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Byron Station, Unit 2
Renewed Facility Operating License No. NPF-66
NRC Docket No. STN50-455

SUBJECT: Byron Station Unit 2 90-Day Inservice Inspection Report for Interval 3, Period 3
and Interval 4, Period 1, (B2R20)

The subject 90-Day Inservice Inspection Report for the Byron Station Unit 2, Refueling Outage Twenty (B2R20) is being submitted pursuant to the requirements of Article IWA-6000, "Records and Reports" of Section XI, "Rules for Inservice Inspection of Nuclear Power Plant Components," of the American Society of Mechanical Engineers Boiler and Pressure Vessel Code 2001 Edition through the 2003 Addenda and Code 2003 Edition through the 2008 Addenda.

This letter provides a copy of Form OAR-1 Owner's Activity Report for inservice inspection activities performed during the previous fuel cycle. This report meets the requirements of the ASME Code Case N-532-4 (3rd Interval Activities) and N-532-5 (4th Interval Activities), "Repair/Replacement Activity" Documentation Requirements and Inservice Summary Report Preparation and Submission". The report covers the inservice inspections conducted prior to and during the Unit 2 Fall 2017 refueling outage.

If there are any questions regarding this matter, please contact Douglas Spitzer, Regulatory Assurance Manager, at (815)-406-2800.

Respectfully,



Thomas D. Chalmers
Acting Site Vice-President
Byron Generating Station

TDC/RP/LZ/rm

Attachments: B2R20 Inservice Inspection Summary Report- Fall 2017 Outage

BYRON STATION UNIT 2 REFUELING OUTAGE 20 INSERVICE INSPECTION REPORT

1.0 INTRODUCTION

Inservice inspections of American Society of Mechanical Engineers (ASME) Class 1, 2, 3, CC, and MC components were conducted at Byron Station Unit 2 from May 16, 2016 through October 20, 2017. The majority of these activities occurred during the twentieth refueling outage (B2R20) from October 2 through October 20, 2017.

The activities were performed in compliance with the rules and regulations of ASME Section XI (2001 Edition / 2003 Addenda and/or 2007 Edition / 2008 Addenda), pursuant to the requirements of 10 CFR 50.55a.

See Section 4.0 for a listing of referenced documents.

This summary report meets the requirements of ASME Code IWA-6000, as modified by the adoption of ASME Code Case N-532-4 (3rd Interval activities) and N-532-5 (4th Interval activities), for the inspection of Class 1, 2, 3, CC, and MC components. The Nondestructive Examination (NDE) Inservice Inspection (ISI) Program for these components was developed in accordance with the requirements and intent of Section XI Subsections IWA, IWB, IWC, IWD, IWE, IWF and IWL, 2001 Edition / 2003 Addenda and/or 2007 Edition / 2008 Addenda.

Note: On July 16, 2017, for Byron Units 1 & 2, the ASME Section XI Code year changed to the 2007 Edition / 2008 Addenda. ISI work completed prior to July 16, 2017 will be under the 2001 Edition / 2003 Addenda.

In addition to the ASME Section XI requirements of examination, certain Nuclear Regulatory Commission (NRC) augmented ISI inspections and industry initiatives (NEI-03-08) were required. The Byron Station Unit 2 augmented ISI examination requirements include:

- a) Class 1 pressure boundary for leakage at nominal operating pressure, in accordance with NRC Generic Letter 88-05;
- b) Class 1 Alloy 600 weld examinations in accordance with N-729-4;
- c) Class 2 and 3 pressure boundary for leakage at nominal operating pressure, in accordance with NUREG 0737;
- d) Class 1 examinations of non-isolable Reactor Coolant System branch lines for Thermal Fatigue in accordance with MRP-146.

1.1 Identification of Examination Requirements

The ISI Program Plan contains examination program tables consistent with the tables found in Subsections IWB, IWC, IWD, IWE, IWF, and IWL-2500 of Section XI of the ASME Code. The examination tables include the corresponding code category, item number, and component/weld selection in conformance with examination. Augmented examinations as specified by NRC and industry initiatives are also included in these tables. ASME Class 1, 2, 3, CC and MC components, or parts of components, that are not included in the examination tables and are exempt from examination, as specified in Section XI Paragraphs IWB, IWC, IWD, IWE, IWL-1220, and Tables IWB, IWC, IWD, IWE, and IWL-2500-1.

For Class 1, 2, and certain non-class piping components, the requirements of Risk Informed Inservice Inspection (RI-ISI) are followed using EPRI TR112657 and Table 1 of ASME Code

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Case N-578-1. The implementation of the Fourth Interval risk-informed program is described in the Byron Station Relief Request I4R-01.

Class 1 or 2 piping welds exempted by IWB and IWC-1220 are not included in the RI-ISI program. Previous selection and examination exemptions identified in Tables IWB and IWC-2500-1 for the piping Examination Categories B-F, B-J, C-F-1, and C-F-2, are not incorporated into the RI-ISI program. With the adoption of RI-ISI, piping welds classified as Risk Category 6 or 7 are not subject to examination.

1.2 Significant Activities during the B2R20 Cycle

Reactor Vessel Head Examinations

The reactor vessel head surface and the head penetrations were visually examined for evidence of leakage per the requirements specified in N-729-4 for Item B4.10 components.

Ultrasonic examination of the RPV Head penetrations was performed as specified in N-729-4 for Item B4.20 components.

Steam Generator Inspections

All four steam generators were inspected by eddy current, UT, and visual methods.

Based on the inspection data and the condition monitoring assessment, no tubes exhibited degradation more than the condition monitoring limits. No tubes required in situ pressure testing to demonstrate structural and leakage integrity. There was no reported SG primary-to-secondary leakage prior to the end of the current inspection interval. The SG performance criteria for operating leakage and structural integrity were satisfied for the preceding Byron Unit 2 SG operating interval encompassing Cycle 19 and Cycle 20, thus meeting condition monitoring requirements.

The Operational Assessment (OA) performed for the AVB wear and TSP/baffle plate wear mechanisms demonstrates that the tube structural and leakage integrity performance criteria will be satisfied at the end of the 2-cycle inspection interval until B2R22 for the mechanical wear mechanisms. The OA for foreign objects is also satisfied for two (2) cycles of operation until B2R22 based on meeting the foreign object size limits for known objects remaining in the SGs and constant volume wear models for upper bundle foreign objects.

A total of 96 tubes were plugged during B2R20, 94 tubes were preventative plugged in the 2A, 2C, & 2D SGs, and two tubes in the 2A SG (R41-C91) & (R44-C81) were plugged based on exceeding the Tech Spec limit of 40% and greater Through-wall.

2.0 **OWNER's ACTIVITY REPORT SHEETS**

The ASME Form OAR-1, Owners Activity Report (OAR-1) and Form NIS-2A, Repair/Replacements Certification Record (NIS-2A) were filed during the cycle. See the attached section for the B2R20 OAR-1.

3.0 CONTAINMENT ISI PROGRAM

During the B2R20 refueling outage, containment liner examinations were completed to comply with the requirements of ASME Section XI Subsection IWE.

The following provisions of 10CFR50.55a were reviewed for conditions that require reporting in the B2R20 ISI Summary Report.

Section XI condition: Concrete containment examinations.

No conditions were found that warranted inclusion in this report as specified by (b)(2)(viii)(E).

The Byron IWL Concrete Containment Surveillance in 2016, for both Unit 1 and Unit 2, has been previously communicated in the B1R21 ISI Summary Report and will not be duplicated in this report.

Section XI condition: Metal containment examinations.

Conditions were found that warranted inclusion in this report as specified by (b)(2)(ix)(A)(2).

(i) Description of the type and estimated extent of degradation, and the conditions that led to the degradation:

Inaccessible areas of the liner plate were made accessible by removing approximately 92' of the moisture barrier in B2R20. The as found condition of the degraded areas behind the moisture barrier is surface corrosion of the carbon steel containment liner. The observed environment is dry with inconsistently scattered areas of small pitting.

Based on ultrasonic testing, the maximum metal loss observed on the containment liner is 0.103" at one location. This is the only location on the containment liner that has reached 40% metal loss from nominal thickness. The nominal plate thickness of the containment liner is 0.250" thick. The two pits identified in B2R20 are the only locations for Unit-2 that exceed the ASME Code Section XI Subsection IWE acceptance criteria of 10%. The pit at D2 Location 1 is 27.2% metal loss from nominal thickness and the pit at D2 Location 3, mentioned previously, resulted in 41.2% metal loss. This information has been gathered from removing the moisture barrier and exposing the liner plate behind it. Approximately 230', out of 440', of the moisture barrier has been removed with subsequent liner inspections complete on these areas. From the inspected areas in all previous and current Unit-2 outages, only the two spots found in B2R20 have exceeded 10% metal loss with the majority of these areas displaying merely minor pitting of the liner plate. It is estimated that the areas of the liner plate to be inspected follow a similar pattern of pitting depths consistent with the minor pitting identified in a few sections of the 230' already inspected.

In B2R20, sections of the moisture barrier that had not been removed since construction, but also including very small sections that were replaced because of previous damage, were cut out which facilitated visual inspections of the containment liner plate under WO 1930869. Further investigation of the containment liner plate revealed that the majority of the liner surface had previously been coated behind the moisture barrier. However, some small sections appeared to only have a coat of primer and a few locations were identified where the coating was not properly applied to the liner surface. Insufficient surface preparation and inattentiveness to prohibit all moisture during the coating process left the containment liner inadequately protected and enabled corrosion of the carbon steel over the current life of the

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plant. This condition of the non-adhering coating was identified at both locations that had a pit exceed the 10% metal loss acceptance criteria, as these small areas of carbon steel were unprotected. Pits D2 Location 2 (0.271") and D2 Location 4 (0.247") are in close proximity, within a few inches, of D2 Location 3 (0.147") and border this pit to provide additional confidence there is no widespread corrosion in this area. All B2R20 areas that were insufficiently coated during construction have been properly cleaned, prepped, and coated with Level 1 coating.

(ii) An evaluation of each area, and the result of the evaluation:

One evaluation was performed to address all the indications identified on the containment liner plate since the corrosion leading to the condition of the containment liner plate has the same contributors affecting the same component. The evaluation, NDIT No. BYR-99-226, determined that localized corrosion resulting in metal loss of up to 0.125" (1/8") on the containment liner is acceptable. All the indications identified in B2R20 are bounded by this evaluation and the containment liner will remain operational and meet its intended design function during the next operating cycle until B2R21 where additional examinations are scheduled.

During the B2R20 moisture barrier walk down, areas of moisture barrier degradation or any moisture barrier suspected of masking the most severe degradation of the liner plate were selected for removal so that the liner plate at that location can be inspected. After recoating the liner plate below the moisture barrier in B2R20, there is approximately 205' – 215' of moisture barrier that will be removed and replaced to reach 100% replacement. This replacement plan will be continued in B2R21 and subsequent outages until complete replacement is achieved. Based on the current degradation history of inspected areas, it can be concluded the areas that remain to be exposed in B2R21 are not experiencing active corrosion or metal loss that would challenge Byron stations owner defined acceptance criteria. No active corrosion has been identified during the containment liner inspections; as found conditions remain dry with inconsistently scattered areas of small pitting.

(iii) A description of necessary corrective actions:

After recoating the liner plate below the moisture barrier in B2R20, there is approximately 205' – 215' of moisture barrier that remains to be removed and replaced to reach 100% replacement. Upon removal in B2R21, the containment liner plate will continue to be thoroughly inspected for signs of degradation. These are the remaining inaccessible sections of the liner plate.

For the B2R20 locations with degradation of the liner plate, these locations were found acceptable by evaluation without repair/replacement activities. Corrective measures have been taken by properly recoating sections of the liner plate and with installing new moisture barrier to provide a seal prohibiting the intrusion of moisture below the floor at the 377' elevation. Per ASME code Section XI, Subsection IWE-2420, successive examinations for the two areas identified in B2R20 will be performed in the next Containment In-Service Inspection Period (B2R22 or B2R23). These areas will receive a VT-1 visual inspection in the next inspection period to assure the protective coating is intact and performing its' design function. A VT-1 is the preferred method as to not have to remove undamaged

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coating and potentially remove more base metal material in the process. If the coating does not remain intact or appears degraded, then the area will need to be prepared for recoating but will first receive an ultrasonic test (UT) in lieu of a VT-1. If reexamination of the identified degradation remains essentially unchanged for the next inspection period, these areas no longer require augmented examination in accordance with Table IWE-2500-1, Examination Category E-C.

3.1 Applicable Documents

Work Order 1930869, U-2 Containment Liner Plate Thickness Exams

Issue Report 4062059, B2R20 M4 Moisture Barrier / Liner Plate Exams

NDE Ultrasonic Testing Report 2017-UT-076

NDE Ultrasonic Testing Report 2017-UT-086

EC 621535, B2R20 Engineering Evaluation for Containment Liner Metal Reduction Exceeding 10% of Nominal Thickness

NDIT No. BYR-99-226, Acceptance Criteria for Containment Liner Reduced Thickness

Calc. No. BYR98-004, Evaluation of Containment Liner Plate Defects, Revision 0

4.0 REFERENCED DOCUMENTS

Code of Federal Regulations, Title 10 Energy

Part 50, Domestic Licensing of Production and Utilization Facilities

50.55a, Codes and Standards

4.1 American Society of Mechanical Engineers Boiler and Pressure Vessel Code

Section XI, Rules for Inservice Inspection of Nuclear Power Plant Components, 2001 Edition / 2003 Addenda and/or 2007 Edition / 2008 Addenda

- Subsection IWA: General Requirements
- Subsection IWB: Requirements for Class 1 Components
- Subsection IWC: Requirements for Class 2 Components
- Subsection IWD: Requirements for Class 3 Components
- Subsection IWE: Requirements for Class MC/Class CC Metallic Liners Components
- Subsection IWF: Requirements for Class 1, 2, 3, and MC Component Supports
- Subsection IWL: Requirements for Class CC Concrete Components
 - a) IWA-6000: Records and Reports
 - b) IWx-1220, Components Exempt from Examination
 - c) IWx-2500, Examination Categories

Code Case N-532-4 (3rd Interval activities) and N-532-5 (4th Interval activities):

Repair/Replacement Activity Documentation Requirements and Inservice Summary Report Preparation and Submission

- Form OAR-1, Owners Activity Report.
- Form NIS-2A, Repair/Replacements Certification Record.

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Code Case N-578-1: Risk-Informed Requirements for Class 1, 2, or 3 Piping, Method B.
Code Case N-729-4: Alternative Examination Requirements for PWR Reactor Vessel Upper Heads with Nozzles Having Pressure-Retaining Partial-Penetration Welds.

4.3 Miscellaneous NRC Documents

Generic Letter 88-05, Boric Acid Corrosion of Carbon Steel Reactor Pressure Boundary Components in PWR Plants.

NUREG 0737, Clarification of TMI Action Plan Requirements.

4.4 Electric Power Research Institute

Topical Report TR112657 Revision B-A, Revised Risk-Informed Inservice Inspection Procedure, December 1999.

Materials Reliability Program: Management of Thermal Fatigue in Normally Stagnant Non-Isolable Reactor Coolant System Branch Lines (MRP-146, Revision 1), June 2011.

4.5 Nuclear Energy Institute

NEI 03-08, Guideline for the Management of Materials Issues.

4.6 Byron Station Documents

Relief Request I4R-01: Alternate Risk-Informed Selection and Examination Criteria for Category B-F, B-J, C-F-1, and C-F-2 Pressure Retaining Piping Welds.

ATTACHMENT 1

FORM OAR-1 OWNER'S ACTIVITY REPORT

Report Number B2R20

Plant Byron Generation Station, 4450 North German Church Road, Byron, Illinois 61010

Unit No. 2 Commercial service date August 2, 1987 Refueling outage no. B2R20
(If applicable)

Current inspection interval Fourth Inspection Interval (ISI), Third Inspection Interval (Containment ISI)
(1st, 2nd, 3rd, 4th, other)

Current inspection period First Inspection Period (ISI and Containment ISI) and Third period of Third Interval
(1st, 2nd, 3rd)

Edition and Addenda of Section XI applicable to the inspection plans ASME Section XI 2001/2007 Edition through 2003/2008 Addenda

Date and revision of inspection plans: January 9th, 2017 / Rev. 1 (Fourth Interval) and June 10, 2012/ Rev. 7 (Third Interval)

Edition and Addenda of Section XI applicable to repair/replacement activities, if different than the inspection plans
Same as above

Code Cases used for inspection and evaluation: N-432-1, N-508-4, N-513-3, N-526, N-532-4, N-532-5, N-561-2, N-562-2, N-569-1, N-586-1, N-597-2, N-600, N-613-1, N-629, N-639, N-641, N-643-2, N-648-1, N-651, N-660, N-661-2, N-705, N-706-1, N-731, N-735, N-747, N-751, N-762, N-765, N-773
(If applicable, including cases modified by Case N-532 and later revisions)

CERTIFICATE OF CONFORMANCE

I certify that (a) the statements made in this report are correct; (b) the examinations and tests meet the Inspection Plan as required by the ASME Code, Section XI; and (c) the repair/replacement activities and evaluations supporting the completion of B2R20 conform to the requirements of Section XI. (refueling outage number)

Signed Scott Esposito ISI Program Owner Date 1-8-18
Owner or Owner's Designee, Title

CERTIFICATE OF INSERVICE INSPECTION

I, the undersigned, holding a valid commission issued by the National Board of Boiler and Pressure Vessel Inspectors and employed by The Hartford Steam Boiler Inspection Company of Hartford, Connecticut have inspected the items described in this Owner's Activity Report, and state that, to the best of my knowledge and belief, the Owner has performed all activities represented by this report in accordance with the requirements of Section XI.

By signing this certificate neither the Inspector nor his employer makes any warranty, expressed or implied, concerning the repair/replacement activities and evaluation described in this report. Furthermore, neither the Inspector nor his employer shall be liable in any manner for any personal injury or property damage or a loss of any kind arising from or connected with this inspection.

James W. Niernery
Inspector's Signature

Commission NB 11622 INR 12 01743 IC
(National Board Number and Endorsement)

Date 9 JAN 18

ATTACHMENT 1

TABLE 1

ITEMS WITH FLAWS OR RELEVANT CONDITIONS THAT REQUIRED EVALUATION FOR CONTINUED SERVICE

Examination Category	Examination Item Number	Item Description	Evaluation Description
C-H	C7.10	2CV219 – Chemical Volume and Control System pipe cap downstream of valve	IR 04064618 BACC Evaluation BYR201718165
C-H	C7.10	2CV057 – Chemical Volume and Control System pipe cap downstream of valve	IR 04064547 BACC Evaluation BYR201718167
C-H	C7.10	2CV8368B – Chemical Volume and Control System check valve closure cap	IR 04064624 BACC Evaluation BYR201718166
D-B	D2.10	2FC004A – Spent Fuel Pool Cooling valve packing	IR 03959896 BACC Evaluation BYR201717345
C-H	C7.10	2FC007 – Spent Fuel Pool Cooling pipe cap downstream of valve	IR 04059837 BACC Evaluation BYR201718127
D-B	D2.10	2FC8756 – Spent Fuel Pool Cooling valve packing	IR 03959895 BACC Evaluation BYR201717346
D-B	D2.10	2FC8762B – Spent Fuel Pool Cooling valve packing	IR 03959908 BACC Evaluation BYR201717347
D-B	D2.10	2FC8762A – Spent Fuel Pool Cooling valve packing	IR 03959899 BACC Evaluation BYR201717344
C-H	C7.10	2PS257 - Primary Sampling tubing threaded fitting	IR 04053569 BACC Evaluation BYR201718046
C-H	C7.10	2PS9355A - Primary Sampling valve packing	IR 04053564 BACC Evaluation BYR201718045
C-H	C7.10	2SI052 – Safety Injection valve packing	IR 04059951 BACC Evaluation BYR201718128
B-P	B15.10	2SI8905D – Safety Injection valve body to bonnet connection	IR 04059979 BACC Evaluation BYR201718129
C-H	C7.10	2SI8801A – Safety Injection valve packing	IR 04062063 BACC Evaluation BYR201718145
C-H	C7.10	2SI8825 – Safety Injection valve packing	IR 04059478 BACC Evaluation BYR201718126
B-P	B15.10	2IC01M – RX Vessel Seal Table threaded connections	IR 04058173 BACC Evaluation BYR201718147
B-P	B15.10	2RC8037B Reactor Coolant valve bolted connection	IR 02727559 BACC Evaluation BYR201617186
B-P	B15.10	2RC8042C – Reactor Coolant valve packing	IR 04058143 BACC Evaluation BYR201718120
B-P	B15.10	2RH8701A – Residual Heat Removal valve packing	IR 04058079 BACC Evaluation BYR201718090

ATTACHMENT 1

TABLE 2

ABSTRACT OF REPAIR/REPLACEMENT ACTIVITIES REQUIRED FOR CONTINUED SERVICE

Code Class	Item Description	Description Of Work	Date Completed	Repair/Replacement Plan Number
3	2VA04SA – 2A SI Pump Cubicle Cooler	Weld buildup on the Tubesheets. IR 02713671.	9/21/2016	WO 01927296
3	2SX035 – Leak at weld defect on SX drain pipe	Repair the leaking weld on the upstream side of valve 2SX035 and the Weld-o-let. IR 02704898.	8/22/2016	WO 01945918
3	2VA03SB- 2B SI Pump Cubicle Cooler	Weld buildup on the lower and upper Tubesheets – IR 02729212.	10/27/2016	WO 01664581
3	2VA02SA – 2A RH Pump Cubicle Cooler	Weld buildup on the divider plate – IR 02714879.	9/21/2016	WO 01601881
1	2SI8905D	Repair seal weld on valve cover- IR 04059979	10/15/2017	WO 04695708
1	2RC01BA	2A Steam Generator tubes (R41-C91) & (R44-C81) required plugging due to exceeding Tech Spec ($\geq 40\%$)	10/18/17	WO 01942331
2	2CV8442	Repair seal weld on check valve cap – IR 04061010	10/09/2017	WO 01782317