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U.S. Nuclear Regulatory Commission
Washington, D.C. 20555-0001

ATTENTION: Document Control Desk

SUBJECT: Duke Energy Corporation
Oconee Nuclear Station - Unit 2
Docket No. 50-270
Inservice Inspection Summary Report for Class MC and CC Component Examinations Completed by End of Refueling Outage EOC17

Pursuant to 10CFR50.55a(b)(2)(viii) and 10CFR50.55a(b)(2) (ix), Duke Energy Corporation submits the attached ISI Summary Report for ASME Class MC and CC Inservice Inspections completed between September 9, 1999 and the end of refueling outage EOC17, which ended on December 16, 1999.

This Summary Report includes a description of planned corrective actions to address leaking tendon grease caps. This description is provided for your information only, and is not intended to represent a commitment.

Questions regarding the attached report may be directed to M. J. Ferlisi at (704) 382-3923.
Very truly yours,

W. R. McCollum, Jr.
Site Vice President

Attachment:
Oconee Nuclear Station Unit 2
Class MC and CC ISI Summary Report for Refueling Outage EOC17

A047

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Oconee Nuclear Station, Unit 2
Class MC and CC ISI Summary Report for Refueling Outage EOC17

By: _____ Date: 3/9/2000
(Mark J. Ferlisi, P.E.)

Reviewed By: _____ Date: 3/9/2000
(R. V. Hester, P.E. IWL
Responsible Engineer)

Approved By: _____ Date: 3-9-2000

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A. ASME Code and Regulatory Requirements for Class MC and CC ISI Summary Reports

10CFR50.55a(g)(4)(v)(B) requires that metallic shell and penetration liners which are pressure retaining components and their integral attachments in concrete containments must meet the inservice inspection, repair, and replacement requirements applicable to components which are classified as ASME Code Class MC. 10CFR50.55a(g)(4)(v)(C) requires that concrete containment pressure retaining components and their integral attachments, and the post-tensioning systems of concrete containments must meet the inservice inspection, repair, and replacement requirements applicable to components which are classified as ASME Code Class CC.

This inservice inspection summary report addresses requirements of 10CFR50.55a(b)(2)(viii) and (ix) for inservice inspections conducted in accordance with the ASME Code, Section XI, Subsections IWE and IWL for the Oconee Unit 2 concrete containment. This inservice inspection summary report does not include information pertaining to post-tensioning system examinations as these examinations were performed in accordance with Oconee's Technical Specifications, as permitted by 10CFR50.55a(g)(6)(ii)(B)(4).

Inservice inspections of Class MC and metallic shell and penetration liners of Class CC components are performed in accordance with the ASME Boiler and Pressure Vessel Code, Section XI, Subsection IWE, 1992 Edition with the 1992 Addenda. Inservice inspections of Class CC components are performed in accordance with the ASME Boiler and Pressure Vessel Code, Section XI, Subsection IWL, 1992 Edition with the 1992 Addenda, except that the provisions of 10CFR50.55a(g)(6)(ii)(B)(4) were used to perform examinations of the concrete post-tensioning system examinations in accordance with Oconee's Technical Specifications during 2EOC17. Article IWA-6000, Records And Reports, paragraph IWA-6210, requires the Owner to prepare inservice inspection summary reports for inservice

inspections performed on Class 1 and 2 pressure retaining components and their supports.

IWA-6000 does not address inservice inspection summary reports for Class MC or CC pressure retaining components and their supports, and the Code does not require preparation and submittal of summary reports for Class MC or CC components. As such, this Class MC and CC ISI Summary Report does not contain all of the information specified in IWA-6220 or IWA-6230. Please note that this report is being submitted within 90 calendar days following the completion of the refueling outage at Oconee Unit 2, in accordance with IWA-6240(b).

Duke Energy Corporation is maintaining a separate Inservice Inspection Program for Class MC and CC pressure retaining components and their integral attachments. Therefore, this ISI Summary Report contains only that inservice inspection information applicable to Code Class MC and CC components. ISI Summary Reports for other Code Class components are to be submitted separately.

This Class MC and CC ISI Summary Report includes all applicable information required by 10CFR50.55a(b)(2)(viii)(D)(3), and 10CFR50.55a(b)(2)(ix)(A) and (D).

B. Discussion of Examinations and Conditions Requiring Reporting

Conditions were observed during refueling outage EOC17 that require inclusion in this Class MC and CC ISI Summary Report, as required by 10CFR50.55a(b)(2)(viii) and (ix). These conditions were identified during the performance of the following examinations:

1. ASME Code, Section XI, IWE Examinations in accordance with Table IWE-2500-1, Category E-D, Item E5.30.
2. ASME Code, Section XI, IWL Examinations in accordance with Table IWL-2500-1, Category L-A, Item L1.10.

Post-tensioning system examinations were performed in accordance with Oconee Technical Specifications during 2EOC17. As such, the reporting requirements of Oconee's Technical Specifications are considered applicable in lieu of the reporting requirements of 10CFR50.55a(b)(2)(viii)(C) and (D). Please note that there were no conditions observed during this inspection of the post-tensioning system that required reporting in accordance with Oconee's Technical Specifications. The requirements of 10CFR50.55a(b)(2)(viii)(C) and (D) shall apply to all future Unit 2 post-tensioning system examinations which shall be performed in accordance with the requirements of the ASME Code, Section XI, Subsection IWL.

Observed Conditions

1. Degraded Moisture barriers were observed at various locations around the liner plate at the basement concrete floor embedment zone. As a result, the moisture barriers at these locations were considered unacceptable and failed to meet the acceptance standards of IWE-3500. Containment metallic liner surfaces beneath affected moisture barriers were exposed after portions of the affected moisture barriers were removed. Exposed metallic surfaces exhibited staining with some possible corrosion.

   The provisions of 10CFR50.55a(b)(2)(ix)(A) were deemed applicable, and the provisions of 10CFR50.55a(b)(2)(ix)(D) were used as an alternative to the requirements of IWE-2430 for additional examination of moisture barriers.

2. Tendon sheathing filler grease leakage was detected during visual examinations of accessible concrete surfaces.

   The provisions of 10CFR50.55a(b)(2)(viii)(D)(3) were deemed applicable.

C. Detailed Description of Reportable Conditions

Condition 1

(1) Description Of Type And Estimated Extent Of Degradation, And The Conditions That Led To The Degradation

Description of Degradation:

Moisture barrier (sealant) materials along the interface between the Reactor Building basement concrete floor and the containment metallic liner were observed to be degraded. Moisture barrier degradation was identified during the performance of ASME Code, Section XI, IWE Examinations in accordance with Table IWE-2500-1, Category E-D, Item E5.30 (Duke Items #E05.30.0001 and #E05.30.0005, as specified in the Containment Inservice Inspection Plan, File #O-62-CISI-0001). Problem Investigation Process Report #O-99-05010 was generated to document and evaluate the observed conditions. At locations where portions of the affected moisture barriers were removed, exposed metallic surfaces of the containment liner exhibited staining with possible corrosion.

Note: The above conditions are similar to those identified during previous inspections at Units 1 and 3, and have been reported in previous Inservice Inspection Summary Reports for Class MC Component Examinations. Concerns with containment liner embedment zone areas at Oconee Units 1, 2, and 3 have also been previously identified in Problem Investigation Reports #0-096-2414 and 1-099-2317. Oconee calculation File #OSC-6749 documents the evaluation performed on these areas as a result of Problem Investigation Report #0-096-2414.

General Location Description:

The above conditions were observed at the Unit 2 Reactor Building basement floor/containment metallic liner interface (embedment zone) at elevation 777' + 6" (nominal). Moisture barrier materials at these locations cover the expansion joint material between the basement concrete floor and the containment metallic liner.

Estimated Extent of Degradation:

Based on the results of evaluations conducted in accordance with Problem Investigation Report #0-096-2414 and additional examinations conducted during refueling outage EOC17, the estimated extent of degradation is as follows:

1. Moisture barrier materials at all of the containment metallic liner embedment zones have aged and degraded. Although some sealant repairs have been made, sealant materials continue to require periodic inspection and preventive maintenance to prevent premature degradation. Based on examinations conducted during the Unit 2 refueling outage EOC17, it can be concluded that these materials have not been completely effective in preventing potential moisture intrusion to inaccessible embedded surfaces of the containment metallic liner.

2. Because of moisture barrier degradation, lack of moisture barrier materials at some locations, and conditions observed during previous inspections, it is believed that all, or portions, of the periphery of the liner plate beneath the embedment zone has been exposed to moisture that cannot drain because of the geometry of the liner plate and Reactor Building basement floor configuration. Other locations that are not submerged may have been, or may continue to be, exposed to periodic

wetting and drying. Visual and ultrasonic thickness examinations conducted on similar locations at Units 1 and 3 have detected no significant wall thickness loss.

Description of Conditions That Led to the Degradation:

Based on operating experience from previous examinations conducted in accordance with 10CFR50, Appendix J, the following conclusions were drawn about conditions that led to the degradation.

1. Maintenance activities (decontamination operations) inside the Reactor Building continue to create a source of moisture which has contacted the embedment zone moisture barriers at the interface between the containment metallic liner and Reactor Building concrete floor.
2. Degradation of sealant materials at embedment zones may have allowed moisture to gain access to inaccessible surfaces of the containment metallic shell. Possible reasons for sealant degradation include the following:
   i. Older sealant material is an epoxy that hardens with age. Aging results in loss of flexibility, shrinking and cracking. Alternative materials with better performance characteristics were not available when these materials were originally installed.
   ii. Inadequate preventive maintenance of expansion joint and embedment zone sealant materials. Please note that these materials have no specified service life and that replacement or repair of these materials is typically performed only after inspections have detected degradation.

(2) Evaluation of the Affected Area and Evaluation Results

To assess the extent and significance of the moisture barrier degradation, portions of affected moisture barrier materials were removed, and exposed surfaces of the liner plate were inspected by Engineering for potential degradation. Conditions of the exposed liner plate are similar to those seen during previous inspections on Units 1 and 3. UT examinations were conducted at several locations based on the apparent relative severity of the degradation observed, and the results indicated no detectable wall thickness loss.

These examination results are consistent with those obtained during previous containment inspections, as documented in Problem Investigation Report #0-096-2414 and Oconee calculation File #OSC-6749.

(3) Description of Necessary Corrective Actions

Immediate Corrective Actions

1. Portions of the affected moisture barriers were repaired during this refueling outage (2EOC17).

2. The Containment ISI Plan has been revised to require that accessible surfaces of the Unit 2 metallic liner (at the embedment zone) be examined in accordance with IWE-2500, Table IWE-2500-1, Examination Category E-C, Item E4.11, as required by IWE-3122.4(b) and IWE-2420(b) and (c). Because this condition is applicable to all Oconee Units, the Containment ISI Plan has been revised to require examination of similar areas in all three units in accordance with IWE-2500, Table IWE-2500-1, Examination Category E-C, Item E4.11.

Long-Term Corrective Actions

1. Remaining portions of affected moisture barriers that have not been repaired during refueling outage 2EOC17 are to be reinspected and repaired as necessary to meet the acceptance standards of IWE-3000 during the next scheduled refueling outage (2EOC18).

2. A Work Order has been initiated to implement Minor Modification #MM ONOE-11398. This modification will install permanent inspection ports at three locations around the Reactor Building embedment zone to permit future visual and ultrasonic thickness examination of portions of the embedded liner in accordance with the ASME Code, Section XI, IWE-2500, Table IWE-2500-1, Examination Category E-C. These inspection ports are to extend from the basement floor surface down to the horizontal embedded liner plate beneath the slab, as specified in Problem Investigation Process Report #0-096-2414. The Containment ISI Plan shall be revised to add examination of these areas after completion of these plant modifications.

The provisions of 10CFR50.55a(b)(2)(ix)(D) were used as an alternative to the requirements of IWE-2430 for additional examination of moisture barriers during Oconee Unit 2 refueling outage EOC17. The following information is provided as required by 10CFR50.55a(b)(2)(ix)(D).

(1) Description of Each Flaw or Area, Including the Extent of Degradation, and the Conditions That Led to the Degradation

Degradation of moisture barrier Items #E05.30.0001 and #E05.30.0005 were detected during the visual, VT-3 examination performed during refueling outage EOC17. This degradation included separation from attached surfaces at the expansion joints, cracking, and missing moisture barrier material at various locations along

the length of the moisture barrier. These conditions may permit moisture intrusion to inaccessible surfaces of the embedded liner plate beneath the Reactor Building basement concrete floor.

Items #E05.30.0001 and #E05.30.0005 are two of three moisture barriers installed at the interior embedment zone between the shell metallic liner and the Reactor Building interior concrete basement floor. All other moisture barriers are installed at locations on the liner interior surface above the embedment zone, and do not protect the metallic liner from moisture resulting from possible standing water at the basement floor elevation.

Moisture barrier degradation on Items #E05.30.0001 and #E05.30.0005 were found at various locations along the entire length of these items. Rather than documenting all of the discrete locations where degradation was observed, the entire length of each item was rejected and was determined not to meet the acceptance standards of IWE-3513.

The conditions that led to the degradation of these moisture barriers have been described previously in this Class MC and CC ISI Summary Report.

(2) Evaluation of the Acceptability of Each Flaw or Area, and the Need for Additional Examinations to Verify That Similar Degradation Does Not Exist in Similar Components

Degradation of moisture barriers is an indicator that there is potential for moisture to access inaccessible portions of the embedded metallic shell. The acceptability of the metallic shell surfaces has been addressed previously in this Class MC ISI Summary Report and these surfaces have been evaluated to be acceptable. As such, the observed conditions on moisture barrier Items #E05.30.0001 and #E05.30.0005 have been evaluated to determine their impact on the acceptability of the component (metallic shell).

Please note that, although moisture barrier degradation and moisture intrusion has been identified at embedment zones in all three Oconee units, these conditions have not resulted in unacceptable degradation of the embedded containment metallic shell.

Because the risk of moisture intrusion is greatest at the Reactor Building interior basement concrete floor and metallic shell interface, it was determined that additional examinations need be performed only on the remaining moisture barrier at this embedment zone. The remaining embedment zone moisture barrier is Item E05.30.0010, as indicated in the Containment ISI Plan.

(3) Description of Necessary Corrective Actions

Corrective actions have been described previously in this Class MC and CC ISI Summary Report.

(4) The Number and Type of Additional Examinations Performed to Ensure Detection of Similar Degradation in Similar Components

Additional visual, VT-3 examinations were performed during Unit 2 refueling outage 2EOC17 on moisture barrier Item E05.30.0010 that seals the embedment zone between the containment metallic shell and the Reactor Building interior basement concrete floor. Similar conditions were observed on this item.

Because similar conditions have been identified at similar locations in all three Oconee Units, no additional examinations other than those documented above need be performed.

Condition 2

Grease leakage was detected at various locations on the exterior concrete surfaces of the Reactor Building during the performance of ASME Code, Section XI, IWL Examinations in accordance with Table IWL-2500-1, Category L-A, Item L1.11, and during the performance of visual examinations required by 10CFR50.55a(b)(2)(viii)(A). These locations are summarized below, and are grouped by Component I.D. number assigned to each concrete surface area identified in the Oconee First Interval Containment Inservice Inspection Plan.

Component I.D. 2-CONC-001

a) Grease staining/leakage observed at construction joint at elevation 864+0, near azimuths 110° and 130° (VT-3C Indication Nos. 13 & 14).

b) Grease staining/leakage observed at construction joint at elevation 844+0, near azimuth 120° (VT-3C Indication No. 16).

c) Grease staining/leakage observed at construction joint at elevation 834+0, near azimuths 110° and 135° (VT-3C Indication Nos. 17 & 18).

d) Grease staining/leakage observed on concrete surfaces at the Main Steam penetration near elevation 854+0, near azimuth 125° (VT-3C Indication No. 21).

e) Grease staining/leakage observed on various tendon end caps and on bearing plates from tendon 62H12 through 62H106 on buttress #2, and from tendon 35H15 through 35H104 on buttress #3. Grease staining/leakage also observed on 19 dome tendon end caps within this examination area (VT-3C Indication Nos. 26 & 27).

Component I.D. 2-CONC-002

a) Grease staining/leakage observed at interface between the ring girder and top of buttress #2 at elevation 955+2, near azimuth 90° (VT-3C Indication No. 11).

b) Grease staining/leakage observed at underside of ring girder at elevation 955+2, near azimuth 35°, adjacent to buttress #1, and beneath dome tendon Mk. 3D104544. (VT-3C Indication No. 12).

c) Grease staining/leakage observed at construction joint on face of buttress #2 at elevation 864+0, near azimuth 88° (VT-3C Indication No. 17).

d) Grease staining/leakage observed on various tendon end caps and on bearing plates from tendon 51H59 through 51H106 on buttress #1, and from tendon 24H11 through 24H105 on buttress #2. Grease staining/leakage also observed on 14 dome tendon end caps within this examination area (VT-3C Indication Nos. 3, 5, 6, 8, 9, 10, 19 & 20).

Component I.D. 2-CONC-003

a) Grease staining/leakage observed at interface between the ring girder and top of buttress #1 at elevation 955+2, near azimuth 30° (VT-3C Indication No. 1).

b) Grease staining/leakage observed at underside of ring girder at elevation 955+2, near azimuth 25°, adjacent to buttress #1 (VT-3C Indication No. 12).

c) Grease staining/leakage observed on various tendon end caps and on bearing plates from tendon 46H49 through 46H105 on buttress #6, and from tendon 13H49 through 13H105 on buttress #1. Grease staining/leakage also observed on 24 dome tendon end caps within this examination area (VT-3C Indication Nos. 15 & 16).

Component I.D. 2-CONC-004

a) Grease staining/leakage observed at underside of ring girder at elevation 955+2, near azimuth 25°, adjacent to buttress #1 (VT-3C Indication No. 12).

b) Grease staining/leakage observed on various tendon end caps and on bearing plates from tendon 35H99 through 35H106 on buttress #5, and from tendon 62H49 through 62H106 on buttress #6. Grease staining/leakage also observed on 26 dome tendon end caps within this examination area (VT-3C Indication Nos. 1, 19 & 20).

Component I.D. 2-CONC-005

a) Grease staining/leakage observed at construction joint at elevation 904+0, near azimuth 272° (VT-3C Indication No. 1).

b) Grease staining/leakage observed at interface between the ring girder and top of buttress #5 at elevation 955+2, near azimuths 268° and 272° (VT-3C Indication Nos. 2 & 3).

c) Grease staining/leakage observed at underside of ring girder at elevation 955+2, near azimuth 215°, adjacent to buttress #4 (VT-3C Indication No. 4).

d) Grease staining/leakage observed at underside of ring girder at elevation 955+2, near azimuth 263°, adjacent to buttress #5 (VT-3C Indication No. 5).

e) Grease staining/leakage observed on various tendon end caps and on bearing plates from tendon 24H11 through 24H105 on buttress #4, and from tendon 51H51 through 51H105 on buttress #5. Grease staining/leakage also observed on 39 dome tendon end caps within this examination area (VT-3C Indication Nos. 7 & 8).

Component I.D. 2-CONC-006

a) Grease staining/leakage observed at crack between dome tendons 1D304333 and 1D306333 (VT-3C Indication No. 8).

b) Grease staining/leakage observed at top of buttress #3, beneath tendon 3D114544 (VT-3C Indication No. 9).

c) Grease staining/leakage observed at crack on buttress #4 at elevation 874+0, near azimuth 208° (VT-3C Indication No. 25).

d) Grease staining/leakage observed at crack on buttress #4 at elevation 864+0, near azimuth 212° (VT-3C Indication No. 28).

e) Grease staining/leakage observed on side face of buttress #4 at elevation 824+0, near azimuth 205° (VT-3C Indication No. 31).

f) Grease staining/leakage observed on various tendon end caps and on bearing plates from tendon 13H11 through 13H105 on buttress #3, and from tendon 46H12 through 46H105 on buttress #4. Grease staining/leakage also observed on 24 dome tendon end caps within this examination area (VT-3C Indication Nos. 10, 33 & 34).

Component I.D. 2-CONC-007

Grease staining/leakage observed on various tendon end caps and on bearing plates from tendon 13H36 through 13H47, and from tendon 51H36 through 51H47 on buttress #1 (VT-3C Indication No. 2).

Component I.D. 2-CONC-009

Grease staining/leakage observed on various tendon end caps and on bearing plates from tendon 51H36 through 51H47 and from tendon 35H37 through 35H47 on buttress #5, and

from tendon 62H37 through 62H47 and from tendon 46H37 through 46H47 on buttress #6 (VT-3C Indication No. 2).

Component I.D. 2-CONC-010

Grease staining/leakage observed on various tendon end caps and on bearing plates from tendon 13H19 through 13H35, and from tendon 51H19 through 51H35 on buttress #1 (VT-3C Indication No. 1).

Component I.D. 2-CONC-011

a) Grease stains observed on exterior of Reactor Building in the Auxiliary Building East Penetration Room near elevation 837+0 and azimuth 250° (VT-3C Indication No. 1).

b) Grease staining/leakage observed on various tendon end caps and on bearing plates from tendon 35H19 through 35H35, and from tendon 51H19 through 51H34 on buttress #5, and from tendon 62H19 through 62H35, and from tendon 46H19 through 46H35 on buttress #6 (VT-3C Indication No. 3).

Component I.D. 2-CONC-012

Grease staining/leakage observed on various tendon end caps and on bearing plates from tendon 13H8 through 13H18, and from tendon 51H8 through 51H18 on buttress #1 (VT-3C Indication No. 1).

Component I.D. 2-CONC-013

Grease staining/leakage observed on various tendon end caps and on bearing plates from tendon 46H5 through 46H18 on buttress #6 (VT-3C Indication No. 1).

Component I.D. 2-CONC-014

Grease staining/leakage observed on various tendon end caps and on bearing plates from tendon 51H4 through 51H17, and from tendon 35H5 through 35H11 on buttress #5, and

from tendon 62H4 through 62H18 on buttress #6 (VT-3C Indication No. 1).

Component I.D. 2-CONC-015

Grease staining/leakage observed on various tendon end caps and on bearing plates from tendon 35H11 through 35H18 on buttress #5 (VT-3C Indication No. 1).

Component I.D. 2-CONC-016

Grease stains observed on exterior of Reactor Building in Auxiliary Building Room 222 near elevation 807+0 and azimuth 245° (VT-3C Indication No. 1).

Component I.D. 2-CONC-017

Grease staining/leakage observed on bearing plates and end caps of tendons 46H1, 46H2, and 46H3 on buttress #6 (VT-3C Indication No. 1).

Component I.D. 2-CONC-021

a) Grease leakage observed on dome exterior concrete surface at vent fitting for tendon 2D550212 (VT-3C Indication No. 4).

b) Minor grease leakage/staining observed on dome exterior concrete surface at vent fitting for tendon 3D654111 (VT-3C Indication No. 6).

Component I.D. 2-CONC-024

Minor grease leakage observed on bottom end caps of 74 tendons in the tendon gallery (VT-3C Indication No. 1).

Discussion of Identified Grease Leakage and Staining

Problem Investigation Process Report No. O-00-00834 was generated to document and evaluate these conditions.

Grease leakage from tendon end caps was observed at gaskets, installation screw holes in caps, and/or threaded vent/fill fittings attached to the caps. Because leakages observed at hoop tendon caps has stained other hoop tendon caps and bearing plates on each buttress, the precise number and location of hoop tendons that are actually leaking grease cannot be accurately determined without additional examinations or maintenance.

Oconee is planning the following corrective actions to address the problem of leaking tendon caps:

1. Reinspection of leaking/stained hoop tendon caps to identify which caps are the likely source of the majority of grease leakage, if this determination cannot be readily made from existing inspection records.

2. Cleaning of tendon bearing plates, tendon caps, and concrete surfaces in the vicinity of leaking hoop tendons.

3. Periodic reinspection of hoop tendon end caps and bearing plates to identify any additional leaking end caps requiring corrective action.

4. Removal of caps from tendon ends with significant leakage to perform an inspection of anchorage hardware. It should be noted that Oconee's experience has been that tendon cap grease leakage of the type indicated in this report has not resulted in an unacceptable level of grease coverage on tendon anchorage components and wires (The oil in the original grease tends to separate from the grease, but the residual viscous grease continues to provide a sufficient coating on the tendon wires and anchorage components).

5. Replacing existing tendon caps removed for anchorage inspections with an improved design to preclude continued grease leakage.

6. Complete regreasing or addition of grease to those tendons that have been fitted with new caps.