Oconee Nuclear Station, Unit 3 Class MC ISI Summary Report for Refueling Outage EOC17

By: _____ Date: 3-15-99
(Mark J. Ferlisi, P.E.)

Reviewed By: _____ Date: 3-15-99

Approved By: _____ Date: 3-16-99

Table of Contents

Section	Subject	Page
A.	ASME Code and Regulatory Requirements for Class MC ISI Summary Reports	3
B.	Discussion of Examinations and Conditions Requiring Evaluation	6
C.	Description of Degradation, Evaluations, and Corrective Actions	7
D.	Discussion of Alternative to the Requirements of IWE-2430 Utilized During 3EOC17	13

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

In accordance with 10 CFR 50.55a (g) (4) (v) (B), 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. This inservice inspection summary report addresses requirements of 10 CFR 50.55a (b) (2) (x) for the metallic shell and penetration liners and their integral attachments of the Oconee Unit 3 concrete containment.

Inservice inspections of Class MC components are performed in accordance with the ASME Boiler and Pressure Vessel Code, Section XI, Subsection IWE, 1992 Edition with the 1992 Addenda. Article IWA-6000, Records And Reports, paragraph IWA-6210, requires the Owner to prepare inservice inspection summary reports 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 pressure retaining components and their supports, and the Code does not require preparation and submittal of summary reports for Class MC components. As such, this Class MC ISI Summary Report does not contain 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 3, in accordance with IWA-6240(b).

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

This Class MC ISI Summary Report includes all applicable information required by 10 CFR 50.55a (b) (2) (x) (A), which states:

(A) For Class MC applications, the licensee shall evaluate the acceptability of inaccessible areas when conditions exist in accessible areas that could indicate the presence of or result in degradation to such inaccessible areas. For each inaccessible area identified, the licensee shall provide the following in the ISI Summary Report required by IWA-6000:

(1) A description of the type and estimated extent of degradation, and the conditions that led to the degradation;

(2) An evaluation of each area, and the result of the evaluation, and;

(3) A description of necessary corrective actions.

In addition, this Class MC ISI Summary Report also includes applicable information required by 10 CFR 50.55a (b) (2) (x) (D), which states:

(D) The following may be used as an alternative to the requirements of IWE-2430.

(1) If the examinations reveal flaws or areas of degradation exceeding the acceptance standards of Table IWE-3410-1, an evaluation shall be performed to determine whether additional component examinations are required. For each flaw or area of degradation identified which exceeds acceptance standards, the licensee shall provide the following in the ISI Summary Report required by IWA-6000:

(i) A description of each flaw or area, including the extent of degradation, and the conditions that led to the degradation.

(ii) The acceptability of each flaw or area, and the need for additional examinations to verify that similar degradation does not exist in similar components, and;

(iii) A description of necessary corrective actions.

(2) The number and type of additional examinations to ensure detection of similar degradation in similar components.

B. Discussion of Examinations and Conditions Requiring Evaluation

Two conditions were observed during refueling outage EOC17 that warrant inclusion in this Class MC ISI Summary Report, as required by 10 CFR 50.55a (b) (2) (x) (A) and 10 CFR 50.55a (b) (2) (x) (D). These conditions were identified during the performance of ASME Code, Section XI, IWE Examinations in accordance with Table IWE-2500-1, Category E-D, Item E5.30 and during routine containment coatings inspections performed in accordance with Oconee Unit 3 procedure #MP/0/B/3005/013.

Please note that IWE examinations (other than those addressed in this report) were performed during refueling outage EOC17 and that no other conditions were found during the performance of these examinations that required evaluation in accordance with 10 CFR 50.55a (b) (2) (x) (A). Because these other IWE examinations met the acceptance standards of Table IWE-3410-1, no additional examinations were required and the provisions of 10 CFR 50.55a (b) (2) (x) (D) were not utilized.

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.

2. Staining was observed on the liner plate and on concrete floor surfaces adjacent to the liner plate at various locations around the basement embedment zone, including some locations where moisture barriers were degraded. Standing water was also observed in the expansion joint between the concrete floor and containment metallic liner in at least one location where moisture barrier materials were missing.

The provisions of 10 CFR 50.55a (b) (2) (x) (A) were deemed applicable, and the provisions of 10 CFR 50.55a (b) (2) (x) (D) were used as an alternative to the

requirements of IWE-2430 for additional examination of moisture barriers.

C. Description of Degradation, Evaluations, Corrective Actions, and Additional Examinations Required

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

Description of Degradation:

1. Moisture barrier (sealant) materials along the interface between the Reactor Building basement concrete floor and the containment metallic liner were observed to be degraded. Degradation included separation from attached surfaces at the expansion joints, and cracking at various locations. These conditions were 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 Item #E05.30.0001, as specified in the Containment Inservice Inspection Plan, File #O-62-CISI-0001).

2. Suspect conditions, including coatings loss, rust stains and corrosion, were observed on surfaces of the containment metallic liner at locations around the periphery of the embedment zone in the Reactor Building basement. Standing water was also observed at some locations within the expansion joint at the embedment zone. Problem Investigation Report #3-098-4856 was initiated during this refueling outage to address these conditions. Please note that these conditions were initially discovered during routine containment coatings inspections performed in accordance with Oconee Unit 3 procedure #MP/0/B/3005/013, and that ASME Code, Section XI, Subsection IWE, Category E-A, Item E1.11 examinations were not performed during this refueling outage.

   Note: Both of the above conditions are similar to those previously identified in 1996 in

Problem Investigation Report #0-096-2414. 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 3 Reactor Building basement floor/containment metallic liner interface (embedment zone) at elevation 777' + 6" (nominal). The noted conditions were observed on accessible liner surfaces and moisture barrier materials (sealant) adjacent to embedded areas. These adjacent embedded areas are obstructed from direct or remote visual examination and are considered inaccessible. Moisture barrier materials cover the expansion joint material between the basement concrete floor and the containment metallic liner. When moisture barrier materials are removed, visual examination is possible on surfaces just above the top of the expansion joint material.

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 3 refueling outage EOC17, it can be concluded that these materials have not been completely effective in preventing moisture intrusion to inaccessible embedded surfaces of the containment metallic liner.

2. Because of moisture barrier degradation and observed moisture intrusion, it is estimated that nearly all of the periphery of the liner plate

beneath the embedment zone has been exposed to moisture and is submerged in standing water that cannot drain because of the geometry of the liner plate and Reactor Building basement floor. 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 to date have detected no significant wall thickness loss at selected locations.

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 have created the source of moisture observed in the expansion joint between the containment metallic liner and Reactor Building concrete floor.
2. Degradation of sealant materials at embedment zones has 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. Insufficient 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

Oconee Nuclear Station Problem Investigation Report #3-098-4856 was initiated to address liner plate coatings degradation and corrosion at embedment zone areas and to document the evaluation of these conditions. This report also contains corrective actions necessary for damaged moisture barrier materials at these locations.

The following actions were taken to assess the extent and significance of the observed degradation:

i. Damaged moisture barrier materials were removed, and a portion of the concrete floor adjacent to the liner plate embedment zone (approximately 4" wide) was removed to expose surfaces of the liner plate for further examination.

ii. A VT-3 visual examination was performed on the exposed surfaces. This examination revealed coatings loss and corrosion on a localized area on the liner plate wall.

iii. Ultrasonic thickness measurements were performed on corroded surfaces at this location. No measurable loss of material was detected even in the most severely affected areas.

iv. No other embedded portions of the liner plate were exposed for visual examination or ultrasonic thickness measurement.

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. Shell metallic liner plate surfaces were cleaned, inspected, and recoated at areas where coatings were damaged.

2. The Reactor Building concrete floor was repaired at locations where concrete had been removed to

permit visual and ultrasonic thickness examinations.

Long-Term Corrective Actions

1. The Containment ISI Plan shall be revised to require that accessible surfaces of the Unit 3 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 potentially applicable to Oconee Units 1 and 2, the Containment ISI Plan shall also be revised to require examination of similar areas in Units 1 and 2 in accordance with IWE-2500, Table IWE-2500-1, Examination Category E-C, Item E4.11 during the first Containment Inservice Inspection Period.

2. Moisture barrier materials are to be completely repaired during the next scheduled refueling outage (3EOC18), as specified in Problem Investigation Process Report #3-O98-4856.

3. Permanent inspection ports are to be installed at three locations around the Reactor Building embedment zone at all three Oconee units 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. This corrective action is specified in Problem Investigation Process Report #0-O96-2414. The Containment ISI Plan shall be revised to add examination of these areas after completion of these plant modifications.

4. In lieu of installing permanent inspection ports as described above, Oconee is evaluating whether portions of the Reactor Building concrete floor can be temporarily removed to expose portions of the embedded liner plate during future refueling outages. Visual and ultrasonic thickness examinations would then be performed on these

exposed liner plate surfaces in accordance with the ASME Code, Section XI, IWE-2500, Table IWE-2500-1, Examination Category E-C. If this option is implemented, concrete would be repaired or replaced following an inspection to prevent additional exposure of the embedded liner plate surfaces to containment atmosphere. Moisture barrier materials would also be reinstalled over the restored areas to preclude any additional moisture intrusion.

D. Discussion of Alternative to the Requirements of IWE-2430 Utilized During 3EOC17

The provisions of 10 CFR 50.55a (b) (2) (x) (D) were used as an alternative to the requirements of IWE-2430 for additional examination of moisture barriers during Oconee Unit 3 refueling outage EOC17.

1. Description of each flaw or area, including the extent of degradation, and the conditions that led to the degradation.

   Degradation of moisture barrier Item #E05.30.0001 was detected during the visual, VT-3 examination performed during refueling outage EOC17. This degradation, which was described previously in this report, included separation from attached surfaces at the expansion joints, and cracking. Both of these conditions may permit moisture intrusion.

   Item #E05.30.0001 is one of 13 moisture barriers specified in the Containment ISI Plan (File #O-62-CISI-0001, Rev. 0), and is one of three similar 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 standing water.

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

   The conditions that led to the degradation of this moisture barrier were described previously in this Class MC 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 portions of the metallic shell which are inaccessible. 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 Item E05.30.0001 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 barriers at this embedment zone. These remaining embedment zone moisture barriers include Items E05.30.0005 and E05.30.0010, as indicated in the Containment ISI Plan.

3. Description of necessary corrective actions.

Degraded moisture barriers at the Unit 3 embedment zone shall be restored to acceptable condition during refueling outage 3EOC18 in 2000.

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 3 refueling outage 3EOC17 on the remaining 2 moisture barriers (Items E05.30.0005 and E05.30.0010) that seal the embedment zone between the containment metallic shell and the Reactor Building interior basement concrete floor. These examinations revealed that Item E05.30.0005 also is degraded, but

that Item E05.30.0010 met the acceptance standards of IWE-3513.

Based on examinations performed on all units as a result of Problem Investigation Process Report #0-096-2414 (December, 1996), it is estimated that similar moisture barrier degradation could also be occurring at various locations on embedment zone moisture barriers installed in Units 1 and 2. Examination of embedment zone moisture barriers in the remaining Oconee units is scheduled for Unit 1 refueling outage 1EOC18 and Unit 2 refueling outage 2EOC17, both during 1999.