee "Post-Tensioning System Loss of Prestress Aging Management Program," which is an activity within the *Containment Inservice Inspection Plan*, is implemented by procedures that are developed and maintained in accordance with the Duke *Quality Assurance Program.*

Regulatory Basis – The Oconee "Post-Tensioning System Loss of Prestress Aging Management Program," which is an activity within the *Containment Inservice Inspection Plan*, will implement the requirements of 10 CFR §50.55a (61 *Federal Register* 41303, dated August 8, 1996*)* and the 1992 Edition with the 1992 Addenda of Subsection IWL, "Requirements for Class CC Concrete Components of Light-Water Cooled Power Plants."

Operating experience which demonstrates the effectiveness of the *Containment Inservice Inspection Plan* applicable to the tendon force monitoring is provided in Section 4.8.2 of Exhibit A of the Application and in response to RAI 4.8-3 contained in Duke letter dated February 8, 1999.