



Byron Generating Station

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December 29, 2015

LTR: BYRON 2015-0152
FILE: 1.10.0101 (1D.101)

United States Nuclear Regulatory Commission
ATTN: Document Control Desk
Washington, DC 20555-0001

Byron Station, Unit 1
Facility Operating License No. NPF-37
NRC Docket No. STN50-454

SUBJECT: Byron Station Unit 1 90-Day Inservice Inspection Report for Interval 3, Period 4, (B1R20)

The subject 90-Day Inservice Inspection Report for the Byron Station Unit 1, Refueling Outage Twenty (B1R20) 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.

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, "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 1 Fall 2015 refueling outage.

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

Respectfully,

A handwritten signature in blue ink, appearing to read "TDC", written over a horizontal line.

Thomas D. Chalmers
Plant Manager
Byron Generating Station

TDC/RGM/AC/sg

Attachment

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ecc: Illinois Emergency Management Agency – Division of Nuclear Safety (with attachment)
Site Vice President – Byron Station (with attachment)
Vice President – Licensing and Regulatory Affairs (with attachment)
Director – Licensing and Regulatory Affairs (with attachment)
Manager – Licensing – Braidwood, Byron and LaSalle Stations (with attachment)
Regulatory Assurance Manager - Byron Station (with attachment)
Exelon Document Control Desk Licensing (with attachment)
R. McBride – Engineering, Byron Station (with attachment)
NRC Coordinator – Byron Station (with attachment)

BYRON STATION UNIT 1 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 1 from March 28, 2014 through October 2, 2015. The majority of these examinations were performed during the twentieth refueling outage (B1R20) from September 14 through October 2, 2015.

The examinations were performed in compliance with the rules and regulations of ASME Section XI (applicable edition and 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, 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, through the 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 1 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-722 and N-729-1;
- 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;
- e) Examination of RCP Flywheel in accordance with Regulatory Guide 1.14 for replaced RCP motor.

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 Case N-578-1. The implementation of the risk-informed program is described in the Byron Station Relief Request I3R-02.

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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.

For the surface examination of the reactor head to flange weld under Examination (Category B-A, Item B1.40), the acceptance standards of Table IWB-3510-3. Note 3 for Table IWB-3510-3 states that the allowable linear flaw size listed in the table are only applicable if the maximum postulated flaw from G-2120 of Appendix G of Section III was justified. G-2120 of the construction code recommends that the maximum flaw depth considered be 25% of the section thickness. The Unit 1 reactor vessel stress report considered a 15% of the section thickness for the maximum flaw depth. IWB-3410.2 states that if the full depth recommended in G-2120 is not postulated, the allowable given in IWB-3510-3 should be reduced in a manner that maintains the same factor of safety. Accordingly, the allowable linear flaw sizes given in IWB-3510-3 were proportioned to the maximum flaw depths in Appendix G and the stress report.

1.2 Significant Activities during the B1R20 Cycle

Reactor Vessel Head Examinations

The reactor vessel head surface and 100% of the head penetrations were visually examined for evidence of leakage per the requirements specified in N-729-1 for Item B4.10 components.

Ultrasonic examination of 100% of the RPV Head penetrations was performed as specified in N-729-1 for Item B4.20 components. The examination results of the reactor head penetrations were acceptable.

Penetrations 31 and 43, which were repaired initially in B1R17, were also examined by the liquid penetrant method as specified in the approved relief request I3R-19. Penetration 43 was acceptable per the acceptance standards. For Penetration 31, four indications were seen and recorded. One rounded indication and one linear indication were rejected per the acceptance standards. The rejected Penetration 31 indications required repair by metal removal (blending) or blending and welding. The repaired areas were reexamined by both volumetric and surface methods and were acceptable.

2.0 **OWNERS 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 OAR-1.

3.0 **CONTAINMENT ISI PROGRAM**

During the B1R20 outage, examinations were completed of the containment liner to comply with the requirements of IWE-2500.

The following provisions of 10CFR50.55a were reviewed for conditions that require reporting in the B1R20 ISI Summary Report.

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INSERVICE INSPECTION REPORT**

Section XI Concrete containment examinations:

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

Section XI Metal containment examinations:

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

3.1 Description

During B1R20, the moisture barrier was examined under Examination Category E-A, Item E1.20. The moisture barrier was removed at nineteen locations. Eight locations were removed as part of an ongoing effort to replace the original moisture barrier material. Four locations were removed to reexamine areas identified initially in B1R18. In addition, the moisture barrier was found degraded at seven new locations and reported in Issue Report 02555113. The degraded moisture barrier areas consisted of small separations of the moisture barrier top surface from the outer edge of the trench with no separation from the containment liner. No full separation has occurred and therefore, no moisture was able to reach the liner plate below the moisture barrier trench.

These degraded areas were completely removed so the containment liner surface behind the moisture barrier could be inspected. Further examination of the containment liner plate revealed that the liner surface was uncoated in a few locations. Corrosion was able to form in the absence of the protective coating that resulted in localized metal loss.

A VT-1 was performed on the liner surface and where needed, pit-gage measurements were taken. A supplemental examination using ultrasonic testing (UT) was performed to identify the thickness of the containment liner in these locations. Two locations had metal loss greater than 10% with readings as follows:

Area 13: remaining thickness of 0.218 inches

Area 17: remaining thickness of 0.216 inches

The nominal wall thickness of the liner plate is 0.250 inches. Therefore, any value below 0.225 inches would need to be evaluated for acceptability, per IWE-3511.3 (Issue Report 02561334).

3.2 Evaluation

The containment liner plate is acceptable as-is with no repair required in B1R20.

An evaluation of the required liner plate thickness has been addressed previously at Byron and acceptance criteria were developed to determine minimum thickness of liner plates. This evaluation is documented in NDI BYR-99-226. This evaluation determined the minimum required thickness of the liner plate is 0.125". The reduction in containment liner thickness in Area 13 and Area 17 have not exceeded the acceptance criteria of NDI BYR-99-226. As a result, no repair/replacement activities to the containment liner are required.

In B1R20, removal of the intact moisture barrier adjacent to the nineteen locations discussed above allowed examination of additional liner surfaces. These adjacent areas showed no significant corrosion.

Therefore, the remaining areas are not suspected of having liner plate corrosion since the inspection of the moisture barrier has not identified any other degraded areas. With the

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moisture barrier intact it is able to perform its' design function of prohibiting moisture from reaching the surface of the liner plate.

3.3 Corrective Actions

All affected areas identified in this inspection were corrected prior to the Unit 1 return to service. The condition of the liner did not warrant repair/replacement activities. Areas showing the absence of the liner coating were recoated and areas where the moisture barrier was removed were restored. These areas were then reexamined and no additional issues were found.

In accordance with ASME code Section XI, Subsection IWE-2420, successive examinations for the areas identified in this inspection will be performed in the next inspection period. This will verify if the condition has remained essentially unchanged and the issue has been corrected. The moisture barrier will be removed at Area 13 and Area 17. These areas will receive a VT-1 examination in the next inspection period to assure the protective coating is intact and performing its' design function. If the degradation has remained essentially unchanged, then these two locations will be removed from successive examination requirements under Table IWE-2500-1, Examination Category E-C.

In addition, as part of an ongoing preemptive effort, areas of the original moisture barrier that have not been replaced in previous outages will be replaced in the next outage.

3.4 Applicable Documents

WO 01755881 Perform General Visual Inspection of Containment Moisture Barrier Issue Report 02555113, Moisture Barrier Degradation and Replacement, 09/14/2015
WO 01675714 B1R20 Partially Remove Moisture Barrier
Ultrasonic Test Report #2015-229
Ultrasonic Test Report #2015-242
Issue Report 02561334, *Reduction in Liner Plate Thickness*, 09/27/2015
Nuclear Design Information Transfer (NDIT) BYR-99-226, *Acceptance Criteria for Containment Liner Reduced Thickness*, 10/27/99

4.0 **REFERENCED DOCUMENTS**

4.1 Code of Federal Regulations, Title 10 Energy

Part 50, *Domestic Licensing of Production and Utilization Facilities*

50.55a, *Codes and Standards*

4.2 American Society of Mechanical Engineers Boiler and Pressure Vessel Code

Section XI, *Rules for Inservice Inspection of Nuclear Power Plant Components*, 2001 Edition, through 2003 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

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- a) IWA-6000: *Records and Reports*
- b) IWx-1220, *Components Exempt from Examination*
- c) IWx-2500, *Examination Categories*

Code Case N-532-4: *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.

Code Case N-578-1: *Risk-Informed Requirements for Class 1, 2, or 3 Piping, Method B.*

Code Case N-722-1: *Additional Examinations for PWR Pressure Retaining Welds in Class 1 Components Fabricated With Alloy 600/82/182 Materials.*

Code Case N-729-1: *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.*

REG Guide 1.14, *Reactor Coolant Pump Flywheel Integrity*

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 I3R-02: *Alternate Risk-Informed Selection and Examination Criteria for Category B-F, B-J, C-F-1, and C-F-2 Pressure Retaining Piping Welds.*

Relief Request I3R-19: *Alternative Requirements for the Repair of a Reactor Vessel Head Penetration In Accordance with 10 CFR 50.55a(a)(3)(i)*

ATTACHMENT 1

FORM OAR-1 OWNER'S ACTIVITY REPORT

Report Number B1R20

Plant Byron Generating Station, 4450 South German Church Road, Byron, Illinois 61010

Unit No. 1 Commercial Service Date September 16, 1985 Refueling Outage Number B1R20
(if applicable)

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

Current Inspection Period Third Inspection Period (ISI and Containment ISI)
(1st, 2nd, 3rd)

Edition and Addenda of Section XI applicable to the Inspection Plans ASME Section XI 2001 Edition through 2003 Addenda

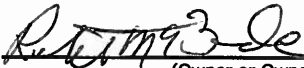
Date / Revision of Inspection Plans June 10, 2012 / Revision 7

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

Code Cases used: N-460, N-513-2, N-528-1, N-532-4, N-545, N-566-2, N-578-1, N-586-1, N-597-2, N-639, N-652-1, N-661, N-665, N-685, N-686-1, N-694-1, N-696, N-700, N-706, N-722-1, N-729-1, N-731, N-739, N-751, N-753

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 B1R20 conform to the requirements of Section XI (refueling outage number)

Signed  Robert McBride, ISI Program Owner Date 12/18/15
(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 the State or Province of Illinois and employed by HSB Global Standards 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

 Commissions NB 11622 ABIN 14017431C
 Inspector's Signature National Board, State, Province, and Endorsements

Date 18 DECEMBER 15

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 | Chemical Volume Control Valve Bolting 1CV8105 | IR 01668347 BACC Evaluation BYR201414223 |
| D-B | D2.10 | Service Water Piping 0SX03CA-48" | IR 01676951 EC 398664 |
| D-B | D2.10 | Boron Addition Pump Seal 1AB03P | IR 02387521 BACC Evaluation BYR201414564 |
| B-P | B15.10 | Reactor Coolant Valve Bolting 1RC8037C | IR 02462780 BACC Evaluation BYR201515071 |
| C-H | C7.10 | Residual Heat Removal Pump Seal 1RH01PA | IR 02467846 BACC Evaluation BYR201515084 |
| C-H | C7.10 | Process Sampling Valve Packing 1PS9355A | IR 02501360 BACC Evaluation BYR201515407 |
| D-B | D2.10 | Fire Protection Pump Seal 1FC01P | IR 02517416 BACC Evaluation BYR201515468 |
| C-H | C7.10 | Residual Heat Removal Flange Bolting 1RH607 | IR 02532041 BACC Evaluation BYR201515584 |
| D-B | D2.10 | Chemical Volume Control Valve Bolting 1CV8519 | IR 02536012 BACC Evaluation BYR201515623 |
| D-B | D2.10 | Service Water Piping 1SX93AB-8" | IR 02547859 Piping Calculation 033437 |
| D-B | D2.10 | Service Water Piping 1SX93AA-8" | IR 02550405 Piping Calculation 021908 |
| B-P | B15.10 | Safety Injection Valve Bolting 1SI8815 | IR 02556267 BACC Evaluation BYR201515764 |
| C-H | C7.10 | Safety Injection Valve Bolting 1SI8801A | IR 02556269 BACC Evaluation BYR201515783 |
| B-P | B15.10 | Safety Injection Valve Bolting 1SI8810C | IR 02556272 BACC Evaluation BYR201515784 |
| C-H | C7.10 | Fire Protection Pipe Cap 1FC023 | IR 02556655 BACC Evaluation BYR201515803 |
| E-A | E1.11 | Containment Liner 1PC01R | IR 02561334 NDIT BYR-99-226 |
| B-P | B15.10 | Reactor Coolant Valve Bolting 1RC8037B | IR 02564032 BACC Evaluation BYR201515923 |

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 |
|------------|------------|---|---|----------------|--------------------------------|
| 1 | 1RC01R | U1 Reactor Vessel Head | Blending repair of tool mark on flange top surface. IR 02555756 | 09/23/15 | WO 01862246-01 |
| | | | Repair of Penetration 31 weld overlay surface indications. IR 02557389 | 09/24/15 | WO 01676406-16 |
| 2 | 1MS018C | 6" NPS Main Steam Power Operated Relief Valve | Repair of internals by welding and machining. IR 02427918 | 09/21/15 | WO 01800481-06 |
| 2 | 1VP01AB | 1B Reactor Containment Fan Cooler Cooling Coils | Weld buildup of the channel heads base metal. IR 02556777 IR 02558510 | 09//29/15 | WO 01720126-03 |
| 2 | 1VP01AC | 1C Reactor Containment Fan Cooler Cooling Coils | Weld buildup of the channel heads base metal. IR 01635708 | 09/26/15 | WO 01735280-02 |
| 3 | OSX03A-30 | U0 Component Cooling Heat Exchanger Outlet Piping | Pinhole leakage in weld between pipe and the heat exchanger outlet flange. IR 02431695 | 01/03/15 | WO 01796966-01 |
| 3 | OWO01CB | 0B Main Control Room Ventilation Chiller | Weld buildup of vessel flanges and end covers. IR 02453901 IR 02453979 IR 02456268 | 02/26/15 | WO 01611526-06 |
| 3 | 1DG01KA-X2 | 1A Diesel Generator Jacket Water Lower Cooler | Weld buildup to the divider plate and flange surface. IR 02432833 | 01/06/15 | WO 01646189-10 |
| 3 | 1DG01KB-X1 | 1B Diesel Generator Jacket Water Upper Cooler | Weld buildup to the flange surface. IR 02442638 IR 02444032 IR 02445376 | 01/31/15 | WO 01646190-02 |
| 3 | 1VA01SA | 1A SX Pump Room Cubicle Cooler | Weld buildup of the divider plate in the upper cooler. IR 02480641 | 02/15/15 | WO 00600895-04 |
| | | | Weld buildup of the divider plate in the lower cooler. IR 02480641 | 04/07/15 | WO 00600895-05 |
| 3 | 1VA01SB | 1B SX Pump Room Cubicle Cooler | Weld buildup of the lower cooler divider plate and the tube sheet. IR 02476547 | 05/02/14 | WO 01724700-01 |
| | | | Weld buildup of the upper cooler divider plate and the tube sheet. IR 01667382 | 06/15/14 | WO 01724700-04 |
| | | | Weld buildup of the lower cooler divider plate and the tube sheet. IR 02476547 | 04/03/15 | WO 01760416-13 |