Exelon Generation.

4300 Winfield Road
Warrenville, IL 60555
630 657 2000 Office

RS-19-078 10 CFR 50.90

September 24, 2019

U.S. Nuclear Regulatory Commission
ATTN: Document Control Desk
Washington, DC 20555-0001

Braidwood Station, Units 1 and 2
Renewed Facility Operating License Nos. NPF-72 and NPF-77
NRC Docket Nos. STN 50-456 and STN 50-457

Byron Station, Units 1 and 2
Renewed Facility Operating License Nos. NPF-37 and NPF-66
NRC Docket Nos. STN 50-454 and STN 50-455

Subject: License Amendment Request to Revise Braidwood Station and Byron Station Technical Specifications 5.5.16, "Containment Leakage Rate Testing Program," for Permanent Extension of Type A and Type C Leak Rate Test Frequencies

In accordance with 10 CFR 50.90, "Application for amendment of license, construction permit or early site permit," Exelon Generation Company, LLC (EGC) requests an amendment to Renewed Facility Operating License Nos. NPF-72 and NPF-77 for Braidwood Station, Units 1 and 2, and Renewed Facility Operating License Nos. NPF-37 and NPF-66 for Byron Station, Units 1 and 2. The proposed change revises Braidwood Station and Byron Station Technical Specifications (TS) 5.5.16, "Containment Leakage Rate Testing Program," to allow for the permanent extension of the Type A Integrated Leak Rate Testing (ILRT) and Type C Leak Rate Testing frequencies.

Specifically, the proposed change will revise Braidwood Station and Byron Station TS 5.5.16 by replacing the references to Regulatory Guide (RG) 1.163, "Performance-Based Containment Leak-Test Program," with a reference to NEI 94-01, "Industry Guideline for Implementing Performance-Based Option of 10 CFR 50, Appendix J," Revision 3-A, and the conditions and limitations specified in NEI 94-01, Revision 2-A, as the documents used to implement the performance-based containment leakage testing program in accordance with Option B of 10 CFR 50, Appendix J.

The proposed amendment is risk-informed and follows the guidance in RG 1.174, "An Approach for Using Probabilistic Risk Assessment in Risk-Informed Decisions on Plant-Specific Changes to the Licensing Basis," Revision 2. EGC has performed Braidwood Station and Byron Station site-specific evaluations to assess the risk significance of the impact of the proposed amendment. Copies of the risk significance evaluations are provided as attachments to this letter.

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The request is subdivided as follows:

Enclosure 1 provides the site-specific information for Braidwood Station, and Enclosure 2 provides the site-specific information for Byron Station. These enclosures contain the following attachments:

- Attachments 1a and 1b provide the description and evaluation of the proposed changes for Braidwood Station and Byron Station, respectively.
- Attachments 2a and 2b provide the markup of the affected TS pages for Braidwood Station and Byron Station, respectively.
- Attachments 3a and 3b provide Calculations 54017-CALC-01 and 54018-CALC-01, the evaluation of risk significance of permanent ILRT extension for Braidwood Station and Byron Station, respectively.

The proposed changes have been reviewed by the Braidwood Station and Byron Station Plant Operations Review Committees in accordance with the requirements of the EGC Quality Assurance Program.

EGC requests approval of the proposed amendment by September 24, 2020. This requested approval date will support the extension of the Byron Station Unit 1 ILRT, which is next required to be performed during the outage in the fall of 2021. Once approved, this amendment will be implemented within 90 days. This implementation period will provide adequate time for the affected station documents to be revised using the appropriate change control mechanisms.

In accordance with 10 CFR 50.91, "Notice for public comment; State consultation," paragraph (b), EGC is notifying the State of Illinois of this application for license amendment by transmitting a copy of this letter and its attachments to the designated State Official.

There are no regulatory commitments contained in this letter. Should you have any questions concerning this letter, please contact Ms. Lisa A. Simpson at (630) 657-2815.

I declare under penalty of perjury that the foregoing is true and correct. Executed on the 24th day of September 2019.

Respectfully,

Dwi Murray
Sr. Manager – Licensing
Exelon Generation Company, LLC

ENCLOSURE 1 – Braidwood Station, Units 1 and 2:

ATTACHMENTS:
1a) Evaluation of the Proposed Change
2a) Proposed Technical Specifications Changes for Braidwood Station, Units 1 and 2
3a) Calculation 54017-CALC-01: Evaluation of Risk Significance of Permanent ILRT Extension for Braidwood Station, Units 1 and 2

ENCLOSURE 2 – Byron Station, Units 1 and 2:

ATTACHMENTS:
1b) Evaluation of the Proposed Change
2b) Proposed Technical Specifications Changes for Byron Station, Units 1 and 2
3b) Calculation 54018-CALC-01: Evaluation of Risk Significance of Permanent ILRT Extension for Byron Station, Units 1 and 2

cc: NRC Regional Administrator, Region III
NRC Senior Resident Inspector, Braidwood Station
NRC Senior Resident Inspector, Byron Station
Illinois Emergency Management Agency – Division of Nuclear Safety

ENCLOSURE 1

Braidwood Station, Units 1 and 2

Renewed Facility Operating License Nos. NPF-72 and NPF-77

License Amendment Request to Revise Braidwood Station, Units 1 and 2, Technical Specifications 5.5.16, "Containment Leakage Rate Testing Program," for Permanent Extension of Type A and Type C Leak Rate Test Frequencies

ATTACHMENT 1a
Description and Assessment

EVALUATION OF THE PROPOSED CHANGE

SUBJECT: License Amendment Request to Revise Braidwood Units 1 and 2 Technical Specifications 5.5.16, "Containment Leakage Rate Testing Program," for Permanent Extension of Type A and Type C Leak Rate Test Frequencies

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ATTACHMENTS:

2a. Proposed Technical Specifications Changes for Braidwood Station, Units 1 and 2
3a. Braidwood Station: Evaluation of Risk Significance of Permanent ILRT Extension

ATTACHMENT 1a
Description and Assessment

1.0 SUMMARY DESCRIPTION

In accordance with 10 CFR 50.90, "Application for amendment of license, construction permit, or early site permit," Exelon Generation Company, LLC (EGC) requests an amendment to Renewed Facility Operating License Nos. NPF-72 and NPF-77 for Braidwood Station (BRW), Unit 1 and Unit 2, respectively.

The proposed change revises Units 1 and 2 Technical Specifications (TS) 5.5.16, "Containment Leakage Rate Testing Program," to reflect the following:

- Increases the existing Type A integrated leakage rate test (ILRT) program test interval from 10 years to 15 years in accordance with Nuclear Energy Institute (NEI) Topical Report (TR) NEI 94-01, "Industry Guideline for Implementing Performance-Based Option of 10 CFR 50, Appendix J," Revision 3-A (Reference 1) and the conditions and limitations specified in NEI 94-01, Revision 2-A (Reference 2).

- Adopts an extension of the containment isolation valve (CIV) leakage rate testing (Type C) frequency from the 60 months currently permitted by 10 CFR 50, Appendix J, "Primary Reactor Containment Leakage Testing for Water-Cooled Power Reactors," Option B, to a 75-month frequency for Type C leakage rate testing of selected components, in accordance with NEI 94-01, Revision 3-A.

- Adopts the use of American National Standards Institute/American Nuclear Society (ANSI/ANS) 56.8-2002, "Containment System Leakage Testing Requirements," (Reference 3).

- Adopts a more conservative allowable test interval extension of nine months, for Type A, Type B and Type C leakage rate tests in accordance with NEI 94-01, Revision 3-A.

Specifically, the proposed change contained herein revises each of the BRW Units 1 and 2 TS 5.5.16, by replacing the references to Regulatory Guide (RG) 1.163, "Performance-Based Containment Leak-Test Program," (Reference 4) and NEI 94-01, Revision 0, (Reference 8) with a reference to NEI 94-01, Revision 3-A, and the conditions and limitations specified in NEI 94-01, Revision 2-A, as the documents used by BRW to implement the performance-based leakage testing program in accordance with Option B of 10 CFR 50, Appendix J.

2.0 DETAILED DESCRIPTION

BRW Units 1 and 2 TS 5.5.16, "Containment Leakage Rate Testing Program," currently states, in part:

> A program shall be established to implement the leakage rate testing of the containment as required by 10 CFR 50.54(o) and 10 CFR 50, Appendix J, Option B, as modified by approved exemptions. This program shall be in accordance with the guidelines contained in Regulatory Guide 1.163, September 1995 and NEI 94-01, Revision 0.

The proposed changes to BRW Units 1 and 2 TS 5.5.16 will replace the reference to RG 1.163 with reference to TR NEI 94-01, Revisions 2-A and 3-A.

The proposed change revises the BRW Units 1 and 2 TS 5.5.16 to read as follows (with recommended changes using strike-out and **bold-type** for clarification purposes):

> A program shall be established to implement the leakage rate testing of the containment as required by 10 CFR 50.54(o) and 10 CFR 50, Appendix J, Option B, as modified by approved exemptions. This program shall be in accordance with the guidelines contained in ~~Regulatory Guide 1.163, September 1995 and~~ **Nuclear Energy Institute (NEI) Topical Report (TR),** NEI 94-01, ~~Revision 0~~ **"Industry Guideline for Implementing Performance-Based Option of 10 CFR 50, Appendix J," Revision 3-A, dated July 2012, and the conditions and limitations specified in NEI 94-01, Revision 2-A, dated October 2008.**

Therefore, the retyped ("clean") version of TS 5.5.16 will appear as follows:

> A program shall be established to implement the leakage rate testing of the containment as required by 10 CFR 50.54(o) and 10 CFR 50, Appendix J, Option B, as modified by approved exemptions. This program shall be in accordance with the guidelines contained in Nuclear Energy Institute (NEI) Topical Report (TR), NEI 94-01, "Industry Guideline for Implementing Performance-Based Option of 10 CFR 50, Appendix J," Revision 3-A, dated July 2012, and the conditions and limitations specified in NEI 94-01, Revision 2-A, dated October 2008.

The marked-up TS page for BRW Units 1 and 2 TS 5.5.16 are provided in Attachment 2a.

Attachment 3a contains the plant specific risk assessment conducted to support this proposed change. This risk assessment follows the guidelines of NRC RG 1.174, Revision 3 (Reference 5) and RG 1.200, Revision 2 (Reference 6). The risk assessment concludes that increasing the ILRT test frequency on a permanent basis to a one-in-fifteen-year frequency is considered to represent a small change in the BRW risk profile.

3.0 TECHNICAL EVALUATION

3.1 Description of Containment System

The BRW containments are post-tensioned reinforced concrete structures with a carbon steel liner on the inside surface. Each containment consists of a cylindrical wall, a flat foundation mat, a shallow dome roof, and penetrations through the structure. The post-tensioning system consists of vertical and horizontal tendons in the cylinder wall and three-way tendons in the dome. The steel liner and its penetrations establish the leakage-limiting boundary of the containment. The post-tensioned reinforced concrete structures provide containment structural integrity.

3.1.1 Containment Structure

The containment structure is a prestressed concrete shell structure made up of a cylinder with a shallow dome roof and flat foundation slab. The cylindrical portion is prestressed by a post-tensioning system consisting of horizontal and vertical tendons. There are three buttresses equally spaced around the containment and each horizontal tendon is anchored at buttresses 240° apart, bypassing the intermediate buttress. The dome post-tensioning system is made up of three groups of tendons oriented 120° to each other and anchored at the vertical face of the dome ring. The entire structure is lined on the inside with steel plate, which acts as a leak tight membrane.

The containment completely encloses the entire pressurized water reactor, steam generators, reactor coolant loops, and portions of the auxiliary and engineered safety features systems. It ensures that leakage of radioactive material to the environment does not cause the dose limits of 10 CFR 50.67, "Accident Source Term," to be exceeded.

The containment has the following dimensions:

a) thickness of base slab: 12'
b) diameter of base slab: 157'
c) inside diameter of containment: 140'
d) inside height of containment: 222'
e) thickness of containment wall: 3'-6"
f) dome thickness: 3'

The base foundation slab is conventionally reinforced with high strength reinforcing steel. A continuous access gallery is provided beneath the base slab for access to the vertical tendons. The top of the base slab, within the containment, is lined with a steel liner plate to provide a leak tight membrane.

The containment cylindrical wall has a constant thickness of 3.5' starting from the base slab elevation (Elev.) of 374' to the dome spring line at Elev. 555' 3-3/8". The wall has been thickened locally around the main steam penetrations, personnel lock, and equipment hatch. Containment reinforcing consists primarily of hoop and meridional steel. Prestressing tendons are arranged in hoop and meridian directions.

3.1.2 Prestressing Tendons

Three groups of tendons oriented 120° to each other have been provided in the dome. In each group there are 40 tendons spaced equally on a horizontal projection. Bearing plates for anchorage of the tendons are placed on wedge shaped pockets located on the vertical face of the dome ring.

The containment wall is prestressed using 201 hoop and 162 vertical unbonded tendons. Each hoop tendon is anchored at buttresses 240° apart, bypassing the intermediate buttress. The hoop tendons are arranged in the wall between Elev. 374'-0" and Elev. 562'-0".

Vertical tendons are anchored at the underside of the base slab at Elev. 362' and at the top of the dome ring at Elev. 579'-0". The anchorage zones for all the tendons have been provided with additional reinforcing to account for transverse tensile stresses resulting from anchorage forces reacting on the concrete.

3.1.3 Equipment Hatch

An equipment hatch is provided for access to the containment during shutdown. The transfer of equipment and components through the containment wall is accomplished through this opening. The equipment hatch is a round barrel frame with dished head access hatch. The equipment access hatch has been furnished with a double-gasketed flange. Provisions are made to pressurize the space between the double gaskets of the door flanges and the weld seam channels at the liner joint, hatch flange, and dished door. The wall around the equipment hatch has been thickened to 7'. The tendons are deflected around the equipment hatch.

3.1.4 Personnel Access Hatch

There are two personnel locks. One penetrates the dished door of the equipment hatch, used for access to the containment building. The second, which penetrates the containment on the side opposite the equipment hatch at grade level, is used as an emergency escape route, an alternate containment access at power, and as routine access for personnel and equipment into and out of the containment building during cold shutdown, refueling mode, and when the reactor is defueled. Both personnel locks are double-door, mechanically latched, welded steel assemblies. The space between the doors can be pressurized to peak containment pressure, P_a, through test connections. The shell wall around the emergency personnel lock has been thickened to 4'-6". Additional reinforcing has been provided to account for stress concentrations due to the openings and pipe support reactions. The tendons are deflected around the penetrations.

3.1.5 Steam Generator Replacement, Unit 1

During Refueling Outage A1R07 in fall 1998, steam generator replacement was completed on BRW Unit 1. This involved cutting an opening in the containment structure to facilitate removal of the original steam generators from containment and movement of the replacement steam generators into containment. During this effort, concrete was removed to provide adequate clearance for a steam generator to pass through the opening. Specific detail regarding the concrete work performed during the restoration of the containment opening following steam generator replacement is contained in Appendix B of the UFSAR. Reinforcing steel of the containment was damaged during the concrete removal process. The steel was repaired by splicing new reinforcing steel bars (rebars) to the remaining rebar in the containment structure. Reinforcing steel repair for the steam generator replacement containment opening is discussed in Section B.2.4 of Appendix B in the UFSAR.

The Unit 1 containment structure was also analyzed using Bechtel computer program BSAP to assess the effects of a temporary construction opening created in the containment wall to accommodate the steam generator replacement activities. A three-dimensional, finite-element model of the containment structure was used in the analysis. Special attention to the area of the opening was given to assess the state of stress in the containment wall during construction and after restoration of the temporary opening.

Subsequent to restoration of the containment opening following steam generator replacement, a containment pressure test as required by the American Society of Mechanical Engineers (ASME) Section XI, 1992 Edition with 1992 Addenda, Subsection IWL-5000 was performed to a pressure equal to the accident pressure. This Type A test also met the requirements of 10 CFR 50 Appendix J, Option B and served to demonstrate the operability of the primary containment structure and containment liner following restoration of the temporary construction opening used during the Unit 1 steam generator replacement project. In addition to this pneumatic pressure test, qualified inspectors performed a visual examination of the containment wall concrete surface in the area of the opening to ensure there was no evidence of conditions indicative of damage or degradation.

3.2 Emergency Core Cooling System (ECCS) Net Positive Suction Head (NPSH) Analysis

Design Analyses for the ECCS pumps show that the NPSH Available is greater than the NPSH Required from the specific vendor performance curves. The analyses cover the ECCS Injection and the ECCS Recirculation Phases.

Upon a safety injection (SI) signal, the ECCS pumps take suction from the reactor water storage tank (RWST) and inject into the reactor coolant system (RCS) cold legs. When the RWST level lowers to 46.7% (LO-2), the suction source for the residual heat removal (RHR) pumps is switched to the containment recirculation sumps. As part of this sequence, the discharge from the RHR pumps is lined-up to supply the suction of the chemical and volume control (CV) and SI pumps. The NPSH requirements during ECCS Recirculation for the CV and SI pumps is satisfied by the RHR pumps discharge pressure. The suction source to the containment spray (CS) pumps is also switched to the containment recirculation sumps after the RWST level lowers to 13%.

Therefore, conditions inside the Containment Building have the potential to influence NPSH parameters only for the RHR and CS pumps. The NPSH analysis for temperatures above 200°F assumes that the vapor pressure of the recirculation sump liquid is equal to the containment pressure. This ensures that credit is not taken for increase in the containment pressure due to the accident. The NPSH analysis for temperatures below 200°F credits the minimum containment air pressure that was present inside containment before the accident. No credit is taken for the increase in containment pressure due to the accident (containment overpressurization).

3.3 Justification for the TS Change

3.3.1 Chronology of Testing Requirements of 10 CFR 50, Appendix J

The testing requirements of 10 CFR 50, Appendix J, "Primary Reactor Containment Leakage Testing for Water-Cooled Power Reactors," (Reference 7) provide assurance that leakage from the containment, including systems and components that penetrate the containment, does not exceed the allowable leakage values specified in the TS. 10 CFR 50, Appendix J also ensures that periodic surveillance of reactor containment penetrations and isolation valves are performed so that proper maintenance and repairs are made during the service life of the containment and those systems and components penetrating primary containment. The limitation on containment leakage provides assurance that the containment would perform its design function following an accident up to and including the plant design basis accident (DBA). Appendix J identifies three types of required tests:

1) Type A tests, intended to measure the primary containment overall integrated leakage rate;

2) Type B tests, intended to detect local leaks and to measure leakage across pressure-containing or leakage limiting boundaries (other than valves) for primary containment penetrations; and,

3) Type C tests, intended to measure containment isolation valve (CIV) leakage rates.

Types B and C tests identify the vast majority of potential containment leakage paths. Type A tests identify the overall (integrated) containment leakage rate and serve to ensure continued leakage integrity of the containment structure by evaluating those structural parts of the containment not covered by Types B and C testing.

In 1995, 10 CFR 50, Appendix J (Reference 7), was amended to provide a performance-based Option B for the containment leakage testing requirements. Option B requires that test intervals for Type A, Type B, and Type C testing be determined by using a performance-based approach. Performance-based test intervals are based on consideration of the operating history of the component and resulting risk from its failure. The use of the term "performance-based" in 10 CFR 50, Appendix J refers to both the performance history necessary to extend test intervals as well as to the criteria necessary to meet the requirements of Option B.

Also, in 1995, RG 1.163, "Performance-Based Containment Leak-Test Program," (Reference 4) was issued. The RG endorsed NEI 94-01, Revision 0, (Reference 8) with certain modifications and additions. Option B, in concert with RG 1.163 and NEI 94-01, Revision 0, allows licensees with a satisfactory ILRT performance history (i.e., two consecutive, successful Type A tests) to reduce the test frequency for the containment Type A (ILRT) test from three tests in 10 years to one test in 10 years. This relaxation was based on an NRC risk assessment contained in NUREG-1493, (Reference 9) and Electric Power Research Institute (EPRI) TR-104285 (Reference 10), both of which showed that the risk increase associated with extending the ILRT surveillance interval was very small. In addition to the 10-year ILRT interval, provisions for extending the test interval an additional 15 months were considered in the establishment of the intervals allowed by RG 1.163 and NEI 94-01, but that this extension of interval "should be used only in cases where refueling schedules have been changed to accommodate other factors."

In 2008, NEI 94-01, Revision 2-A (Reference 2), was issued. This document describes an acceptable approach for implementing the optional performance-based requirements of Option B to 10 CFR 50, Appendix J, subject to the limitations and conditions noted in Section 4.0 of the NRC Safety Evaluation (SE) on NEI 94-01 (Reference 11). NEI 94-01, Revision 2-A, includes provisions for extending Type A ILRT intervals to up to 15 years and incorporates the regulatory positions stated in RG 1.163 (Reference 4). It delineates a performance-based approach for determining Type A, Type B, and Type C containment leakage rate surveillance testing frequencies. Justification for extending test intervals is based on the performance history and risk insights.

In 2012, NEI 94-01, Revision 3-A (Reference 1), was issued. This document describes an acceptable approach for implementing the optional performance-based requirements of Option B to 10 CFR 50, Appendix J and includes provisions for extending Type A ILRT intervals to up to 15 years. NEI 94-01 has been endorsed as an acceptable methodology for complying with the provisions of 10 CFR Part 50, Appendix J, Option B, by RG 1.163 and NRC SEs dated June 25, 2008 and June 8, 2012 (References 4, 11, and 12, respectively). The regulatory positions stated in RG 1.163, as modified by References 11 and 12, are incorporated in NEI 94-01 Revision 3-A. It delineates a performance-based approach for determining Type A, Type B, and Type C containment leakage rate surveillance testing frequencies. Justification for extending test intervals is based on the performance history and risk insights.

Extensions of Type B and Type C test intervals are allowed based upon completion of two consecutive periodic as-found tests where the results of each test are within a licensee's allowable administrative limits. Intervals may be increased from 30 months up to a maximum of 120 months for Type B tests (except for containment airlocks) and up to a maximum of 75 months for Type C tests. If a licensee considers extended test intervals of greater than 60 months for Type B or Type C tested components, the review should include the additional considerations of as-found tests, schedule and review as described in NEI 94-01, Revision 3-A, Section 11.3.2.

The NRC has provided guidance concerning the use of test interval extensions in the deferral of ILRTs beyond the 15-year interval in NEI 94-01, Revision 2-A, NRC SE Section 3.1.1.2, which states, in part:

> As noted above, Section 9.2.3, NEI TR 94-01, Revision 2, states, "Type A testing shall be performed during a period of reactor shutdown at a frequency of at least once per 15 years based on acceptable performance history." However, Section 9.1 states that the "required surveillance intervals for recommended Type A testing given in this section may be extended by up to 9 months to accommodate unforeseen emergent conditions but should not be used for routine scheduling and planning purposes." The NRC staff believes that extensions of the performance-based Type A test interval beyond the required 15 years

> should be infrequent and used only for compelling reasons. Therefore, if a licensee wants to use the provisions of Section 9.1 in TR NEI 94-01, Revision 2, the licensee will have to demonstrate to the NRC staff that an unforeseen emergent condition exists.

NEI 94-01, Revision 3-A, Section 10.1, Introduction, concerning the use of test interval extensions in the deferral of Type B and Type C LLRTs, based on performance states, in part, that:

> Consistent with standard scheduling practices for TS Required Surveillances, intervals of up to 120 months for the recommended surveillance frequency for Type B testing and up to 75 months for Type C testing given in this section may be extended by up to 25% of the test interval, not to exceed nine months.
>
> Notes: For routine scheduling of tests at intervals over 60 months, refer to the additional requirements of Section 11.3.2.
>
> Extensions of up to nine months (total maximum interval of 84 months for Type C tests) are permissible only for non-routine emergent conditions. This provision (nine-month extension) does not apply to valves that are restricted and/or limited to 30-month intervals in Section 10.2 (such as BWR MSIVs) or to valves held to the base interval (30 months) due to unsatisfactory LLRT performance.

The NRC also provided the following concerning the extension of ILRT intervals to 15 years in NEI 94-01, Revision 3-A, NRC SE Section 4.0, Condition 2, which states, in part:

> The basis for acceptability of extending the ILRT interval out to once per 15 years was the enhanced and robust primary containment inspection program and the local leakage rate testing of penetrations. Most of the primary containment leakage experienced has been attributed to penetration leakage and penetrations are thought to be the most likely location of most containment leakage at any time.

3.3.2 <u>Current BRW Primary Containment Leakage Rate Testing Program Requirements</u>

10 CFR 50, Appendix J was revised, effective October 26, 1995, to allow licensees to choose containment leakage testing under either Option A, "Prescriptive Requirements," or Option B, "Performance-Based Requirements." On April 4, 1996, the NRC issued Amendment No. 73 to Facility Operating License No. NPF-72 and Amendment No. 73 to Facility Operating License No. NPF-77 for BRW, Unit Nos. 1 and 2, respectively (Reference 14), authorizing the implementation of 10 CFR 50, Appendix J, Option B for Types A, B and C tests. The amendment modified the TS to replace the existing scheduling requirements for overall integrated and local containment leakage rate testing with a requirement to perform the testing in accordance with 10 CFR Part 50, Appendix J, Option B, "Performance-Based Containment Leakage Rate Testing."

Current BRW Units 1 and 2 TS 5.5.16 requires that a program be established to comply with the containment leakage rate testing requirements of 10 CFR 50.54(o) and 10 CFR 50, Appendix J, Option B. The program is required to be in accordance with the guidelines contained in RG 1.163 (Reference 4). RG 1.163 endorses, with certain exceptions, NEI 94-01, Revision 0 (Reference 8), as an acceptable method for complying with the provisions of Appendix J, Option B.

RG 1.163, Section C.1 states that licensees intending to comply with 10 CFR 50, Appendix J, Option B, should establish test intervals based upon the criteria in Section 11.0 of NEI 94-01, Revision 0, rather than using test intervals specified in ANSI/ANS 56.8-1994 (Reference 15). NEI 94-01, Section 11.0 refers to Section 9, which states that Type A testing shall be performed

during a period of reactor shutdown at a frequency of at least once per ten years based on acceptable performance history. Acceptable performance history is defined as completion of two consecutive periodic Type A tests where the calculated performance leakage was less than 1.0 L_a (where L_a is the maximum allowable leakage rate at peak post-accident pressure). Elapsed time between the first and last tests in a series of consecutive satisfactory tests used to determine performance shall be at least 24 months.

Adoption of the Option B performance-based containment leakage rate testing program altered the frequency of measuring primary containment leakage in Types A, B, and C tests but did not alter the basic method by which Appendix J leakage testing is performed. The test frequency is based on an evaluation of the "as-found" leakage history to determine a frequency for leakage testing, which provides assurance that leakage limits will not be exceeded. The allowed frequency for Type A testing as documented in NEI 94-01 is based, in part, upon a generic evaluation documented in NUREG-1493 (Reference 9). The evaluation documented in NUREG-1493 included a study of the dependence of reactor accident risks on containment leak tightness. NUREG-1493 concluded in Section 10.1.2 that reducing the frequency of Type A tests (ILRT) from the original three (3) tests per 10 years to one (1) test per 20 years was found to lead to an imperceptible increase in risk. The estimated increase in risk is very small because ILRTs identify only a few potential containment leakage paths that cannot be identified by Types B and C testing, and the leaks that have been found by Type A tests have been only marginally above existing requirements. Given the insensitivity of risk to containment leakage rate and the small fraction of leakage paths detected solely by Type A testing, NUREG-1493 concluded that increasing the interval between ILRTs is possible with minimal impact on public risk.

3.3.3 <u>BRW 10 CFR 50, Appendix J, Option B Licensing History</u>

<u>April 4, 1996 – License Amendment No. 73</u>

The NRC issued Amendment No. 73 to Facility Operating License No. NPF-72 and Amendment No. 73 to Facility Operating License No. NPF-77 for BRW, Unit Nos. 1 and 2, respectively. The amendments modified the TS to replace the existing scheduling requirements for overall integrated and local containment leakage rate testing with a requirement to perform the testing in accordance with 10 CFR Part 50, Appendix J, Option B, Performance-Based Containment Leakage Rate Testing. Option B allows test scheduling to be adjusted based on past performance (Reference 14).

<u>May 4, 2001 – License Amendment No. 113</u>

The NRC issued Amendment No. 113 to Facility Operating License No. NPF-72 and Amendment No. 113 to Facility Operating License No. NPF-77 for BRW, Unit Nos. 1 and 2, respectively. The amendments revised the licenses and Technical Specifications to reflect approval of an increase in maximum thermal power from 3411 megawatts thermal (MWt) to 3586.6 MWt. This resulted in an approximate increase of 70 megawatts electric (MWe) for BRW Unit 1 and an approximate 40 MWe increase for BRW Unit 2. Included as part of the amendments, was a revision to TS 5.5.16, "Containment Leakage Rate Testing Program," which changed the peak calculated containment internal pressure for the design basis LOCA (P_a) to 42.8 pounds per square inch gauge (psig) for Unit 1 and 38.4 psig for Unit 2 (Reference 16).

September 8, 2006 – License Amendment No. 140

The NRC issued Amendment No. 140 to Facility Operating License No. NPF-72 and Amendment No. 140 to Facility Operating License No. NPF-77 for BRW, Unit Nos. 1 and 2, respectively. The amendments fully implemented alternative source term pursuant to 10 CFR 50.67. The amendment revised TS 5.5.16, "Containment Leakage Rate Testing Program," to reflect a change in the maximum allowable containment leakage rate leakage limit (L_a), at design accident pressure (P_a), from 0.10% to 0.20% of containment air weight per day (Reference 17).

April 2, 2008 – License Amendment No.149

The NRC issued Amendment No.149 to Facility Operating License No. NPF-72 and Amendment No.149 to Facility Operating License No. NPF-77 for BRW, Units 1 and 2, respectively. The amendments revised TS 5.5.16, "Containment Leakage Rate Testing Program," to reflect a one-time, 5-year extension of the containment Type A test (containment integrated leakage rate test (ILRT)) interval requirement, under 10 CFR 50, Appendix J, Option B, from 10 years to 15 years. The amendment allowed the next Type A ILRT to be performed within 15 years of the most recent Type A test at BRW, but no later than October 5, 2013, for Unit 1 and no later than May 4, 2014, for Unit 2 (Reference 18).

March 13, 2014 – License Amendment No. 175

The NRC issued Amendment No. 175 to Facility Operating License No. NPF-72 and Amendment No. 175 to Facility Operating License No. NPF-77, for BRW, Units 1 and 2, respectively. The amendment revised the date for the performance of the BRW, Unit 2, Type A, or integrated containment leakage rate test described in TS 5.5.16, "Containment Leakage Rate Testing Program." Specifically, the change revised the date for the performance of the Type A test from "no later than May 4, 2014," to "prior to entering MODE 4 at the start of Cycle 18." Additionally, a requirement was established for BRW, Unit 2, to exit the MODES of applicability for containment as described in TS 3.6.1, "Containment" (i.e., MODES 1-4), no later than May 4, 2014 (Reference 19).

July 5, 2017 – License Amendment No. 193

The NRC issued Amendment No. 193 to Renewed Facility Operating License No. NPF-72 and Amendment No. 193 to Renewed Facility operating License No. NPF-77, for BRW, Units 1 and 2, respectively. This amendment made administrative changes to the BRW TS. Specifically, removed text "as modified by the following exceptions:" and removed Exceptions 1 and 2 in their entirety, as the Type A tests were performed on September 27, 2013, and May 13, 2014, for BRW, Units 1 and 2, respectively. These were the first Type A tests performed after the October 5, 1998, Type A test and the May 4, 1999, Type A test for BRW, Units 1 and 2, respectively. (Reference 20)

3.3.4 Integrated Leakage Rate Testing (ILRT) History

As noted previously, BRW TS 5.5.16 currently requires Types A, B, and C testing in accordance with RG 1.163, which endorses the methodology for complying with Option B. Since the adoption of Option B, the performance leakage rates are calculated in accordance with NEI 94-01, Section 9.1.1 for Type A testing. Tables 3.3.4-1 and 3.3.4-2 list the past Periodic Type A ILRT results for BRW, Units 1 and 2, respectively.

Table 3.3.4-1: BRW Unit 1 Type A Testing History [1]				
Test Date	**95% Upper Confidence Limit (wt.%/day)**	**As-Left Leakage (wt.%/day)**	**Acceptance Criteria (wt.%/day)**	**Test Method**
5/21/1986 [2]	0.0333	0.0340	0.075	Total Time
2/2/1991	0.05286 [3]	0.0557	0.075	Mass Point
11/8/1995	0.06324	0.06419	0.075	Mass Point
10/5/1998 [4]	0.0605	0.0707	0.075	Mass Point
9/24/2013 [7]	0.0497	0.05571	0.150 [6]	Mass Point

Table 3.3.4-2: BRW Unit 2 Type A Testing History [1]				
Test Date	**95% Upper Confidence Limit (wt.%/day)**	**As-Left Leakage (wt.%/day)**	**Acceptance Criteria (wt.%/day)**	**Test Method**
9/6/1987 [2]	0.0490	0.04946	0.075	Total Time
9/12/1991	0.05259 [5]	0.0554	0.075	Mass Point
10/27/1994	0.04944	0.05317	0.075	Mass Point
5/4/1999	0.0487	0.06278	0.075	Mass Point
5/17/2014 [7]	0.106747	0.108347	0.150 [6]	Mass Point

Notes for Tables 3.3.4-1 and 3.3.4-2:

(1) All Unit 1 and Unit 2 Type A tests were performed at a test pressure greater than P_a. Therefore, a partial pressure calculation to adjust the wt.%/day for reduced test pressure was not required. During the Pre-Operational test, data was also collected, and a leakage rate calculated at reduced pressure. However, only the leakage rate results calculated from data taken at full pressure are displayed above.

(2) This ILRT was a Pre-Operational Test.

(3) This test was performed using the Mass Point test method, based on ANSI/ANS 56.8-1987. Using this test method, the "As-Found" total containment leakage rate was calculated to be in excess of the maximum allowable leakage rate of 0.075 wt.%/day (0.75 L_a).

Prior to the performance of the statistical leak rate test, during the temperature stabilization period, leakage was observed from the Equipment Hatch airlock shaft seal. The leakage was evident, as during the test, the hatch is aligned with the interior door closed and the exterior door open to facilitate inspection of the seals. This was the last containment barrier to be isolated. It was only after these seals were blocked that the ILRT leakage dropped below 0.75 L_a.

The airlock had been As-Found tested following the start of the refueling outage, prior to performance of the Type A test. That test showed the leakage to be small. It should be noted that the Type A test was performed with the outer door open. This door is closed during the Type B test. The leakage found during the Type A test was all from the inner door.

The Type B test results indicate that under Post-LOCA conditions, the outer door would stop any leakage past the inner door. Thus, the minimum pathway leakage calculations of this pathway are not affected by this leak or the isolation of the leak from the inner door. Thus, no penalty is required to be added to the ILRT results as a result of this isolation though it was added as a result of management's conservative approach to ILRT testing.

The discrepancy between the results of the Type B test performed on the airlock prior to the Type A test and the results observed during the Type A test require explanation. The shaft seals may have been damaged following the Type B test at the start of the outage. Alternately, the Type B test may not adequately test the inner door due to possible direction dependency of leakage through the shaft seals. It must be noted that the outer door was challenged in the proper direction by the Type B test performed prior to the Type A test.

After the inner door seals were blocked, the ILRT was completed without any significant events. The final adjusted "As-Left" total containment leakage rate was calculated to be 0.0557 wt.%/day.

(4) This ILRT was conducted following the steam generator replacement completed during the A1R07 refueling outage. This test demonstrated containment integrity before transitioning to a mode where containment operability was required.

(5) This test was considered an "As-Found" failure due to the leaking 2B Steam Generator manway cover. The manway cover presented a leakage path that was not able to be quantified but cause a leakage rate from containment above the acceptance limit for the ILRT. This leakage was observed during the temperature stabilization period. Once the steam generator's leak pathway was blocked, conditions in the containment appeared to stabilize and the statistical leak rate test commenced. The test occurred over a twenty-four period and an acceptable "As-Left" leak rate was observed and measured by the ILRT instrumentation. During the restoration of the ILRT, the 2B upper manway cover was found to have its seating surface damaged by steam cuts. The manway cover was repaired, and leak tightness was verified.

(6) On September 8, 2006, the NRC issued Amendment No. 140 to the Facility Operating Licenses for both BRW Unit 1 and BRW Unit 2 (ML062340420 - Reference 17). The amendments implemented an alternative accident source term pursuant to 10 CFR 50.67. The amendments revised TS 5.5.16 to reflect a change in the maximum allowable containment leakage rate (L_a), at P_a, from 0.10% of containment air weight per day to 0.20% of containment air weight per day.

(7) A one-time, 5-year extension of Type A testing was approved by the NRC with Amendment No. 175 to Facility Operating License No. NPF-72 and Amendment No. 175 to Facility Operating License No. NPF-77 for the BRW, Unit Nos. 1 and 2, respectively (Reference 19).

3.3.5 <u>Performance Leakage Rate Determination</u>

The current ILRT test interval for BRW, Units 1 and 2, is ten years. Verification of this interval is presented in Tables 3.3.5-1 and 3.3.5-2. The acceptance criteria used for this verification is contained in NEI 94-01, Rev. 2-A and Rev. 3-A, Section 5.0, Definitions, and is as follows:

The **performance leakage rate** is calculated as the sum of the Type A upper confidence limit (UCL) and as-left minimum pathway leakage rate (MNPLR) leakage rate for all Type B and Type C pathways that were in service, isolated, or not lined up in their test position (i.e., drained and vented to containment atmosphere) prior to performing the Type A test. In addition, leakage pathways that were isolated during performance of the test because of excessive leakage must be factored into the performance determination. The performance criterion for Type A tests is a performance leak rate of less than 1.0 La.

Table 3.3.5-1: Verification of Current Extended ILRT Interval for BRW Unit 1						
Test Date	**95% UCL Leakage Rate (wt.%/day) (Test Pressure)**	**Volume Level Corrections (wt.%/day)**	**Types B and C Penalties (wt.%/day)**	**Components Isolated During ILRT (wt.%/day)**	**Performance Leakage Rate (wt.%/day)**	**Acceptance Criteria (wt.%/day)**
10/5/1998	0.0605 (48.2 psig, P_a = 47.8 psig)	0.000135	0.01010	0	0.0707	0.075 (1)
9/24/2013 (3)	0.0497 (43.7 psig, P_a = 42.8 psig)	0.00141	0.0046	0	0.05571	0.150 (2)

Table 3.3.5-2: Verification of Current Extended ILRT Interval for BRW Unit 2						
Test Date	**95% UCL Leakage Rate (wt.%/day) (Test Pressure)**	**Volume Level Corrections (wt.%/day)**	**Types B and C Penalties (wt.%/day)**	**Components Isolated During ILRT (wt.%/day)**	**Performance Leakage Rate (wt.%/day)**	**Acceptance Criteria (wt.%/day)**
5/4/1999	0.0487 (47.3 psig, P_a = 44.4 psig)	0.000098	0.01401	0	0.06278	0.075 (1)
5/17/2014 (3)	0.106747 (40.4 psig, P_a = 38.4 psig)	-0.001	0.0026	0	0.108347	0.150 (2)

Notes for Tables 3.3.5-1 and 3.3.5-2:

(1) For the 1998 (Unit 1) and 1999 (Unit 2) ILRT tests, the acceptance criterion was 1.0 L_a (0.1 wt.%/day).

(2) For the 2013 (Unit 1) and 2014 (Unit 2) ILRT tests, the acceptance criterion was 1.0 L_a (0.2 wt.%/day). Reference Tables 3.3.4-1 and 3.3.4-2 Note 6 above regarding this increase in acceptance criteria for the performance leakage rate.

(3) A one-time, 5-year extension of Type A testing was approved by the NRC with Amendment No. 175 to Facility Operating License No. NPF-72 and Amendment No. 175 to Facility Operating License No. NPF-77 for the BRW, Unit Nos. 1 and 2, respectively (Reference 19).

3.4 Plant Specific Confirmatory Analysis

3.4.1 Methodology

A plant specific confirmatory analysis was performed to provide a risk assessment of extending the currently allowed containment Type A ILRT to a permanent interval of fifteen years. The risk assessment follows the guidelines from:

- NEI 94-01, Revision 3-A (Reference 1).
- The NEI "Interim Guidance for Performing Risk Impact Assessments in Support of One-Time Extensions for Containment Integrated Leakage Rate Test Surveillance Intervals" from November 2001 (Reference 21).
- The NRC regulatory guidance on the use of Probabilistic Risk Assessment (PRA) stated in RG 1.200 (Reference 6) as applied to ILRT interval extensions.
- Risk insights in support of a request for a change of a plant's licensing basis as outlined in RG 1.174, Revision 3 (Reference 5).
- The methodology used for Calvert Cliffs to estimate the likelihood and risk implications of corrosion-induced leakage of steel liners going undetected during the extended test interval (Reference 22).
- The methodology used in EPRI 1018243, Revision 2-A of EPRI 1009325 (Reference 13).

Revisions to 10 CFR 50, Appendix J (Option B) allow individual plants to extend the Integrated Leak Rate Test (ILRT) Type A surveillance testing frequency requirement from three in ten years to at least once in ten years. The revised Type A frequency is based on an acceptable performance history defined as two consecutive periodic Type A tests at least 24 months apart in which the calculated performance leakage rate was less than the limiting containment leakage rate of 1.0 L_a.

The basis for the current 10-year test interval is provided in Section 11.0 of NEI 94-01, Revision 0, and established in 1995 during development of the performance-based Option B to Appendix J. Section 11.0 of NEI 94-01 states that NUREG-1493, "Performance-Based Containment Leak Test Program," September 1995 (Reference 9), provides the technical basis to support rulemaking to revise leakage rate testing requirements contained in Option B to Appendix J. The basis consisted of qualitative and quantitative assessments of the risk impact (in terms of increased public dose) associated with a range of extended leakage rate test intervals. To supplement the NRC's rulemaking basis, NEI undertook a similar study. The results of that study are documented in Electric Power Research Institute (EPRI) Research Project TR-104285, "Risk Impact Assessment of Revised Containment Leak Rate Testing Intervals" (Reference 10).

The NRC report on performance-based leak testing, NUREG-1493, analyzed the effects of containment leakage on the health and safety of the public and the benefits realized from the containment leak rate testing. In that analysis, it was determined that for a representative PWR plant (i.e., Surry), containment isolation failures contribute less than 0.1% to the latent risks from reactor accidents. Consequently, it is desirable to show that extending the ILRT interval will not lead to a substantial increase in risk from containment isolation failures for BRW.

NEI 94-01 Revision 3-A supports using EPRI Report No. 1009325 Revision 2-A (EPRI 1018243), "Risk Impact Assessment of Extended Integrated Leak Rate Testing Intervals," for performing risk impact assessments in support of ILRT extensions (Reference 13). The Guidance provided in Appendix H of EPRI Report No. 1009325 Revision 2-A builds on the EPRI Risk Assessment methodology, EPRI TR-104285. This methodology is followed to determine the appropriate risk

information for use in evaluating the impact of the proposed ILRT changes.

It should be noted that containment leak-tight integrity is also verified through periodic in-service inspections conducted in accordance with the requirements of the American Society of Mechanical Engineers (ASME) Boiler and Pressure Vessel Code Section XI. More specifically, Subsection IWE provides the rules and requirements for in-service inspection of Class MC pressure-retaining components and their integral attachments, and of metallic shell and penetration liners of Class CC pressure-retaining components and their integral attachments in light-water cooled plants. Furthermore, NRC regulations 10 CFR 50.55a(b)(2)(ix)(E) require licensees to conduct visual inspections of the accessible areas of the interior of the containment. The associated change to NEI 94-01 will require that visual examinations be conducted during at least three other outages, and in the outage during which the ILRT is being conducted. These requirements will not be changed as a result of the extended ILRT interval. In addition, Appendix J, Type B local leak tests performed to verify the leak-tight integrity of containment penetration bellows, airlocks, seals, and gaskets are also not affected by the change to the Type A test frequency.

In the SE issued by the NRC letter dated June 25, 2008 (Reference 11), the NRC concluded that the methodology in EPRI TR-1009325, Revision 2, was acceptable for referencing by licensees proposing to amend their TS to extend the ILRT surveillance interval to 15 years, subject to the limitations and conditions noted in Section 4.0 of the Safety Evaluation (SE). Table 3.4.1-1 addresses each of the four limitations and conditions for the use of EPRI 1009325, Revision 2-A.

Table 3.4.1-1: EPRI Report No. 1009325, Revision 2 - Limitations and Conditions

Limitation/Condition (from Section 4.2 of SE)	BRW Response
1. The licensee submits documentation indicating that the technical adequacy of their PRA is consistent with the requirements of RG 1.200 relevant to the ILRT extension.	BRW PRA technical adequacy is addressed in Section 3.4.2 of this LAR and Attachment 3a, "Braidwood Station: Evaluation of Risk Significance of Permanent ILRT Extension," Appendix A, "PRA Acceptability."
2.a. The licensee submits documentation indicating that the estimated risk increase associated with permanently extending the ILRT surveillance interval to 15 years is small, and consistent with the clarification provided in Section 3.2.4.5 of this SE.	Since the ILRT does not impact core damage frequency (CDF), the relevant criterion is large early release frequency (LERF). The increase in LERF resulting from a change in the Type A ILRT test interval from 3 in 10 years to 1 in 15 years is estimated as 4.04E-8/year for Unit 1 and 3.98E-8/year for Unit 2 using the EPRI guidance. This value increases negligibly if the risk impact of corrosion-induced leakage of the steel liners occurring and going undetected during the extended test interval is included. Therefore, the estimated change in LERF is determined to be "very small" using the acceptance guidelines of RG 1.174 (Reference 5).

Table 3.4.1-1: EPRI Report No. 1009325, Revision 2 - Limitations and Conditions	
Limitation/Condition (from Section 4.2 of SE)	**BRW Response**
	When external event risk is included, the increase in LERF resulting from a change in the Type A ILRT test interval from 3 in 10 years to 1 in 15 years is estimated as 5.48E-7/year for Unit 1 and 5.54E-7/year for Unit 2 using the EPRI guidance, and total LERF is 7.34E-6/year for Unit 1 and 7.13E-6/year for Unit 2. As such, the estimated change in LERF is determined to be "small" using the acceptance guidelines of RG 1.174. (See Attachment 3a, Section 7 of this submittal.)
2.b. Specifically, a small increase in population dose should be defined as an increase in population dose of less than or equal to either 1.0 person-rem per year or 1% of the total population dose, whichever is less restrictive.	The effect resulting from changing the Type A test frequency to 1-per-15 years, measured as an increase to the total integrated plant risk for those accident sequences influenced by Type A testing is 0.135 person-rem/year for Unit 1 and 0.133 person-rem/year for Unit 2. NEI 94-01 (Reference 1) states that a "small" population dose is defined as an increase of ≤ 1.0 person-rem per year, or ≤ 1% of the total population dose, whichever is less restrictive for the risk impact assessment of the extended ILRT intervals. The results of this calculation meet these criteria. Moreover, the risk impact for the ILRT extension when compared to other severe accident risks is negligible. (See Attachment 3a, Section 7 of this submittal.)
2.c. In addition, a small increase in CCFP should be defined as a value marginally greater than that accepted in a previous one-time 15-year ILRT extension requests. This would require that the increase in CCFP be less than or equal to 1.5 percentage point.	The increase in the conditional containment failure probability from the 3 in 10 year interval to 1 in 15 year interval is 0.864% for Unit 1 and 0.864% for Unit 2. NEI 94-01 states that increases in CCFP of ≤ 1.5% are "small." Therefore, this increase is judged to be "small." (See Attachment 3a, Section 7 of this submittal.)
3. The methodology in EPRI Report No. 1009325, Revision 2, is acceptable except for the calculation of the increase in expected population dose (per year of reactor operation). In order to make the methodology acceptable, the average leak rate accident case (accident case 3b) used by the licensees shall be 100 L_a instead of 35 L_a.	The representative containment leakage for Class 3b sequences is 100L_a based on the guidance provided in EPRI Report No. 1009325, Revision 2-A (EPRI 1018243) (Reference 13). (See Attachment 3a, Section 4 of this submittal.)
4. A license amendment request (LAR) is required in instances where containment over-pressure is relied upon for ECCS performance.	Containment overpressure is not required for ECCS performance and is discussed in Section 3.2 of this submittal. Therefore, no additional request is needed.

3.4.2 PRA Acceptability

3.4.2.1 PRA Quality Statement for Permanent 15-Year ILRT Extension

The BB016a2 version of the BRW PRA model is the most recent evaluation of internal event risk. The BRW PRA modeling is highly detailed, including a wide variety of initiating events, modeled systems, operator actions, and common cause events. The PRA model quantification process used for the BRW PRA is based on the single top fault tree methodology, which is a well-known PRA methodology in the industry.

The BRW Internal Events and Fire PRA models have been peer reviewed to RG 1.200 Rev 2. The internal events model and Fire PRA have open Facts and Observations (F&Os); further details are provided in Attachment 3a, Section A.2 of this submittal.

EGC employs a multi-faceted approach to establishing and maintaining the technical adequacy and plant fidelity of the PRA models for all operating EGC nuclear generation sites. This approach includes both a proceduralized PRA maintenance and update process and the use of self-assessments and independent peer reviews. The following information describes the EGC approach to PRA model maintenance, as it applies to the BRW PRA.

3.4.2.2 PRA Maintenance and Update

The EGC risk management process ensures that the applicable PRA model is an accurate reflection of the as-built and as-operated plants. This process is defined in the EGC Risk Management program, which consists of a governing "Risk Management" procedure and subordinate implementation training and reference materials (T&RMs).

- EGC procedure "Full Power Internal Event (FPIE) PRA Model Update" delineates the responsibilities and guidelines for updating the full power internal events PRA models at all operating Exelon nuclear generation sites.
- EGC procedure "Fire PRA Model Update and Control" delineates the responsibilities and guidelines for updating the station fire PRA.

The overall EGC Risk Management program defines the process for implementing regularly scheduled and interim PRA model updates, tracking issues identified as potentially affecting the PRA models (e.g., due to changes in the plant, industry operating experience, etc.) and controlling the model and associated computer files. To ensure the current PRA model remains an accurate reflection of the as-built, as-operated plants, the following activities are routinely performed:

- Documentation of the PRA model, PRA products, and bases documents.
- Controlling electronic storage of Risk Management (RM) products including PRA update information, PRA models, and PRA applications.
- Updating the full power, internal events PRA models for EGC nuclear generation sites.
- Use of quantitative and qualitative risk models in support of the On-Line Work Control Process Program for risk evaluations for maintenance tasks (corrective maintenance, preventive maintenance, minor maintenance, surveillance tests and modifications) on systems, structures, and components (SSCs) within the scope of the Maintenance Rule (10 CFR 50.65(a)(4)).

As previously indicated, RG 1.200 also requires that additional information be provided as part of the LAR submittal to demonstrate the technical adequacy of the PRA model used for the risk assessment. Each of these items (plant changes not yet incorporated into the PRA model, relevant peer review findings, and consistency with applicable PRA Standards) is discussed.

3.4.2.3 Plant Changes Not Yet Incorporated into the PRA Model

Each EGC station maintains an updating requirements evaluation (URE) database to track all enhancements, corrections, and unincorporated plant changes. During the normal screening conducted as part of the plant change process, if a potential model update is identified, a new URE database item is created. Depending on the potential impact of the identified change, the requirements for incorporation will vary.

As part of this PRA evaluation, a review of open items in the URE database for BRW is performed, and an assessment of the impact on the results of the application is made. A few open UREs may lead to insignificant changes in CDF and LERF. Therefore, the model is adequate to perform this ILRT extension analysis.

3.4.2.4 Applicability of Peer Review Facts and Observations (F&Os)

The peer review process has demonstrated the technical acceptability of the BRW PRA models. The purpose of the industry PRA peer review process is to provide a method for establishing the technical capability and adequacy of a PRA relative to expectations of knowledgeable practitioners, using a set of guidance that establishes a set of minimum requirements. PRA peer reviews continue to be performed as PRAs are updated (and upgraded) to ensure the ability to support risk-informed applications and has proven to be a valuable process for establishing technical adequacy of nuclear power plant PRAs.

The internal events (IE) PRA (IEPRA) model was subject to a self-assessment and a full-scope peer review conducted in July 2013. The fire PRA model was subject to a self-assessment and a full-scope peer review conducted in October 2015. Findings were reviewed and closed using the process documented in Reference 23 as accepted by the NRC (Reference 24). The closure review was conducted in February 2017 (Reference 25). The F&O Closure Review, consisting of an assessment of existing finding-level F&Os for the full-power internal events PRA (FPIE PRA), the internal flood PRA (IFPRA), and the internal fire PRA (FPRA), was performed for BRW, Units 1 and 2. Table A-1 in Attachment 3a of this submittal provides a summary of open findings and dispositions of the BRW F&O Closure Review.

3.4.2.5 Conclusion

This information demonstrates the PRA is of sufficient quality and level of detail to support the ILRT extension analysis.

3.4.3 Summary of Plant-Specific Risk Assessment Results

The findings of the BRW, Units 1 and 2 Risk Assessment contained in Attachment 3a of this submittal confirm the general findings of previous studies that the risk impact associated with extending the ILRT interval from three in ten years to one in 15 years is small.

Based on the results from Attachment 3a, Section 5.2 and the sensitivity calculations presented in Attachment 3a, Section 5.3, the following conclusions regarding the assessment of the plant risk are associated with extending the Type A ILRT test frequency to 15 years:

- RG 1.174 (Reference 5) provides guidance for determining the risk impact of plant-specific changes to the licensing basis. RG 1.174 defines "very small" changes in risk as resulting in increases of CDF less than 1.0E-06/year and increases in LERF less than 1.0E-07/year. Since the ILRT does not impact CDF, the relevant criterion is LERF. The increase in LERF resulting from a change in the Type A ILRT test interval from 3 in 10 years to 1 in 15 years is estimated as 4.04E-8/year for Unit 1 and 3.98E-8/year for Unit 2, using the EPRI guidance. This value increases negligibly if the risk impact of corrosion-induced leakage of the steel liners occurring and going undetected during the extended test interval is included. Therefore, the estimated change in LERF is determined to be "very small" using the acceptance guidelines of RG 1.174. The risk change resulting from a change in the Type A ILRT test interval from 3 in 10 years to 1 in 15 years bounds the 1 in 10 years to 1 in 15 years risk change. Considering the increase in LERF resulting from a change in the Type A ILRT test interval from 1 in 10 years to 1 in 15 years is estimated as 1.68E-8/year for Unit 1 and 1.66E-8/year for Unit 2, the risk increase is "very small" using the acceptance guidelines of RG 1.174.

- When external event risk is included, the increase in LERF resulting from a change in the Type A ILRT test interval from 3 in 10 years to 1 in 15 years is estimated as 5.48E-7/year for Unit 1 and 5.54E-7/year for Unit 2, using the EPRI guidance, and total LERF is 7.34E-6/year for Unit 1 and 7.13E-6/year for Unit 2. As such, the estimated change in LERF is determined to be "small" using the acceptance guidelines of RG 1.174. The risk change resulting from a change in the Type A ILRT test interval from 3 in 10 years to 1 in 15 years bounds the 1 in 10 years to 1 in 15 years risk change. When external event risk is included, the increase in LERF resulting from a change in the Type A ILRT test interval from 1 in 10 years to 1 in 15 years is estimated as 2.28E-7/year for Unit 1 and 2.31E-7/year for Unit 2, and the total LERF is 7.03E-6/year for Unit 1 and 6.81E-6/year for Unit 2. Therefore, the risk increase is "small" using the acceptance guidelines of RG 1.174. As discussed in Attachment 3a, Sections 5.1.3 and 5.2.7, the EPRI methodology used to estimate the increase in LERF and the models used to estimate total LERF are conservative. Therefore, although the total LERF is near the RG 1.174 threshold, the conservative methodology adds margin.

- The effect resulting from changing the Type A test frequency to 1-per-15 years, measured as an increase to the total integrated plant risk for those accident sequences influenced by Type A testing is 0.135 person-rem/year for Unit 1 and 0.133 person-rem/year for Unit 2. NEI 94-01 (Reference 1) states that a "small" population dose is defined as an increase of ≤ 1.0 person-rem per year, or ≤ 1% of the total population dose, whichever is less restrictive for the risk impact assessment of the extended ILRT intervals. The results of this calculation meet these criteria. Moreover, the risk impact for the ILRT extension when compared to other severe accident risks is negligible.

- The increase in the conditional containment failure probability from the 3 in 10-year interval to 1 in 15-year interval is 0.864% for Unit 1 and 0.864% for Unit 2. NEI 94-01 (Reference 1) states that increases in CCFP of ≤ 1.5% are "small." Therefore, this increase is judged to be "small."

Therefore, increasing the ILRT interval to 15 years is considered to be "small" since it represents a small change to the BRW risk profile.

3.4.4 Previous Assessments

The NRC in NUREG-1493 (Reference 9) has previously concluded that:

- Reducing the frequency of Type A tests (ILRTs) from 3 per 10 years to 1 per 20 years was found to lead to an imperceptible increase in risk. The estimated increase in risk is very small because ILRTs identify only a few potential containment leakage paths that cannot be identified by Type B or Type C testing, and the leaks that have been found by Type A tests have been only marginally above existing requirements.

- Given the insensitivity of risk to containment leakage rate and the small fraction of leakage paths detected solely by Type A testing, increasing the interval between integrated leakage-rate tests is possible with minimal impact on public risk. The impact of relaxing the ILRT frequency beyond 1 in 20 years has not been evaluated. Beyond testing the performance of containment penetrations, ILRTs also test integrity of the containment structure.

The conclusions for BRW confirm these general conclusions on a plant-specific basis considering the severe accidents evaluated for BRW, the BRW containment failure modes, and the local population surrounding BRW.

3.4.5 RG 1.174, Revision 3, Defense in Depth Evaluation

RG 1.174, Revision 3 (Reference 5) describes an approach that is acceptable for developing risk-informed applications for a licensing basis change that considers engineering issues and applies risk insights. One of the considerations included in RG 1.174 is Defense in Depth. Defense in Depth is a safety philosophy that employs successive compensatory measures to prevent accidents or mitigate damage if a malfunction, accident, or naturally caused event occurs at a nuclear facility. The following seven considerations, as presented in RG 1.174, Revision 3, Section C.2.1.1.2, will serve to evaluate the proposed licensing basis change for overall impact on Defense in Depth.

1. Preserve a reasonable balance among the layers of defense.

A reasonable balance of the layers of defense (i.e., minimizing challenges to the plant, preventing any events from progressing to core damage, containing the radioactive source term, and emergency preparedness) helps to ensure an apportionment of the plant's capabilities between limiting disturbances to the plant and mitigating their consequences. The term "reasonable balance" is not meant to imply an equal apportionment of capabilities. The NRC recognizes that aspects of a plant's design or operation might cause one or more of the layers of defense to be adversely affected. For these situations, the balance between the other layers of defense becomes especially important when evaluating the impact of the proposed licensing basis change and its effect on defense in depth.

Response:
Several layers of defense are in place to ensure the BRW containment structure(s), penetrations, isolation valves, and mechanical seal systems continue(s) to perform their intended safety function. The purpose of the proposed change is to extend the testing frequencies of the Type A ILRT from 10 years to 15 years and Type C LLRTs for selected components from 60-months to 75-months.

As shown in NUREG-1493, Performance-Based Containment Leak-Test Program (Reference 9), increasing the test frequency of ILRTs up to a 20-year test interval was found to lead to an imperceptible increase in risk. The estimated increase in risk is very small because ILRTs identify only a few potential containment leakage paths that cannot be identified by Type B or Type C testing. The study also concluded that extending the frequency of Type B tests is possible with no adverse impact on risk as identified leakage through Type B mechanical penetrations are both infrequent and small. Finally, the study concluded that Types B and C tests could identify the vast majority (greater than 95 percent) of all potential leakage paths.

Several programmatic factors can also be cited as layers of defense ensuring the continued safety function of the BRW containment pressure boundary. NEI 94-01, Revisions 2-A and 3-A, require sites adopting the 15-year extended ILRT interval perform visual examinations of the accessible interior and exterior surfaces of the containment structure for structural degradation that may affect the containment leak-tight integrity at the frequency prescribed by the guidance or, if approved through a TS amendment, at the frequencies prescribed by ASME Section XI. Additionally, several measures are put in place to ensure integrity of the Types B and C tested components. NEI 94-01 limits large containment penetrations such as airlocks, purge and vent valves, boiling water reactor (BWR) main steam and feedwater isolation valves, to a maximum 30-month testing interval. For those valves that meet the performance standards defined in NEI 94-01, Revision 3-A, and are selected for test intervals greater than 60 months, a leakage understatement "penalty" is added to the MNPLR prior to the frequency being extended beyond 60-months. Finally, identification of adverse trends in the overall Types B and C leakage rate summations and available margin between the Type B and Type C leakage rate summation and its regulatory limit are required by NEI 94-01, Revision 3-A, to be shown in the BRW post-outage report(s). Therefore, the proposed change does not challenge or limit the layers of defense available to assess the ability of the BRW containment structure to perform its safety function.

PRA Response:
The use of the risk metrics of LERF, population dose, and conditional containment failure probability collectively ensures the balance between prevention of core damage, prevention of containment failure, and consequence mitigation is preserved. The change in LERF is "very small" with respect to internal events and "small" when including external events per RG 1.174, and the change in population dose and CCFP are "small" as defined in this analysis [provided in Attachment 3a of this submittal] and are consistent with NEI 94-01, Revision 3-A.

2. ***Preserve adequate capability of design features without an overreliance on programmatic activities as compensatory measures.***

Nuclear power plant licensees implement a number of programmatic activities, including programs for quality assurance, testing and inspection, maintenance, control of transient combustible material, foreign material exclusion, containment cleanliness, and training. In some cases, activities that are part of these programs are used as compensatory measures; that is, they are measures taken to compensate for some reduced functionality, availability, reliability, redundancy, or other feature of the plant's design to ensure safety functions (e.g., reactor vessel inspections that provide assurance that reactor vessel failure is unlikely). NUREG-2122, "Glossary of Risk-Related Terms in Support of Risk-Informed Decision Making," (Reference 26) defines "safety function" as those functions needed to shut down the reactor, remove the residual heat, and contain any radioactive material

release.

A proposed licensing basis change might involve or require compensatory measures. Examples include hardware (e.g., skid-mounted temporary power supplies); human actions (e.g., manual system actuation); or some combination of these measures. Such compensatory measures are often associated with temporary plant configurations. The preferred approach for accomplishing safety functions is through engineered systems. Therefore, when the proposed licensing basis change necessitates reliance on programmatic activities as compensatory measures, the licensee should justify that this reliance is not excessive (i.e., not overly reliant). The intent of this consideration is not to preclude the use of such programs as compensatory measures but to ensure that the use of such measures does not significantly reduce the capability of the design features (e.g., hardware).

Response:
The purpose of the proposed change is to extend the testing frequencies of the Type A ILRT from 10 years to 15 years and select Type C LLRTs from 60-months to 75-months. Several programmatic factors were defined in the response to Question 1 above, which are required when adopting NEI 94-01, Revisions 2-A and 3-A. These factors are conservative in nature and are designed to generate corrective actions if the required testing or inspections are deemed unsatisfactory well in advance to ensure the continued safety function of the containment is maintained. The programmatic factors are designed to provide differing ways to test and/or examine the containment pressure boundary in a manner that verifies the BRW containment pressure boundary will perform its intended safety function. Since the proposed change does not alter the configuration of the BRW containment pressure boundary, continued performance of the tests and inspections associated with NEI 94-01 will only serve to ensure the continued safety function of the containment without affecting any margin of safety.

PRA Response:
The adequacy of the design feature (the containment boundary subject to Type A testing) is preserved as evidenced by the overall "small" change in risk associated with the Type A test frequency change.

3. ***Preserve system redundancy, independence, and diversity commensurate with the expected frequency and consequences of challenges to the system, including consideration of uncertainty.***

As stated in RG 1.174, Section C.2.1.1.1, the defense-in-depth philosophy has traditionally been applied in plant design and operation to provide multiple means to accomplish safety functions.

System redundancy, independence, and diversity result in high availability and reliability of the function and also help ensure that system functions are not reliant on any single feature of the design. Redundancy provides for duplicate equipment that enables the failure or unavailability of at least one set of equipment to be tolerated without loss of function. Independence of equipment implies that the redundant equipment is separate such that it does not rely on the same supports to function.

This independence can sometimes be achieved by the use of physical separation or physical protection. Diversity is accomplished by having equipment that performs the same function rely on different attributes such as different principles of operation, different

physical variables, different conditions of operation, or production by different manufacturers which helps reduce common-cause failure (CCF).

A proposed change might reduce the redundancy, independence, or diversity of systems. The intent of this consideration is to ensure that the ability to provide the system function is commensurate with the risk of scenarios that could be mitigated by that function. The consideration of uncertainty, including the uncertainty inherent in the PRA, implies that the use of redundancy, independence, or diversity provides high reliability and availability and also results in the ability to tolerate failures or unanticipated events.

Response:
The proposed change to extend the testing frequencies of the Type A ILRT from 10 years to 15 years and select Type C LLRTs from 60-months to 75-months does not reduce the redundancy, independence or diversity of systems. As shown in NUREG-1493, increasing the test frequency of ILRTs up to a 20-year test interval was found to lead to an imperceptible increase in risk. The estimated increase in risk is very small because ILRTs identify only a few potential containment leakage paths that cannot be identified by Type B or Type C testing. The study also concluded that extending the frequency of Type B tests is possible with no adverse impact on risk as identified leakage through Type B mechanical penetrations are both infrequent and small. Additionally, the study concluded that Types B and C tests could identify the vast majority (greater than 95 percent) of all potential leakage paths.

Despite the change in test interval, containment isolation diversity remains unaffected and will continue to provide the inherent isolation, as designed. In addition, NEI 94-01, Revisions 2-A and 3-A, Section 11.3.2 requires a schedule of tests be developed, for components on a test interval greater than 60 months, such that unanticipated random failures and unexpected common-mode failures are avoided. This is typically accomplished by implementing test intervals at approximately evenly distributed intervals. Therefore, the proposed change preserves system redundancy, independence, and diversity and ensures a high reliability and availability of the containment structure to perform its safety function in the event of unanticipated events.

PRA Response:
The redundancy, independence, and diversity of the containment subject to the Type A test is preserved, commensurate with the expected frequency and consequences of challenges to the system, as evidenced by the overall "small" change in risk associated with the Type A test frequency change.

4. *Preserve adequate defense against potential common-cause failures (CCFs).*

An important aspect of ensuring defense in depth is to guard against CCF. Multiple components may fail to function because of a single specific cause or event that could simultaneously affect several components important to risk. The cause or event may include an installation or construction deficiency, accidental human action, extreme external environment, or an unintended cascading effect from any other operation or failure within the plant. CCFs can also result from poor design, manufacturing, or maintenance practices. Defenses can prevent the occurrence of failures from the causes and events that could allow simultaneous multiple component failures. Another aspect of guarding against CCF is to ensure that an existing defense put in place to minimize the impact of CCF is not significantly reduced; however, a reduction in one defense can be compensated for by adding another.

Response:
As part of the proposed change, BRW will be required to adopt the performance-based testing standards outlined in NEI 94-01, Revisions 2-A and 3-A, along with ANSI/ANS 56.8-2002. NEI 94-01 Revisions 2-A and 3-A, Section 11.3.2 requires a schedule of tests be developed, for components on test intervals greater than 60 months, such that unanticipated random failures and unexpected common-mode failures are avoided. This is typically accomplished by implementing test intervals at approximately evenly distributed intervals. In addition, components considered to be risk-significant from a PRA standpoint are required to be limited to a testing interval less than the maximum allowable limit of 75-months. For those components that have demonstrated satisfactory performance and have had their testing limits extended, administrative testing limits are assigned on a component-by-component basis and are used to identify potential valve or penetration degradation. Administrative limits are established at a value low enough to identify and should allow early correction in advance of total valve failure. Should a component exceed its administrative limit during testing, NEI 94-01, Revisions 2-A and 3-A, require cause determinations be performed designed to reinforce achieving acceptable performance. The cause determination is designed to identify and address common-mode failure mechanisms through appropriate corrective actions. The proposed change also imposes a requirement to address "margin management" (i.e., margin between the current containment leakage rate and its pre-established limit). As a result, adoption of the performance-based testing standards proposed by this change ensures adequate barriers exist to preclude failure of the containment pressure boundary due to common-mode failures and, therefore, continues to guard against CCF.

PRA Response:
Adequate defense against CCFs is preserved. The Type A test detects problems in the containment, which may or may not be the result of a CCF; such a CCF may affect failure of another portion of containment (i.e., local penetrations) due to the same phenomena. Adequate defense against CCFs is preserved via the continued performance of the Types B and C tests and the performance of inspections. The change to the Type A test, which bounds the risk associated with containment failure modes including those involving CCFs, does not degrade adequate defense as evidenced by the overall "small" change in risk associated with the Type A test frequency change.

5. ***Maintain multiple fission product barriers.***

Fission product barriers include the physical barriers themselves (e.g., the fuel cladding, reactor coolant system pressure boundary, and containment) and any equipment relied on to protect the barriers (e.g., containment spray). In general, these barriers are designed to perform independently so that a complete failure of one barrier does not disable the next subsequent barrier. For example, one barrier, the containment, is designed to withstand a double-ended guillotine break of the largest pipe in the reactor coolant system, another barrier.

A plant's licensing basis might contain events that, by their very nature, challenge multiple barriers simultaneously. Examples include interfacing-system loss-of-coolant accidents, steam generator tube rupture, or crediting containment accident pressure. Therefore, complete independence of barriers, while a goal, might not be achievable for all possible scenarios.

Response:
The purpose of the proposed change is to extend the testing frequencies of the Type A ILRT from 10 years to 15 years and select Type C LLRTs from 60-months to 75-months. As part of the proposed change, BRW will be required to adopt the performance-based testing standards outlined in NEI 94-01, Revisions 2-A and 3-A, along with ANSI/ANS 56.8-2002. The overall containment leakage rate calculations associated with the testing standards contain inherent conservatisms through the use of margin. Plant TS require the overall primary containment leakage rate to be less than or equal to 1.0 L_a. NEI 94-01 requires the As-Found Type A test leakage rate must be less than the acceptance criterion of 1.0 L_a given in the plant TS. Prior to entering a mode where containment integrity is required, the As-Left Type A leakage rate shall not exceed 0.75 L_a. The As-Found and As-Left values are as determined by the appropriate testing methodology specifically described in ANSI/ANS-56.8–2002. Additionally, the combined leakage rate for all Type B and Type C tested penetrations shall be less than or equal to 0.6 L_a, determined on a maximum pathway basis from the As-Left LLRT results prior to entering a mode where containment integrity is required. This regulatory approach results in a 25% and 40% margin, respectively, to the 1.0 L_a requirements. For those local leak rate tested components that have demonstrated satisfactory performance and have had their testing limits extended, administrative testing limits are assigned on a component by component basis and are used to identify potential valve or penetration degradation. Administrative limits are established at a value low enough to identify and allow early correction in advance of total valve failure. Should a component exceed its administrative limit during testing, NEI 94-01, Revisions 2-A and 3-A, require cause determinations be performed designed to reinforce achieving acceptable performance. The cause determination is designed to identify and address common-mode failure mechanisms through appropriate corrective actions. Therefore, the proposed change adopts requirements with inherent conservatisms to ensure the margin to safety limit is maintained, thereby, preserving the containment fission product barrier.

PRA Response:
Multiple Fission Product barriers are maintained. The portion of the containment affected by the Type A test extension is still maintained as an independent fission product barrier, albeit with an overall "small" change in the reliability of the barrier.

6. Preserve sufficient defense against human errors.

Human errors include the failure of operators to correctly and promptly perform the actions necessary to operate the plant or respond to off-normal conditions and accidents, errors committed during test and maintenance, and incorrect actions by other plant staff. Human errors can result in the degradation or failure of a system to perform its function, thereby significantly reducing the effectiveness of one of the layers of defense or one of the fission product barriers. The plant design and operation include defenses to prevent the occurrence of such errors and events. These defenses generally involve the use of procedures, training, and human engineering; however, other considerations (e.g., communication protocols) might also be important.

Response:
Sufficient defense against human errors is preserved. Errors committed during testing and maintenance may be reduced by the less frequent performance of the Type A, Type B, and Type C tests (less opportunity for errors to occur).

PRA Response:
Sufficient defense against human errors is preserved. The probability of a human error to operate the plant, or to respond to off-normal conditions and accidents is not significantly affected by the change to the Type A testing frequency. Errors committed during test and maintenance may be reduced by the less frequent performance of the Type A test (less opportunity for errors to occur).

7. ***Continue to meet the intent of the plant's design criteria.***

For plants licensed under 10 CFR Part 50 or 10 CFR Part 52, the plant's design criteria are set forth in the current licensing basis of the plant. The plant's design criteria define minimum requirements that achieve aspects of the defense-in-depth philosophy; as a consequence, even a compromise of the intent of those design criteria can directly result in a significant reduction in the effectiveness of one or more of the layers of defense. When evaluating the effect of the proposed licensing basis change, the licensee should demonstrate that it continues to meet the intent of the plant's design criteria.

Response:
The purpose of the proposed change is to extend the testing frequencies of the Type A ILRT from 10 years to 15 years and select Type C LLRTs from 60-months to 75-months. The proposed extensions do not involve either a physical change to the plant or a change in the manner in which the plant is operated or controlled. As part of the proposed change, BRW will be required to adopt the performance-based testing standards outlined in NEI 94-01, Revisions 2-A and 3-A, along with ANSI/ANS 56.8-2002. The leakage limits imposed by plant TS remain unchanged when adopting the performance-based testing standards outlined in NEI 94-01, Revision 3-A, and ANSI/ANS 56.8-2002. Plant design limits imposed by the Updated Final Safety Analysis Report (UFSAR) also remain unchanged as a result of the proposed change. Therefore, the proposed change continues to meet the intent of the plant's design criteria to ensure the integrity of the BRW containment pressure boundary.

PRA Response:
The intent of the plant's design criteria continues to be met. The extension of the Type A test does not change the configuration of the plant or the way the plant is operated.

Conclusion:

The responses to the seven Defense in Depth questions above concludes that the existing Defense in Depth has not been diminished; rather, in some instances has been increased. Therefore, the proposed change does not comprise a reduction in safety.

3.5 Non-Risk Based Assessment

3.5.1 Safety-Related (Service Level I) Protective Coatings Program

The Safety-Related Protective Coatings Program provides a common approach in controlling application, maintaining, and periodically assessing safety-related (Service Level I) protective coatings.

The failure of the Service Level I coatings could adversely affect the operation of the ECCS by clogging the ECCS suction strainers. Proper maintenance of the Service Level I coatings ensures that coating degradation will not impact the operability of the ECCS systems. The program includes

a visual examination of all reasonably accessible Service Level I coatings inside containment during every refueling outage and includes assessment and repair for any condition that adversely affects the intended function of Service Level I coatings.

Service Level I coatings will prevent or minimize the loss of material due to corrosion, but these coatings are not credited for managing the effects of corrosion for the carbon steel containment liners and components at BRW. This program ensures only that the Service Level I coatings maintain adhesion so as to not affect the intended function of the ECCS suction strainers.

3.5.1.1 Unqualified/Degraded Coatings in Containment

The size of the ECCS Recirculation Sump Screens was determined based on the results of head loss testing that used design basis debris loading. Coatings (qualified and unqualified) were used in the test mixed with the other design basis debris. The debris load used for head loss testing included the maximum and bounding qualified and unqualified coatings debris load for all breaks.

BRW has followed the guidance from the NRC Safety Evaluation (SE) for generic safety issue GSI-191 for determining the quantity of coating debris (Reference 27). Per Section 3.4.2.1 of the SE, the following LOCA effects on coatings are assumed:

- All coatings [qualified and unqualified] in the ZOI will fail,
- All "qualified" (DBA-qualified or acceptable) coatings outside the ZOI will remain intact
- All "unqualified" coatings will fail.

The BRW design basis debris term for qualified coating has been calculated based on a Zone of Influence (ZOI) radius of 10D (Reference 28). It is recognized that the 10D ZOI assumption does result in significant conservatism. In fact, WCAP-16568-P, "Jet Impingement Testing to Determine the Zone of Influence (ZOI) for DBA-Qualified/ Acceptable Coatings," provides results of industry testing that support using a ZOI of 4D or greater for qualified epoxy coatings and a ZOI of 5D or greater for qualified un-top coated inorganic zinc coatings. In order to quantify the available margins, one debris generation case has been performed with a 5D ZOI applied to epoxy coatings, and a 10D ZOI applied to inorganic zinc coatings. The results of these analyses show that the total coating debris generated with a reduced ZOI is about 1/3 of the coating debris generated with a ZOI of 10D.

Site Engineering is responsible for verifying that the amount of coatings inside the primary containment does not exceed limits defined in design basis calculations and the UFSAR. This calculation ensures that the amount of coatings transported to the ECCS Recirculation sump does not degrade the ECCS system performance.

The total amount of protective coating debris (including Qualified 10D epoxy/epoxy phenolic and inorganic zinc, and Unqualified Coatings) inside the containment building is limited to 45.9 cubic feet (ft^3) for each unit. This quantity was considered acceptable based on ECCS suction strainer head loss testing. The results of the testing have been incorporated in the design basis analysis.

The estimated volumes of Qualified (10D) coatings and Unqualified Coatings inside the Unit1 and Unit 2 BRW primary containments are summarized in Tables 3.5.1.1-1 through 3.5.1.1-6 below. The total volume for each containment is below the design limit and is considered to be a conservative estimate.

Table 3.5.1.1-1: Unit 1 Primary Containment Unqualified Coatings following A1R20 Refueling Outage, April 2018	
Design Limit	12.8 ft^3
Total Volume following A1R20	7.57 ft^3
Margin at start up following A1R20	5.23 ft^3
Percent of Design Limit at start up	59.14%

Table 3.5.1.1-2: Unit 1 Primary Containment Qualified Coatings 10D (epoxy/epoxy phenolic) following A1R20 Refueling Outage, April 2018 (1)	
Design Limit	26.0 ft^3
Total Volume following A1R20	25.474 ft^3
Margin at start up following A1R20	0.526 ft^3
Percent of Design Limit at start up	97.98%

Table 3.5.1.1-3: Unit 1 Primary Containment Qualified Coatings 10D (inorganic zinc) following A1R20 Refueling Outage, April 2018 (1)	
Design Limit	7.1 ft^3
Total Volume following A1R20	6.819 ft^3
Margin at start up following A1R20	0.281 ft^3
Percent of Design Limit at start up	96.04%

Table 3.5.1.1-4: Unit 2 Primary Containment Unqualified Coatings following A2R20 Refueling Outage, October 2018	
Design Limit	12.8 ft^3
Total Volume following A2R20	8.10 ft^3
Margin at start up following A2R20	4.7 ft^3
Percent of Design Limit at start up	63.28%

Table 3.5.1.1-5: Unit 2 Primary Containment Qualified Coatings 10D (epoxy/epoxy phenolic) following A2R20 Refueling Outage, October 2018 (1)	
Design Limit	26.0 ft^3
Total Volume following A2R20	25.474 ft^3
Margin at start up following A2R20	0.526 ft^3
Percent of Design Limit at start up	97.98%

Table 3.5.1.1-6: Unit 2 Primary Containment Unqualified Coatings 10D (inorganic zinc) following A2R20 Refueling Outage, October 2018 (1)	
Design Limit	7.1 ft^3
Total Volume following A2R20	6.819 ft^3
Margin at start up following A2R20	0.281 ft^3
Percent of Design Limit at start up	96.04%

Note 1: Based on the similarities between the Byron and Braidwood Units, the original quantities of qualified coating within the ZOI have been calculated based on Byron Unit 1 documents and have been made applicable to all four Units. The original quantities are adjusted as necessary to reflect changes in coating quantities inside containment.

3.5.2 Maintenance Rule Structures Monitoring Program

The Maintenance Rule Structures Monitoring Program provides an approach to systematically evaluate the various plant structures such that the effectiveness of a maintenance program can be demonstrated. The implementation of this program to meet the requirements of 10 CFR 50.65, commonly referred to as the Maintenance Rule, using the guidance of NEI 96-03, "Guidelines for Monitoring the Condition of Structures at Nuclear Power Plants." The Maintenance Rule requires that licensees monitor the performance or condition of structures, systems, or components, against established criteria. Performance monitoring of structures is impracticable; thus, condition monitoring has been set forth as the method of determining compliance with these established requirements. This program may also be used to examine structures that are outside the scope of the Maintenance Rule such as commitments made to support plant license renewals.

Unlike active plant components such as pumps, valves, generators, etc., which have prescribed periodic maintenance activities based on Technical Specifications requirements, manufacturers' recommendations, and industry experience; structures are primarily passive in nature and are not normally subjected to periodic maintenance activities. Therefore, the definition of a maintenance program with respect to structures consists of the condition monitoring and timely repair, replacement, or refurbishment of age-related or event related degradation which will prevent continued degradation resulting in the loss of serviceability or the design function of the structure.

The development of this program consists of defining those tasks and the frequency at which they will be performed which will ensure that timely identification, assessment, and repair, replacement, or refurbishment of component degradation is accomplished. EGC procedures provide the bases for identification of those structures, which will be monitored under the program; the specific monitoring tasks and examination criteria for each component; evaluation of the results of the monitoring activities; and the acceptance criteria for each component. The resulting documentation will be used for trending of potential continued degradation and the need for corrective action.

3.5.3 Containment Inservice Inspection Plan

The BRW Third Interval Containment Inservice Inspection (CISI) Program Plan was developed in accordance with the requirements of 10 CFR 50.55a, "Codes and Standards" (Reference 29), subject to the limitations and modifications contained within paragraph (b) of the regulation. This plan has been developed to comply with the 2013 Edition of American Society of Mechanical Engineers (ASME) Boiler and Pressure Vessel (BPV) Code, Section XI, Rules for Inservice Inspection of Nuclear Power Plant Components, and implements the requirements of:

- TS 3.6.1, Containment
- TS 5.5.6, Pre-Stressed Concrete Containment Tendon Surveillance Program
- ASME Section XI, Subsection IWE, Requirements for Class MC and Metallic Liners of Class CC Components of Light-Water Cooled Plants
- ASME Section XI, Subsection IWL, Requirements for Class CC Concrete Components of Light-Water-Cooled Plants

ATTACHMENT 1a
Description and Assessment

The Inservice Inspection (ISI) Program Plan details the requirements for the examination and testing of ISI Class 1, 2, 3, MC, and CC pressure retaining components, supports, containment structures, metal liners, and post-tensioning systems at BRW, Units 1, 2, and Common (0). Unit Common components are included in the Unit 1 sections, reports, and tables. The ISI Program Plan also includes CISI, Risk-Informed Inservice Inspection (RI-ISI), Augmented Examinations (AUG), and System Pressure Testing (SPT) requirements imposed on or committed to by BRW. The ISI Program Plan is also credited as the existing program for BRW License Renewal Aging Management Programs (AMPs) (reference Section 3.8 of this submittal).

The Fourth ISI Interval and Third CISI Interval are effective from August 29, 2018, through July 28, 2028, for BRW Unit 1 and effective from November 5, 2018, through October 16, 2028, for BRW Unit 2. Along with the update to the ISI Program for the Fourth ISI Interval for ISI Class 1, 2, and 3 components, including their supports, the CISI Program is also being updated for the Third CISI Interval for ISI Class MC and CC components. This update will enable all the ISI and CISI components/piping structural elements to be based on the same effective Edition of ASME Section XI. The common ASME Code of Record for the Fourth ISI Interval and the Third CISI Interval is the 2013 Edition.

Paragraph IWA-2430(c)(1) of ASME Section XI allows an inspection interval to be extended as much as one year or reduced without restriction, and paragraph IWA-2430(d) allows an inspection interval to be extended when a unit is out of service continuously for six months or more. The extension may be taken for a period of time not to exceed the duration of the outage. See Tables 3.5.3-1 and 3.5.3-2 for intervals, periods, and detailed notes regarding any current extensions being taken that apply to BRW's Fourth ISI Interval and Third CISI Interval.

The Fourth ISI Interval for ISI Class 1, 2, and 3 components and supports and the Third CISI Interval for ISI Class MC Components and Surfaces are divided into three inspection periods as determined by calendar years within the intervals. Table 3.5.3-1 identifies the period start and end dates for the interval as defined by the Inspection Program. In accordance with paragraph IWA-2430(c)(3), the inspection periods specified in these tables may be extended by as much as one year or reduced without restriction to enable inspections to coincide with BRW refueling outages.

The inspection of ISI Class CC components and tendons for the Third CISI Interval shall be performed in accordance with Paragraphs IWL-2410 and IWL-2420. Table 3.5.3-2 identifies the inspection schedule.

The BRW CISI Plan includes ASME Section XI ISI Class MC pressure retaining components and their integral attachments (including the ISI Class CC metal liner), and Class CC components and structures, and post-tensioning systems that meet the criteria of Subarticle IWA-1300. This Containment ISI Plan also includes information related to augmented examination areas, component accessibility, and examination review.

The inspection of containment structures, components, and post-tensioning systems are performed per EGC procedures. In addition, vendor procedures are used to complete more complex surveillances such as tendon testing.

Table 3.5.3-1: BRW Units 1 & 2 Third and Fourth CISI Interval/Period/Outage Matrix (for CISI Class MC Component Examinations)						
Unit 1		**Period**	**Interval**	**Period**	**Unit 2**	
Outage Number	**Projected Outage Started Date**	**Start Date to End Date**	**Start Date to End Date**	**Start Date to End Date**	**Projected Outage Started Date**	**Outage Number**
A1R21 (3-1-1)	Scheduled October 2019	1st 8/29/18 to 7/28/21 (1)	3rd (Unit 1) 8/29/18 to 7/28/28 3rd (Unit 2) 11/05/18 to 10/16/28	1st 11/05/18 to 12/16/21 (2)	Scheduled April 2020	A2R21 (3-1-1)
A1R22 (3-1-2)	Scheduled April 2021				Scheduled October 2021 (2)	A2R22 (3-1-2)
A1R23 (3-2-1)	Scheduled October 2022	2nd 7/29/21 to 7/28/25		2nd 12/17/21 to 10/16/25	Scheduled April 2023	A2R23 (3-2-1)
A1R24 (3-2-2)	Scheduled April 2024				Scheduled October 2024	A2R24 (3-2-2)
A1R25 (3-3-1)	Scheduled October 2025	3rd 7/29/25 to 7/28/28		3rd 10/17/25 to 10/16/28	Scheduled April 2026	A2R25 (3-3-1)
A1R26 (3-3-2)	Scheduled April 2027				Scheduled October 2027	A2R26 (3-3-2)
A1R27 (4-1-1)	Forecast October 2028	1st 7/29/28 to 7/28/31	4th (Unit 1) 7/29/28 to 7/28/38 (3) 4th (Unit 2) 10/17/28 to 10/16/38 (3)	1st 10/17/28 to 10/16/31	Forecast April 2029	A2R27 (4-1-1)
A1R28 (4-1-2)	Forecast April 2030				Forecast October 2030	A2R28 (4-1-2)
A1R29 (4-2-1)	Forecast October 2031	2nd 7/29/31 to 7/28/35		2nd 10/17/31 to 10/16/35	Forecast April 2032	A2R29 (4-2-1)
A1R30 (4-2-2)	Forecast April 2033				Forecast October 2033	A2R30 (4-2-2)
A1R31 (4-3-1)	Forecast October 2034	3rd 7/29/35 to 7/28/38		3rd 10/17/35 to 10/16/38	Forecast April 2035	A2R31 (4-3-1)
A1R32 (4-3-2)	Forecast April 2036				Forecast October 2036	A2R32 (4-3-2)

Note 1: Due to delays in the anticipated issuance of 10 CFR 50.55a, the start of the BRW Unit 1 Third CISI Interval was shifted 31 days after the original pattern, as allowed by Paragraph IWA-2430(c)(1). This adjustment was made to maintain both units on the same Code of Record for the Fourth ISI Interval, which does not modify the end date of the interval.

Note 2: The BRW Unit 2 first period end date was extended by sixty days as permitted by Paragraph IWA-2430(c)(3) to allow outage A2R22 to remain within the first period.

Note 3: The schedule for the Fourth CISI interval is proposed and may be subject to change. The Fourth interval CISI program has yet to be developed.

Table 3.5.3-2: BRW Units 1 & 2 Third and Fourth CISI Interval/Period/Outage Matrix (for ISI Class CC-Concrete Surface and Tendon Component Examinations)				
Year	Unit 1		Unit 2	
	Concrete Surface Examinations (Scope)	Tendon Examinations (Scope)	Concrete Surface Examinations (Scope)	Tendon Examinations (Scope)
2021 (35th Year)	In accordance with IWL-2510	Only examinations required by IWL-2524 and IWL-2525	In accordance with IWL-2510	All examinations required by IWL-2520
2026 (40th Year)	In accordance with IWL-2510	All examinations required by IWL-2520	In accordance with IWL-2510	Only examinations required by IWL-2524 and IWL-2525
2031 (45th Year)	In accordance with Fourth CISI Interval Requirements (1)	In accordance with Fourth CISI Interval Requirements (1)	In accordance with Fourth CISI Interval Requirements (1)	In accordance with Fourth CISI Interval Requirements (1)
2036 (50th Year)	In accordance with Fourth CISI Interval Requirements (1)	In accordance with Fourth CISI Interval Requirements (1)	In accordance with Fourth CISI Interval Requirements (1)	In accordance with Fourth CISI Interval Requirements (1)

Note 1: The schedule for the Fourth CISI interval is proposed and may be subject to change. The Fourth Interval CISI Plan has yet to be developed.

Note: With the exception of some dome tendon anchorages, which are considered not accessible due to safety hazards, all BRW ISI Class CC components and concrete surfaces are accessible for examination during operational periods. In the event one or more of the inaccessible dome tendons anchorages are selected under Paragraph IWL-2521, the requirements of Paragraph IWL-2521.1, "Exemptions," shall be applied. Completion of ISI Class CC examinations for BRW Units 1 and 2 is not outage dependent.

Note: The Subsection IWL examination schedule for ISI Class CC concrete surfaces meets the requirements of Subarticle IWL-2400. Paragraph IWL-2510 examinations will be performed once every 5 years. They will begin not more than 1 year prior to the specified date and will be completed not more than 1 year after such date. The initial Subsection IWL concrete examinations for each unit were required to be completed between September 9, 1996, and September 8, 2001, by 10 CFR 50.55a. The rolling 5-year examination date and associated 2-year window for each unit is determined from these first examination dates. Therefore, the schedule of the concrete surface examinations is relative to the baseline (1st 5-Year Period) concrete surface examinations that were completed when the use of the requirements of Subsection IWL of ASME Section XI was initially mandated.

Note: BRW Units 1 and 2 meet the requirements of ASME Section XI, Paragraph IWL-2421, "Sites with Multiple Plants." The BRW Units 1 and 2 containments utilize the same pre-stressing system, are essentially identical in design, were constructed within two years, and are similarly exposed to and protected from the outside environment.

Note: The requirement of 10 CFR 50.55a(b)(2)(viii) paragraphs (H) and (I) shall be applied to examinations and tests performed in accordance with ASME Section XI, Subsection IWL.

3.5.3.1 Third Interval CISI Program

Pursuant to 10 CFR 50.55a(g), licensees are required to update their CISI Programs to meet the requirements of ASME Section XI once every ten years or inspection interval. The CISI Program is required to comply with the latest Edition and Addenda of ASME Section XI incorporated by reference in 10 CFR 50.55a twelve months prior to the start of the Third CISI Interval per 10 CFR 50.55a(g)(4)(ii). The start of the Third CISI Interval was modified to be on August 29, 2018, for Unit 1, and November 5, 2018, for Unit 2. Based on these dates, the latest Edition and Addenda of the referenced Code twelve months prior to the start of the Third CISI Interval was the 2013 Edition.

The BRW Units 1 and 2 Third Interval CISI Program Plan was developed in accordance with the requirements of 10 CFR 50.55a, and the 2013 Edition of ASME Section XI, subject to the limitations and modifications contained within Paragraph (b) of the regulation. The BRW Third Interval CISI Program Plan addresses Subsections IWE, IWL, Mandatory Appendices of ASME Section XI, approved Code Cases, approved alternatives through relief requests and SEs, and utilizes Inspection Program as defined therein.

The start of the BRW Unit 1 Third CISI Interval was shifted 31 days after the original pattern, as allowed by Paragraph IWA-2430(c)(1). This adjustment was made in order to keep both units on the same Code of Record for the Third CISI Interval, which does not modify the end date of the interval.

The start of the BRW Unit 2 Third CISI Interval was shifted 19 days after the original pattern, as allowed by Paragraph IWA-2430(c)(1). This adjustment was made in order to keep the entire A2R22 outage within the Second CISI Interval. This change will not modify the end date of the interval.

The BRW Third CISI Interval is effective from August 29, 2018, through July 28, 2028, for Unit 1, and from November 5, 2018, through October 16, 2028, for Unit 2.

3.5.3.2 Inaccessible Areas

The following conditions are required to be reported in the ISI Summary Report per IWA-6000:

Reference 50.55a(b)(2)(viii)(E) – For Class CC applications, the applicant or licensee must evaluate the acceptability of inaccessible areas when conditions exist in accessible areas that could indicate the presence of or the result in degradation to such inaccessible areas. For each inaccessible area identified, the applicant or licensee must 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.

Reference 50.55a(b)(2)(viii)(H) – For each inaccessible area of concrete identified for evaluation under IWL-2512(a), or identified as susceptible to deterioration under IWL-2512(b), the licensee must provide the applicable information specified in paragraphs (b)(2)(viii)(E)(1), (2), and (3) of this section in the ISI Summary Report required by IWA-6000.

Reference 50.55a(b)(2)(viii)(I) – During the period of extended operation of a renewed license under part 54 of this chapter, the licensee must perform the technical evaluation under IWL–2512(b) of inaccessible below-grade concrete surfaces exposed to foundation soil, backfill, or groundwater at periodic intervals not to exceed 5 years. In addition, the licensee must examine representative samples of the exposed portions of the below-grade concrete, when such below-grade concrete is excavated for any reason.

Reference 50.55a(b)(2)(ix)(A) – For Class MC applications, the following apply to inaccessible areas.

(1) The applicant or licensee must evaluate the acceptability of inaccessible areas when conditions exist in accessible areas that could indicate the presence of or could result in degradation to such inaccessible areas.

(2) For each inaccessible area identified for evaluation, the applicant or licensee must provide the following in the ISI Summary Report as required by IWA–6000:

(i) A description of the type and estimated extent of degradation, and the conditions that led to the degradation;
(ii) An evaluation of each area, and the result of the evaluation; and
(iii) A description of necessary corrective actions.

3.5.3.3 Code Cases

Per 10 CFR 50.55a(b)(5), ASME Code Cases that have been determined to be suitable for use in ISI Program Plans by the NRC are listed in RG 1.147, "Inservice Inspection Code Case Acceptability - ASME Section XI, Division 1" (Reference 30). The most recent version of a given Code Case incorporated in the revision of RG 1.147 referenced in 10 CFR 50.55a(b)(5)(i) at the time it is applied within the ISI Program shall be used. The latest revision of RG 1.147 incorporated into this document is Revision 18. As this RG is revised, newly approved Code Cases may be evaluated for plan implementation at BRW per paragraph IWA-2441(e) and proposed for use in revisions to the ISI Program Plan.

Per the latest revision of RG 1.147, if a Code Case is implemented by a licensee and a later version of the Code Case is incorporated by reference into 10 CFR 50.55a and listed in Tables 1 and 2 of RG 1.147 during the licensee's present 120-month ISI Program interval, the licensee may use either the later version or the previous version. An exception to this provision would be the inclusion of a limitation or condition on the use of the Code Case that is necessary, for example, to enhance safety.

The use of Code Cases (other than those listed in RG 1.147) may be authorized by the NRC upon request, pursuant to 10 CFR 50.55a(z).

There are no CISI related ASME Code Cases currently being utilized by BRW outside of those ASME Code Cases contained in RG 1.147, Revision 18.

3.5.3.4 Relief Requests

In accordance with 10 CFR 50.55a, when a licensee either proposes alternatives to ASME Section XI requirements, which provide an acceptable level of quality and safety, determines compliance with ASME Section XI requirements would result in hardship or unusual difficulty without a compensating increase in the level of quality and safety, or determines that specific

ASME Section XI requirements for inservice inspection are impractical, the licensee shall notify the NRC and submit information to support the determination.

There are no containment related relief requests or any additional CISI code cases approved for use at BRW through a request for alternatives.

3.5.3.5 <u>Augmented Examination Areas</u>

The containment sections of the ISI Classification Basis Document discuss the containment design and components. Metal containment surface areas, subject to accelerated degradation and aging, require augmented examination per Examination Category E-C and Paragraph IWE-1240.

Similarly, concrete surfaces may be subject to Detailed Visual examination in accordance with Item Number L1.12 and Paragraph IWL-2310(b), if declared to be "Suspect Areas."

A significant condition is a condition that is identified as requiring application of additional augmented examination requirements under Paragraph IWE-1240 or IWL-2310.

In order to monitor for tendon exposure to free water and moisture and manage any potentially adverse effects, a periodic tendon water monitoring and grease sampling program will be implemented. The program will consist of:

- A baseline inspection of tendon grease caps at the bottom of all vertical and dome tendons, as well as all below-grade horizontal tendons, prior to the period of extended operation. The baseline inspection will check for evidence of free water and grease discoloration, with further actions taken based upon the condition of the grease.

- A follow-up tendon grease cap inspection of all vertical and dome tendons, as well as all below-grade horizontal tendons, will be performed within 10 years of the initial inspection, using the same approach as the baseline inspection.

- For those tendons where free water, moisture, and grease did not meet acceptance criteria during the two previous inspections, periodic monitoring of grease chemistry and moisture, free water, and grease discoloration will be performed on a frequency not to exceed 10 years. Tendons, which exhibit significant quantities of free water (e.g., more than eight ounces) during periodic monitoring, will be inspected more often, with the timing of follow-up inspections increased until a frequency is achieved that no longer results in significant amounts of free water observed during successive inspections. Tendon water inspection and draining frequencies may vary from annual to every 10 years, depending upon grease chemistry and moisture parameters meeting Subsection IWL acceptance criteria. The maximum 10-year periodic frequency is meant to address any tendons, which exhibit evidence of free water, but the quantity is observed to be insignificant, with no observable grease discoloration, and given that the tendon wasn't inspected for at least 10 years prior. More frequent follow-up inspections will be performed for tendons, which exhibit insignificant quantities of free water but were inspected within the 10 years prior. In all cases, the frequency of inspections for water in individual tendons will be adjusted to be commensurate with the severity of the conditions found during each examination.

- BRW has performed augmented inspections on additional tendons beyond those selected for the ASME Section XI, Subsection IWL program. The BRW augmented inspections are performed on a 5-year frequency in conjunction with the ASME Section XI, Subsection IWL aging management program. The current augmented examinations of additional tendons will continue until the periodic tendon water monitoring and grease sampling program described above is implemented.

Corrective actions will be taken as necessary to ensure that the tendon grease meets ASME Section XI, Subsection IWL requirements.

In the First CISI Interval, portions of the BRW Units 1 and 2 containment liner below the moisture barrier (MB) at Elev. 377' were identified as augmented surface areas requiring examination in accordance with Paragraph IWE-1240. These surface areas were categorized in accordance with Table IWE-2500-1, Examination Category E-C, Item Number E4.12, requiring volumetric examination of 100% of the minimum wall thickness locations identified during each inspection period until the areas examined remain essentially unchanged for the next three inspection periods. Additionally, three (3) gouges on the liner plate were recorded in BRW Unit 2. These areas were also re-inspected per IWE Examination Category E-C.

In the Second CISI Interval, fourteen (14) flaws or areas of degradation on the BRW Unit 1 containment liner and five (5) flaws or areas of degradation on the BRW Station Unit 2 containment liner were identified as augmented surface areas requiring successive examinations in accordance with Paragraph IWE-2420(b). The indications were evaluated and some of the flaws for BRW Unit 1 required weld repairs. Re-examination was still required of the accepted locations in the next inspection period. These surface areas have been categorized in accordance with Table IWE-2500-1, Examination Category E-C, Item Number E4.11, requiring detailed visual examinations (i.e., VT-1) of 100% of the identified surface area each inspection period until the areas examined remain essentially unchanged for the next inspection period. When/If such areas no longer require augmented examination in accordance with Paragraph IWE-2420(d), the examination requirements and associated extent and frequency of Examination Category E-A apply for the remainder of the interval.

In the Third CISI Interval, augmented surface areas require volumetric examination of 100% of the minimum wall thickness locations identified during each inspection period until the areas examined remain essentially unchanged for the next inspection period. Once an augmented area remains unchanged for one full period, the areas fall back to the normal Examination Category E-A examination schedule.

3.5.3.6 Component Accessibility

ISI Class MC and CC components subject to examination shall remain accessible for either direct or remote visual examination from at least one side per the requirements of ASME Section XI, Paragraph IWE-1230.

Paragraph IWE-1231(a)(3) requires 80% of the pressure-retaining boundary that was accessible after construction to remain accessible for either direct or remote visual examination, from at least one side of the vessel, for the life of the plant. BRW generated a calculation that addresses compliance with this requirement by calculating the containment pressure boundary surface area that was accessible for examination at the beginning of the CISI Program and determining the limit for surface area which may be made inaccessible for the balance of plant life.

Portions of components embedded in concrete or otherwise made inaccessible during construction are exempted from examination, provided that the requirements of ASME Section XI, Paragraph IWE-1232 have been fully satisfied.

In addition, inaccessible surface areas exempted from examination include those surface areas where visual access by line of sight with adequate lighting from permanent vantage points is obstructed by permanent plant structures, equipment, or components; provided these surface areas do not require examination in accordance with the inspection plan, or augmented examination in accordance with Paragraph IWE-1240.

3.5.3.7 Responsible Individual and Responsible Engineer

ASME Section XI, Subsection IWE requires the Responsible Individual to be involved in the development, performance, and review of the CISI examinations. The Responsible Individual shall meet the requirements of ASME Section XI, Paragraph IWE-2320.

ASME Section XI, Subsection IWL requires the Responsible Engineer to be involved in the development, approval, and review of the CISI examinations. The Responsible Engineer shall meet the requirements of ASME Section XI, Paragraph IWL-2330.

3.5.3.8 Examination Categories

Tables 3.5.3.8-1 and 3.5.3.8-2 provide a summary of the ASME Section XI pressure retaining components, supports, containment structures, metal liners, post-tensioning systems, system pressure testing, and augmented examination program components for the Fourth ISI Interval and the Third CISI Interval at BRW. If a particular Examination Category and Item Number do not apply to BRW, they are not included in these tables.

Table 3.5.3.8-1: Unit 1 Inservice Inspection Summary Table

Examination Category (with Examination Category Description)	Item Number	Description	Exam Requirements	Total Number of Components by System
E-A Containment Surfaces	E1.11	Containment Vessel Pressure Retaining Boundary – Accessible Surface Areas	General Visual	185
	E1.30	Containment Vessel Pressure Retaining Boundary – Moisture Barriers	General Visual	1
E-C Containment Surfaces Requiring Augmented Examination	E4.11	Containment Surface Areas – Visible Surfaces	Visual, VT-1	2
	E4.12	Containment Surface Areas – Surface Area Grid, Minimum Wall Thickness Locations	Volumetric	2
E-G Pressure Retaining Bolting	E8.10	Bolted Connections	Visual, VT-1	71
L-A Concrete	L1.11	Concrete Surfaces – All Accessible Surface Areas	General Visual	3
	L1.12	Concrete Surfaces – Suspect Areas (No Suspect Areas Identified)	Detailed Visual	(Note 1)
	L1.13	Concrete Surfaces – Inaccessible Below-Grade Areas	IWL-2512(c)	1 (Note 2)
L-B Unbonded Post-Tensioning System	L2.10	Tendon	IWL-2522 Tendon Force Measurement	483
	L2.20	Tendon – Wire or Strand	IWL-2523.2 Sample Examination and Testing	483
	L2.30	Tendon – Anchorage Hardware and Surrounding Concrete (One anchorage on each end of tendon)	Detailed Visual	966
	L2.40	Tendon – Corrosion Protection Medium (Samples taken from each tendon end)	IWL-2525.2(a), IWL-2526 Corrosion Protection Analysis	966
	L2.50	Tendon – Free Water (Samples taken from each tendon)	IWL-2525.2(b) Free Water Analysis	966

Note for Cat. E-A: Surface area determined under "Accessible Calculation for IWE/MC Surface Area."

Notes for Cat. L-A:
1) There were no areas identified as Suspect Areas for examination. If areas are identified while performing inspections, they will be inspected per IWL-2510.
2) For Inaccessible Below-Grade Areas, such as concrete surfaces exposed to the foundation soil, backfill, or ground water, the method of examination is defined by the Responsible Engineer, based on Paragraph IWL-2512(b) evaluation.

Table 3.5.3.8-2: Unit 2 Inservice Inspection Summary Table				
Examination Category (with Examination Category Description)	**Item Number**	**Description**	**Exam Requirements**	**Total Number of Components by System**
E-A Containment Surfaces	E1.11	Containment Vessel Pressure Retaining Boundary – Accessible Surface Areas	General Visual	185
	E1.30	Containment Vessel Pressure Retaining Boundary – Moisture Barriers	General Visual	1
E-C Containment Surfaces Requiring Augmented Examination	E4.11	Containment Surface Areas – Visible Surfaces	Visual, VT-1	1
	E4.12	Containment Surface Areas – Surface Area Grid, Minimum Wall Thickness Locations	Volumetric	1
E-G Pressure Retaining Bolting	E8.10	Bolted Connections	Visual, VT-1	116
L-A Concrete	L1.11	Concrete Surfaces – All Accessible Surface Areas	General Visual	3
	L1.12	Concrete Surfaces – Suspect Areas (No Suspect Areas Identified)	Detailed Visual	(Note 1)
	L1.13	Concrete Surfaces – Inaccessible Below-Grade Areas	IWL-2512(c)	1 (Note 2)
L-B Unbonded Post-Tensioning System	L2.10	Tendon	IWL-2522 Tendon Force Measurement	483
	L2.20	Tendon – Wire or Strand	IWL-2523.2 Sample Examination and Testing	483
	L2.30	Tendon – Anchorage Hardware and Surrounding Concrete (One anchorage on each end of tendon)	Detailed Visual	966
	L2.40	Tendon – Corrosion Protection Medium (Samples taken from each tendon end)	IWL-2525.2(a), IWL-2526 Corrosion Protection Analysis	966
	L2.50	Tendon – Free Water (Samples taken from each tendon)	IWL-2525.2(b) Free Water Analysis	966

Note for Cat. E-A: Surface area determined under "Accessible Calculation for IWE/MC Surface Area."

Notes for Cat. L-A:
1) There were no areas identified as Suspect Areas for examination. If areas are identified while performing inspections, they will be inspected per IWL-2510.
2) For Inaccessible Below-Grade Areas, such as concrete surfaces exposed to the foundation soil, backfill, or ground water, the method of examination is defined by the Responsible Engineer, based on Paragraph IWL-2512(b) evaluation.

3.5.4 Supplemental Inspection Requirements

In the Safety Evaluation Report for NEI 94-01 Revision 2-A (Reference 2), the NRC stated the following requirement for the performance of Supplemental Visual Inspections in SE Section 3.1.1.3, Adequacy of Pre-Test Inspections (Visual Examinations):

> Subsections IWE and IWL (References 13 and 14) of the ASME Code, Section XI, as incorporated by reference in 10 CFR 50.55a, require general visual examinations two times within a 10-year interval for concrete components (Subsection IWL), and three times within a 10-year interval for steel components (Subsection IWE). To avoid duplication or deletion of examinations, licensees using NEI TR 94-01, Revision 2, have to develop a schedule for containment inspections that satisfy the provisions of Section 9.2.3.2 of this TR and ASME Code, Section XI, Subsection IWE and IWL requirements.

The performance of inspections in accordance with the requirements for Appendix J Primary Containment Inspection will be utilized to ensure compliance with the visual inspection requirements of NEI 94-01, Revision 3-A (Reference 1). These inspections are conducted under procedure "Visual Inspection of the Containment Surfaces Prior to the Type A Leak Test, Braidwood Station." The purpose of this procedure is to ensure that the structural integrity of the containment structure is maintained by the performance of a visual examination of the accessible interior and exterior metal and concrete surfaces and accessible leak chase channels, pursuant to Technical Specifications 3.6.1.1. These containment inspections must be completed with satisfactory findings before the ILRT test commences.

3.5.5 Primary Containment Leakage Rate Testing Program - Type B and Type C Testing Program

BRW Types B and C testing program requires testing of electrical penetrations, airlocks, hatches, flanges, and CIVs in accordance with 10 CFR 50, Appendix J, Option B and RG 1.163 (Reference 4). The results of the test program are used to demonstrate that proper maintenance and repairs are made on these components throughout their service life. The Types B and C testing program provides a means to protect the health and safety of plant personnel and the public by maintaining leakage from these components below appropriate limits. In accordance with Unit 1 and Unit 2 TS 5.5.16, the allowable maximum pathway total Types B and C leakage is 0.6 L_a or 540.48 standard cubic feet per hour (SCFH), where L_a equals approximately 900.81 SCFH, for Unit 1 and 0.6 L_a or 499.12 SCFH, where L_a equals approximately 831.87 SCFH, for Unit 2.

As discussed in NUREG-1493 (Reference 9), Type B and Type C tests can identify the vast majority of all potential containment leakage paths. Type B and Type C testing will continue to provide a high degree of assurance that containment integrity is maintained.

A review of the Type B and Type C test results from 2008 through 2018 for BRW has shown substantial margin between the actual As-Found (AF) and As-Left (AL) outage summations and the regulatory requirements as described below:

- The As-Found minimum pathway leak rate average for BRW Unit 1 shows an average of 6.323% of 0.6 L_a with a high of 7.777% 0.6 L_a.
- The As-Left maximum pathway leak rate average for BRW Unit 1 shows an average of 10.535% of 0.6 L_a with a high of 12.380% 0.6 L_a.

- The As-Found minimum pathway leak rate average for BRW Unit 2 shows an average of 5.769% of 0.6 L_a with a high of 13.761% 0.6 L_a.
- The As-Left maximum pathway leak rate average for BRW Unit 2 shows an average of 9.129% of 0.6 L_a with a high of 11.467% 0.6 L_a.

Tables 3.5.5-1 and 3.5.5-2 provide LLRT data trend summaries for BRW inclusive of the 2013 (Unit 1) and 2014 (Unit 2) ILRTs.

Table 3.5.5-1: BRW Unit 1 Type B and C LLRT Combined As-Found/As-Left Trend Summary

RFO/Year	2009 A1R14	2010 A1R15	2012 A1R16	2013 A1R17	2015 A1R18	2016 A1R19	2018 A1R20
AF Min Path (SCFH)	37.904	30.259	31.816	23.569	40.025	42.035	33.624
Fraction of 0.6 L_a (percent)	7.013	5.599	5.887	4.361	7.405	7.777	6.221
AL Max Path (SCFH)	57.832	50.021	58.785	46.696	66.909	62.387	55.959
Fraction of 0.6 L_a (percent)	10.700	9.255	10.876	8.640	12.380	11.543	10.354
AL Min Path (SCFH)	36.948	27.302	32.707	22.141	34.405	39.385	33.567
Fraction of 0.6 L_a (percent)	6.836	5.051	6.051	4.097	6.366	7.287	6.21

Table 3.5.5-2: BRW Unit 2 Type B and C LLRT Combined As-Found/As-Left Trend Summary

RFO/Year	2008 A2R13	2009 A2R14	2011 A2R15	2012 A2R16	2014 A2R17	2015 A2R18	2017 A2R19	2018 A2R20
AF Min Path (SCFH)	15.904	28.966	22.039	18.905	25.214	68.685	20.671	29.979
Fraction of 0.6 L_a (percent)	3.186	5.803	4.416	3.788	5.052	13.761	4.141	6.006
AL Max Path (SCFH)	47.095	49.910	41.507	43.508	40.321	44.239	40.709	57.233
Fraction of 0.6 L_a (percent)	9.436	10.000	8.316	8.717	8.078	8.863	8.156	11.467
AL Min Path (SCFH)	25.455	29.369	16.158	19.432	24.362	22.215	20.659	36.998
Fraction of 0.6 L_a (percent)	5.100	5.884	3.237	3.893	4.881	4.451	4.139	7.413

3.5.5.1 Type B and Type C Local Leak Rate Testing Program Implementation Review

No BRW Units 1 and 2 Type B or Type C components on an extended frequency have exceeded their administrative limits over the last two refueling outages.

BRW Types B and C Component Performance Summary:

The percentage of the total number of BRW Unit 1 Type B tested components that are on performance-based extended test intervals is 50.0%.

The percentage of the total number of BRW Unit 2 Type B tested components that are on performance-based extended test intervals is 50.0%.

Those Type B penetrations not on an extended test frequency are either:

- Used during RFOs and therefore must be AL tested each RFO subsequent to use, or

- Limited to a test frequency of 30 months per the Primary Containment Leakage Rate Testing Program.

The percentage of the total number of BRW Unit 1 Type C tested components that are on 60-month extended performance-based test intervals is 51.1%.

The percentage of the total number of BRW Unit 2 Type C tested components that are on 60-month extended performance-based test intervals is 42.6%.

The Type C penetrations not on a 60-month test frequency for a reason other than exceedance of their administrative limit during an As-Found Type C test are either:

- On a 30-month frequency (resulting in a test every RFO) following valve replacement or major maintenance to re-establish their performance history of two satisfactory consecutive AF tests,
- Used or removed during RFOs to support Flex or outage requirements,
- Tested on an RFO frequency to satisfy IST 24-month test frequency requirements, or
- Have met the performance requirements of two satisfactory consecutive AF tests after the last Type C test but have not yet been moved to an extended test frequency of 60 months.

3.6 Operating Experience (OE)

During the conduct of the various examinations and tests conducted in support of the Containment related programs previously mentioned, issues that do not meet established criteria or that provide indication of degradation, are identified, placed into the site's corrective action program, and corrective actions are planned and performed.

For the BRW Primary Containment, the following site specific and industry events have been evaluated for impact on BRW:

- Information Notice (IN) 1992-20, "Inadequate Local Leak Rate Testing"
- IN 1999-10, Revision 1, "Degradation of Prestressing Tendon Systems in Prestressed Concrete Containments"
- IN 2004-09, "Corrosion of Steel Containment and Containment Liner"
- IN 2010-12, "Containment Liner Corrosion"
- IN 2014-07, "Degradation of Leak-Chase Channel Systems for Floor Welds of Metal Containment Shell and Concrete Containment Metallic Liner"
- Regulatory Issue Summary (RIS) 2016-07, "Containment Shell of Liner Moisture Barrier Inspection"

Each of these areas is discussed in detail in Sections 3.6.1 through 3.6.6, respectively.

3.6.1 IN 1992-20, "Inadequate Local Leak Rate Testing"

The NRC issued IN 92-20 to alert licensees of problems with local leak rate testing two-ply stainless steel bellows used on piping penetrations at four different plants: Quad Cities Nuclear Power Station, Dresden Nuclear Station, Perry Nuclear Power Plant and the Clinton Station. Specifically, LLRTs could not be relied upon to accurately measure the leakage rate that would occur under accident conditions since, during testing, the two plies in the bellows were in contact with each other, restricting the flow of the test medium to the crack locations. Any two-ply bellows of similar construction may be susceptible to this problem. The common issue in the four events was the failure to adequately perform local leak rate testing on different penetration configurations leading to problems that were discovered during ILRT tests in the first three cases.

In the event at Quad Cities, the two-ply bellows design was not properly subjected to LLRT pressure and the conclusion of the utility was that the two-ply bellows design could not be Type B LLRT tested as configured.

In the events at both Dresden and Perry, flanges were not considered a leakage path when the Type C LLRT test was designed. This omission led to a leakage path that was not discovered until the plant performed an ILRT test.

In the event at Clinton, relief valve discharge lines that were assumed to terminate below the suppression pool minimum drawdown level were discovered to terminate at a level above that datum. These lines needed to be reconfigured and the valves should have been Type C LLRT tested.

Discussion:

This IN was reviewed on April 12, 1993, and it was determined that no action or response was required by the station.

3.6.2 IN 1999-10, Revision 1, "Degradation of Prestressing Tendon Systems in Prestressed Concrete Containments"

The NRC issued IN 99-10 to alert addressees to describe the degradation associated with the tendon prestressing system of prestressed concrete containments (PCCs). The specific items addressed included: (1) prestressing tendon wire breakage, (2) the effects of high temperature on the prestressing forces in tendons, and (3) trend analysis of prestressing forces.

ATTACHMENT 1a
Description and Assessment

This IN was based on the results of inspections of PCCs and PCC tendons which identified a number of concerns related to the degradation of prestressing tendon systems in PCCs and the ability of the containment structure to perform its function. Findings relevant to these concerns are discussed below.

(1) Prestressing Tendon Wire Breakage

Recent observations related to containment prestressing systems have revealed conditions that may precipitate breakage of tendon wires. Conditions such as uneven shim stack heights on the anchor-heads, spalling and cracking of concrete beneath the anchor-head base plates, free water in the bottom grease caps, poorly drained top anchorage ledges, and the absence of filler grease in various areas can lead to corrosion of tendons and eventually to wire breakage.

(2) Effects of High Temperature on the Prestressing Forces in Tendons

Licensees at a number of plants have reported lower-than-predicted prestressing forces for vertical, hoop, and dome tendons. Investigations and analyses have indicated that the relaxation losses in prestressing tendon range from 15.5 to 20 percent over 40 years at an average sustained temperature of 32°C (90°F) around the tendons. However, the tendon relaxation loss values assumed in the original design of PCCs vary between 4 and 12 percent. These values were determined at the presumed ambient temperature of 20°C (68°F).

(3) Comparison and Trending of Prestressing Forces

It is important to adhere to the guidance in RG 1.35.1 (Reference 31), "Determining Prestressing Forces for Inspection of Prestressed Concrete Containments (PCC)," or equivalent methods to maintain the safety function of the prestressing tendon system and the concrete containment. Moreover, proper comparison and trending analysis are critical in determining the future trends in prestressing force in PCCs. Licensees have reported losses using the average forces determined from the liftoff testing, thereby masking the true variation in the loss of prestressing forces. An analysis using an average of the liftoff forces for regression analysis does not give results that are statistically valid.

As nuclear power plants continue to age, in particular, plants with a PCC, the management and mitigation of the effects of degradation as a result of aging become increasingly more important. The containment structure serves as the final barrier against the release of fission products to the environment under postulated design-basis accident conditions. Therefore, it is essential that its integrity be maintained. The focus on the prestressing tendon system for containment integrity is based on the vital role it plays. In addition to the issue of tendon relaxation, other aspects of the prestressing tendon system, such as controlling the material condition of the tendon galleries and maintenance of the tendon system to minimize corrosion, are also important.

PCC degradations, such as concrete spalling, water infiltration into tendon galleries, and concrete cracking in the containment and the containment dome, all affect the containment's ability to perform its intended function. It remains important to ensure that the cumulative effects of degradation mechanisms do not compromise the safety of the containment. The attributes discussed in this IN will be useful in identifying the potential problem areas and in evaluating the results of the inservice inspections of containments.

Discussion:

This issue is applicable to the BRW Containment Structures and the BRW Containment Inservice Inspection Program. This issue is not a duplicate of other input to the station, nor is it similar to other events, equipment, or processes already reviewed. This document (NRC Information Notice 99-10) addresses specific issues that relate to containment tendon degradation that have been recently identified at other utilities. This issue has no impact on the operability of structures, systems, or components. One area that is addressed in the Information Notice is the performance of a Regression Analysis for the containment tendons. Going forward, in the event the results of these calculations and evaluations reveal an adverse trend in the post tensioning system at BRW appropriate documentation in accordance with the corrective action program will be generated. Although the procedures include limitations, actions, and acceptance criteria that address the issues included in the Information Notice, enhancements were warranted to provide a direct correlation with the tendon force regression analysis that is specified in Information Notice 99-10. The IWL Tendon Examination procedure was revised to include the following requirements:

> ENSURE a Regression Analysis for the post tensioning system has been performed per NRC Information Notice 99-10 after completion of inspection/testing (Site Material Programs Engineer). This analysis shall include at minimum, justification that post tensioning system for each group of tendons and containment structure will continue to maintain minimum design prestress force until next scheduled exam and test period for that unit and for the life of the unit (e.g., 60 year period for units with renewed license). Trending lines are to be developed for the life of the unit (e.g., 60 year period for units with renewed license).
>
> 1. INITIATE appropriate documentation in accordance with the corrective action program if it is determined that minimum design prestress forces will not be maintained for any group of tendons until next inspection period or that it is anticipated minimum design prestress forces will not be maintained for life of the unit (e.g., 60 year period for units with renewed license).
>
> 2. COMPLETE this regression analysis within 6 months of completion of this procedure for this inspection period.

This issue does not require additional training of station personnel. This issue does not have any impact on the simulator. No other plant applications are affected by this issue. This issue applies to the Unit 1 and Unit 2 containment structures, which are identical. This issue does not affect system trains and both units can be addressed under one action plan.

There is no impact on the Maintenance Rule. This issue has no impact on vendor manuals, drawings, or EQ qualifications. This issue has no impact on design data in controlled databases. This issue has no impact on controlled computer software. This issue has no impact on the Preventative Maintenance program.

Other stations were reviewed for technical information: BYR, BRW, and LaSalle are affected by Information Notice 99-10. The topic was discussed in three conference calls. The participants were the Corporate Structural Engineering Lead and the respective program owners and Responsible Engineers from each site. The structural department in Corporate Engineering was also involved in the resolution of this issue and communicated this subject matter to the other Exelon stations. Communication among all affected stations has occurred.

3.6.3 <u>IN 2004-09, "Corrosion of Steel Containment and Containment Liner"</u>

The NRC issued IN 2004-09 to alert addressees to recent occurrences of corrosion in freestanding metallic containments and in liner plates of reinforced and pre-stressed concrete containments. Any corrosion (metal thinning) of the liner plate or freestanding metallic containment could change the failure threshold of the containment under a challenging environmental or accident condition. Thinning changes, the geometry of the containment shell or liner plate, which may reduce the design margin of safety against postulated accident and environmental loads. Recent experience has shown that the integrity of the MB seal at the floor-to-liner or floor-to-containment junction is important in avoiding conditions favorable to corrosion and thinning of the containment liner plate material.

There have been numerous industry events and NRC INs related to containment liner corrosion. The root cause of the containment liner issue is exposure of the metal liner to water/fluids, etc. An amendment to Section 50.55a of Title 10 of the Code of Federal Regulations (10 CFR 50.55a) (61 FR 41303) became effective September 9, 1996. This amendment requires the use of Subsections IWE and IWL of Section XI of the ASME Boiler and Pressure Vessel Code to perform inservice inspections of containment components. These subsections provide detailed requirements for inservice inspection of Class MC pressure-retaining components and their integral attachments and of metallic shells and penetration liners of Class CC pressure-retaining components and their integral attachments. Inspection of concrete containment shell and steel liner plate in accordance with 10 CFR 50.55a involves consideration of potential corrosion areas. Such inspection includes examination, evaluation, repair, and replacement of corroded areas of the liner plate.

As a result of these required containment inservice inspections, licensees have found that over time, the existing floor-to-containment seal can degrade, allowing moisture into the crevice between the containment liner plate and floor. Small amounts of stagnant water behind the floor seal area promote pitting corrosion. To identify corrosion in this area, licensees have had to remove the original floor seal and either excavate the concrete or do a visual inspection aided by fiber optics. Licensee corrective actions for this condition have typically included inspections to determine the extent of corrosion, evaluations of containment integrity, and installation of new floor-to-containment moisture seal barriers.

In some instances, corrosion has been found at higher elevations of the liner plates. Generally, the instances of such corrosion have been associated with foreign objects (wooden pieces, workers" gloves, wire brush handles, etc.) lodged between the liner plate and the concrete. As the corrosion is initiated in the areas not visible during visual examinations, such instances of corrosion were found when corrosion had penetrated through the liner thickness. Some licensees have performed ultrasonic examination of the suspect areas (areas of obvious bulging, hollow sound, etc.) to detect such corroded areas.

<u>Discussion:</u>

The containment structural concrete and liner are ASME Code components and are covered and monitored by the CISI Program at BRW. This issue of liner degradation around the area of the MB has been recognized by the industry as an area susceptible to accelerated degradation and aging. NRC IN 97-10 alerted utilities to potential problems.

No further actions are required as result of review of this IN. Both units' containment liners are examined each period per ASME Section XI IWE requirements. Augmented areas have been identified (primarily in vicinity of MB) and have augmented examination schedules and also require augmented exams (VT-1 and ultrasonic exams). The BRW liner degradation was discovered in A2R07. The entire MB was removed and replaced for Unit 1 during A1R08. The containment liner in the vicinity of the MB was examined and recoated prior to installing a new MB. Also, the entire MB was removed and replaced for Unit 2 during A2R08. The containment liner in the vicinity of the MB was examined and recoated prior to installing a new MB. The areas of the liner found degraded have been categorized as augmented and have been VT-1 examined in A1R10 and A2R10, respectively, as well as ultrasonically tested and will continue to be examined for next three periods until there is no change for all three periods. The degraded areas of the liner will continue to be classified as augmented and will have augmented examination schedules.

Engineering evaluations have been performed on the degraded areas during A2R07, A1R08, A2R08, A2R09, A1R10, and A2R11. Corrective actions have been completed on both units including: (1) Removal and replacement of the entire MB; (2) Service Level I qualified coating applied to the portion of liner exposed below MB; (3) New dry Cerablanket material below the MB has been installed; and (4) Portions of the Class CC liner below the MB were categorized and have been examined as Category E-C in the IWE Program Plan.

3.6.4 <u>IN 2010-12, "Containment Liner Corrosion"</u>

The NRC issued IN 2010-12 to alert plant operators to three events that occurred where the steel liner of the containment building was corroded and degraded. At the Beaver Valley and Brunswick plants, material had been found in the concrete, which trapped moisture against the liner plate and corroded the steel. In one case, it was material intentionally placed in the building and in the other case; it was foreign material, which had inadvertently been left in the form when the wall was poured. But the result in both cases was that the material trapped moisture against the steel liner plate leading to corrosion. In the third case, Salem, an insulating material placed between the concrete floor and the steel liner plate absorbed moisture and led to corrosion of the liner plate.

<u>Discussion:</u>

This issue is applicable to EGC station programs and SSCs; however, implementation of IWE examinations, as well as applicable Appendix J testing assure containment structures or liner integrity. There are no operability concerns identified. EGC units have implemented periodic examinations during refueling outages on metallic containment structures or liners in accordance with Section XI, Subsection IWE. The applicable Exelon visual examination procedures require the conditions described in the IN examples to be recorded. Conditions that may affect containment surface integrity are then required to be evaluated by engineering evaluation or repair/replacement prior to startup from refueling outages.

A review of similar station events has revealed that metallic containment surfaces or liner corrosion were identified at some EGC units during periodic IWE examinations and during refueling outage(s). However, the conditions were dispositioned in accordance applicable rules of ASME Section XI.

Station vulnerability was analyzed, and it was determined that rigorously implementing the examinations and tests in accordance with the requirements of IWE and Appendix J and dispositioning observed conditions in accordance with ASME Section XI rules are existing barriers

that ensure the integrity of metallic containment surfaces or liners. No additional actions are recommended.

3.6.5 IN 2014-07, "Degradation of Leak-Chase Channel Systems for Floor Welds of Metal Containment Shell and Concrete Containment Metallic Liner"

The NRC issued IN 2014-07 to inform the industry of issues concerning degradation of floor weld leak-chase channel systems of steel containment shell and concrete containment metallic liner that could affect leak-tightness and aging management of containment structures. Specifically, this IN provides examples of operating experience at some plants of water accumulation and corrosion degradation in the leak-chase channel system that has the potential to affect the leak-tight integrity of the containment shell or liner plate. In each of the examples, the plant had no provisions in its ISI plan to inspect any portion of the leak-chase channel system for evidence of moisture intrusion and degradation of the containment metallic shell or liner within it. Therefore, these cases involved the failure to perform required visual examinations of the containment shell or liner plate leak-chase systems in accordance with the ASME Code Section XI, Subsection IWE, as required by 10 CFR 50.55a(g)(4).

The containment basemat metallic shell and liner plate seam welds of pressurized water reactors are embedded in 3' to 4' thick concrete floor during construction and are typically covered by a leak-chase channel system that incorporates pressurizing test connections. This system allows for pressure testing of the seam welds for leak-tightness during construction and also while in service, as required. A typical basemat shell or liner weld leak-chase channel system consists of steel channel sections that are fillet welded continuously over the entire bottom shell or liner seam welds and subdivided into zones, each zone with a test connection.

Each test connection consists of a small carbon or stainless-steel tube (less than 1" diameter) that penetrates through the back of the channel and is seal-welded to the channel steel. The tube extends up through the concrete floor slab to a small access (junction) box embedded in the floor slab. The steel tube, encased in a pipe, projects up through the bottom of the access box with a threaded coupling connection welded to the top of the tube, allowing for pressurization of the leak-chase channel. After the initial tests, steel threaded plugs or caps are installed in the test tap to seal the leak-chase volume. Gasketed cover plates or countersunk plugs are attached to the top of the access box flush with the containment floor. In some cases, the leak-chase channels with plugged test connections may extend vertically along the cylindrical shell or liner to a certain height above the floor.

Discussion:

BRW has a different design from the typical description provided in the IN report. Based on review of BRW's configuration drawing, the pressurization pipes configuration has the pressurization pipes above the concrete slab making the potential for moisture intrusion highly unlikely or remote. Per review of NRC IN 2014-07, the configuration of the leak chase channels in these events were different as the pressurization pipes are covered or submerged below the floor or concrete slab which could result in moisture accumulation in the access box resulting in possible moisture intrusion into the pressurization caps the leak chase channel. Therefore, the BRW leak chase channel system design and layout vary from that of this IN.

Based on review of this IN 2014-07, there are no operability concerns associated with the leak chase channel systems for floor welds or metal containment shell and concrete containment

metallic liner. The station leak chase channels exist on both units; however, they have been inspected during A1R17 and A2R17 with current actions in place to add this into the IWE scope as an augmented inspection of the containment liner during future outages based on commitments made to License Renewal.

This event is applicable to BRW based on the procedures and process not having anything in place to inspect the pressurization pipe caps. There is a need to include the inspection of these pressurization pipe caps into the IWE Program even though it is not required by the Section XI code. The leak-chase system that is installed in both BRW Units does not fulfill any part of the containment pressure retaining boundary function, and is therefore, not part of the ASME Section XI IWE Program per IWE-1100. However, the leak-chase systems do cover part of the liner plates and welds that are in the IWE Program and need to be monitored to ensure the integrity of the inaccessible welds are maintained. Thereby, making these areas inaccessible to inspection. It is important to know their condition since their failure could cause the inaccessible area to degrade.

The Corporate containment program procedure and the containment inspection procedure have been revised to identify degradation of these leak chases for no other reason than to provide assurance that the inaccessible regions that are in the program do not degrade or at least get an assessment if degradation is found. In addition, BRW has taken several actions to include inspection of the leak-chase pressurization pipe caps into the scope of the IWE program. There is no station vulnerability as the pressurization pipes have been inspected during A1R17 and A2R17. Moving forward, these inspections will be included in the IWE Program Inspection Scope for the containment liner.

3.6.6 <u>NRC RIS 2016-07, "Containment Shell or Liner Moisture Barrier Inspection"</u>

The NRC issued RIS 2016-07 to reiterate the NRC staff's position in regard to ISI requirements for MB materials, as discussed in the ASME Code, Section XI, Subsection IWE. The NRC staff identified several instances in which containment shell or liner MB materials were not properly inspected in accordance with ASME Code Section XI, Table IWE-2500-1, Item E1.30. Note 4 (Note 3 in editions before 2013) for Item E1.30 under the "Parts Examined" column states:

> Examination shall include moisture barrier materials intended to prevent intrusion of moisture against inaccessible areas of the pressure retaining metal containment shell or liner at concrete-to-metal interfaces and a metal-to-metal interfaces which are not seal welded. Containment moisture barrier materials include caulking, flashing and other sealants used for this application.

Examples of inadequate inspections have included licensees not identifying sealant materials at metal-to-metal interfaces as MBs because they do not specifically match Figure IWE-2500-1, and licensees not inspecting installed MBs (as required by Item E1.30) because the material was not included in the original design or was not identified as a "moisture barrier" in design documents.

<u>Discussion:</u>

RIS 2016-07 was reviewed and an action generated to add an enhancement for BRW to IWE model work orders to identify each type of MB area instead of generalizing all MBs. All MBs are on Elev. 377', but while performing examinations it is important to identify the specific MB being examined (foam, leak chase caps). Adding this information to model work orders and VT forms will provide clarity and improve documentation at BRW station.

While previous IWE program owners knew of the capped pressurization pipes and included them in their overall visual inspection of the containment liner, the model work orders did not explicitly identify the capped pressurization pipes. Therefore, the instructions in the model work orders for IWE General Visual Exams were revised to provide clarity on MB inspections by adding the following NOTE.

> *NOTE: Moisture Barrier locations include caulking material installed at concrete to liner interface inside containment at elevation 377'. In addition to the caulking material, inspections of the non-ASME Pressurization Pipes and Caps for Liner Leak Chase Channels are also required as part of License Renewal. There are 100 capped pressurization pipes in 4 groups that penetrate through the basemat inside containment on elevation 374'.*

3.7 Results of Recent Containment Inspections

3.7.1 <u>Primary Containment Coatings Condition Assessment, Unit 1 RFO A1R19, Fall 2016</u>

Safety-related coatings assessment of the Service Level I Primary Containment coated surfaces were completed at BRW Unit 1 during the 2016 A1R19 RFO.

Interior surfaces of the primary containment, components, and equipment were inspected and assessed.

Inspection Findings:

<u>Containment Liner Plate, All Elevations, Outside Missile Barrier (OMB)</u>

The Containment liner plate (liner) is inspected every outage to assess the overall condition of the safety-related protective coatings. The liner was originally coated with Carbozinc 11, an inorganic zinc primer and top coated with Carboline Phenoline 305, a phenolic epoxy. Areas of coating degradation identified on the liner consisted of general mechanical damage and isolated areas of disbondment. Degraded areas of loose coating are typically repaired, or hand tool cleaned with a paint scraper to remove loose top coat, back to sound, intact coating. This is a routine outage coating maintenance item that does not impact operability. The coating damaged areas were observed in all areas of containment except for the very top areas of Elev. 426'. Most of the damaged areas were on Elev. 401' and Elev. 377'.

Mechanical damage to the liner (from equipment and tool transportation during outages) was the primary coating defect observed. Mechanical damage on each of the elevations identified is located from containment floor/grating levels up to about 6'. This type of damage typically results in loss of the topcoat material, due to cracking and chipping. Any loose or delamination coating material found throughout the containment was stabilized (scraped back to sound, tightly adhered material, with the chips contained and properly disposed of).

A requirement associated with the containment safety-related coating evaluation is to identify areas on the liner plate and inner concrete walls where loose coating is to be scraped and collected. Table 3.7.1.1-1 indicates the areas (identified by elevation and column number) where loose coating was identified and removed.

Table 3.7.1.1-1: Scraped Loose Coating Areas > 1 Sq. Foot			
Elev. 377'	**Elev. 401'**	**Elev. 412'**	**Elev. 426'**
R-18 to R-21	R-19 to R-21	R-19	R-14
R-2 to R-4	R-12 to R-15	R-20	R-4
R-8 to R-16	R-17 to R-18	R-12	
R-13 to R-14			

377' Elevation (OMB)

The containment liner on Elev. 377' has mechanical impact damage. The areas of most mechanical damage are located across from the four RCFCs, especially "A" and "B." The floor areas in front of the RCFCs are narrow and the damaged coating is from carried tools and equipment. The MB was removed for UT and VT inspections. The coating under the MB was in good condition with only a few locations needing repairs from coating failure and corrosion. Most of the mechanical damage resulted from barrier removal operations. Approximately 270 different 2" x 2" areas of coating were removed to facilitate the VT and UT inspections. Coating repair was performed when NDE inspections and examinations were completed.

401' Elevation (OMB)

On Elev. 401' OMB, the liner plate is moderately damaged from scaffold and tool movement up to the 6' elevation, with a few minor areas of top coat mechanical damage down to sound primer. The liner coating system is in good condition from R-8 to R-13 and is tightly bonded.

412' Elevation

The safety-related coatings on the containment liner on Elev. 412' are in good condition. The coatings on piping and support hangers are also in good condition, except for a few areas.

426' Elevation

The containment liner on Elev. 426' is in good condition with only a few areas of mechanical damage to the top coat. The areas of loose coatings were scraped to sound coating and coating chips were bagged and properly removed. The concrete floor coating was in good condition with minimal mechanical damage. The upper areas of the liner plate appeared to be in good condition, including the Dome and the Polar Crane.

377', 390' and 401' Elevations, Inside Missile Barrier (IMB)

The majority of the coating deficiencies on elevations 377', 390' and 401' consist of uncoated piping, support hangers or damage to coatings on inner concrete walls, resulting from the modification or removal of supports. These areas should be scheduled for repair during the next outage.

The steel and concrete test coupons located on Elev. 377' IMB are coated with the common safety-related coating systems used throughout the containment. Carbozinc 11, inorganic zinc as a primer (not top coated) for carbon steel, inorganic zinc with a Carboline Phenoline 305 epoxy topcoat for the carbon steel liner plate and sealed concrete coated with an epoxy surface and top coated with an epoxy finish coat (coating system for concrete not identified). Examination of the coupons is a standard requirement of the inspection walk down. The zinc coated steel coupons

were in good condition. The steel coupons with zinc primer and epoxy topcoat were in good condition although two test coupons had mechanical damage with chipped coating. The concrete coupons were in good condition.

Recommendations and Conclusions

Areas of mechanical damage with inorganic zinc primer intact are providing corrosion protection to the steel substrate and do not require immediate action. Areas on the containment liner where the protective coating has disbonded, exposing the steel substrate, should be scheduled for repair during the next outage. Also, areas of rusting on piping should be repaired to mitigate corrosion. Any loose, flaking coating that was not removed to sound coating during the current outage should be scheduled for removal next outage to assure that licensing commitments are in compliance.

The A1R19 outage coating assessment identified areas of degraded coating that require repair. No current coating conditions were identified that appear to impact structural integrity, plant operations, or the safe shutdown. Repair work should be planned for future outages to address the degraded coating areas identified. Such repairs will reduce radiation levels resulting from fixed contamination on exposed substrates, mitigate progressive coating degradation, and prevent damage to exposed steel and concrete substrates. There is a considerable mechanical damage to the containment liner near the equipment hatch at Elev. 401'. These areas should be continuously monitored and ultimately repaired. Exposed, rusting carbon steel areas should be repaired. Bare concrete and grout should also be coated for decontamination issues.

Coating Repairs Made During A1R19

During the A1R19 outage, areas in containment were identified for coating stabilization (scraping loose coating), coating repair, and for initial coating application. Five (5) items identified for initial coating application were located on Elev. 401' IMB. They were 4" Tube Steel supports and one 3" pipe weld, associated with "A" Motor Reactor Coolant Pump Interference Removals located at R-14, and 3" Tube Steel weld repair on Elev. 377' OMB at R-21.

3.7.2 Primary Containment Coatings Condition Assessment, Unit 1 RFO A1R20, Spring 2018

Safety-related coatings assessment of the Service Level I Primary Containment coated surfaces were completed at BRW Unit 1 during the 2018 A1R20 RFO.

Interior surfaces of the primary containment, components, and equipment were inspected and assessed.

Inspection Findings:

Containment Liner Plate, All Elevations, OMB

The Containment liner plate (liner) is inspected every outage to assess the overall condition of the safety-related protective coatings. The liner was originally coated with Carbozinc 11, an inorganic zinc primer and top coated with Carboline Phenoline 305, a phenolic epoxy. Areas of coating degradation identified on the liner consisted of general mechanical damage and isolated areas of disbondment. Degraded areas of loose coating are typically repaired or hand tool cleaned with a paint scraper to remove loose top coat, back to sound, intact coating. This is a routine outage coating maintenance item that does not impact operability. The coating damaged areas were

observed in all areas of containment except for the very top areas of Elev. 426'. Most of the damaged areas were on Elev. 401' and Elev. 377'.

Mechanical damage to the liner (from equipment and tool transportation during outages) was the primary coating defect observed. Mechanical damage on each of the elevations identified is located from containment floor/grating levels up to about 6'. This type of damage typically results in loss of the topcoat material, due to cracking and chipping. Any loose or delamination coating material found throughout the containment was stabilized (scraped back to sound, tightly adhered material, with the chips contained and properly disposed of).

A requirement associated with the containment safety-related coating evaluation is to identify areas on the liner plate and inner concrete walls where loose coating is to be scraped and collected. Table 3.7.2.1-1 indicates the areas (identified by elev. and column number) where loose coating was identified and removed.

Table 3.7.2.1-1: Scraped Loose Coating Areas > 1 Sq. Foot

Elev. 377'	Elev. 401'	Elev. 412'	Elev. 426'
R-18 to R-4	R-19 to R-4	R-15	R-6
R-4 to R-5	R-10 to R-18		R-16
R-8 to R-12			
R-15 to R-17			

<u>377' Elevation (OMB)</u>

The containment liner on Elev. 377' has mechanical impact damage. The areas of most mechanical damage are located across from the four RCFCs, especially "A" and "B." The floor areas in front of the RCFCs are narrow and the damaged coating is from carried tools and equipment. There was no MB removed for UT and VT inspections this outage.

<u>401' Elevation (OMB)</u>

On the Elev. 401' OMB, the liner plate is moderately damaged from scaffold and tool movement up to the 6' elevation, with a few minor areas of top coat mechanical damage down to sound primer. The liner coating system is in good condition from columns R-8 to R-13 and is tightly bonded.

<u>412' Elevation</u>

The safety-related coatings on the containment liner on Elev. 412' are in good condition. The coatings on piping and support hangers are also in good condition, except for a few areas.

<u>426' Elevation</u>

The containment liner on Elev. 426' is in good condition with only a few areas of mechanical damage to the top coat. The areas of loose coatings were scraped to sound coating and coating chips were bagged and properly removed. The concrete floor coating was in good condition with minimal mechanical damage. The upper areas of the liner plate appeared to be in good condition, including the Dome and the Polar Crane.

377', 390' and 401' Elevations (IMB)

Most of the coating deficiencies on elevations 377', 390' and 401' consist of uncoated piping, support hangers or damage to coatings on inner concrete walls, resulting from the modification or removal of supports. These areas should be scheduled for repair during the next outage.

The steel and concrete test coupons located on Elev. 377' IMB are coated with the common safety-related coating systems used throughout the containment. Carbozinc 11, inorganic zinc as a primer (not top coated) for carbon steel, inorganic zinc with a Carboline Phenoline 305 epoxy topcoat for the carbon steel liner plate, and sealed concrete coated with an epoxy surface and top coated with an epoxy finish coat. Examination of the coupons is a standard requirement of the inspection walk down. The zinc coated steel coupons were in good condition. The steel coupons with zinc primer and epoxy topcoat were in good condition although two test coupons had mechanical damage with chipped coating. These are the same two from last outage. The concrete coupons were in good condition.

Recommendations and Conclusions

Areas of mechanical damage with inorganic zinc primer intact are providing corrosion protection to the steel substrate and do not require immediate action. Areas on the containment liner where the protective coating has disbonded, exposing the steel substrate, should be scheduled for repair during the next outage. Also, areas of rusting on piping should be repaired to mitigate corrosion. Any loose flaking coating that was not removed to sound coating during the current outage should be scheduled for removal next outage to assure that licensing commitments are in compliance.

The A1R20 outage coating assessment identified areas of degraded coating that require repair. No current coating conditions were identified that appear to impact structural integrity, plant operations, or the safe shutdown. Repair work should be planned for future outages to address the degraded coating areas identified. Such repairs will reduce radiation levels resulting from fixed contamination on exposed substrates, mitigate progressive coating degradation, and prevent damage to exposed steel and concrete substrates. Although some repairs were made near the Elev. 401' Equipment Hatch, there still is a considerable amount of mechanical damage to the containment liner in this area. These areas should be continuously monitored and ultimately repaired. Exposed, rusting carbon steel areas should be repaired. Bare concrete and grout should also be coated for decontaminability issues.

Coating Repairs Made During A1R20

During the A1R20 outage, areas in containment were identified for coating stabilization (scraping loose coating), coating repair, and for initial coating application. More than 70 coating repairs were made to the Elev. 401' OMB and Elev. 377' OMB Liner Plate. Ten supports identified for coating repair were located on Elev. 401' IMB. They were 4" Tube Steel supports and 2" angle iron supports, associated with Reactor Coolant Pump Motor "C" Interference Removals located at R-4.

3.7.3 Primary Containment Coatings Condition Assessment, Unit 2 RFO A2R19, Spring 2017

Safety-related coatings assessment of the Service Level I Primary Containment coated surfaces were completed at BRW Unit 2 during the 2017 A2R19 RFO.

Interior surfaces of the primary containment, components, and equipment were inspected and assessed.

Inspection Findings:

Containment Liner Plate, All Elevations, OMB

The Primary Containment liner plate was evaluated during this scheduled outage to assess the overall condition of the safety-related protective coatings. The liner was originally coated with Carbozinc 11, an inorganic zinc primer and top coated with Carboline Phenoline 305, a phenolic epoxy. Areas of random coating degradation identified on the liner, (on all elevations of containment) generally consisted of mechanical damage and topcoat disbondment. Most of the degraded areas were on Elev. 401'. Mechanical impact damage to the liner is due to equipment movement and tool transportation during outages. All observed mechanical damage was located from containment floor levels up to approximately 7'. This is not an age-related degradation, but loose coating is still a significant coatings issue. The adhesive top coat bonding may be compromised where the damage is most severe. Identified loose or delaminated coating material found throughout the containment was stabilized (scraped back to sound, tightly adhered material, and the loose coating debris contained and properly disposed). This routine outage coating maintenance item does not impact the plant or systems health or operability.

Elevation 377' Structures and Components (OMB)

The Primary Containment interior liner surface on Elev. 377' has random areas of mechanical impact damage. The floor areas in front of the RCFCs are narrow and the damage is from carried tools and equipment impacting the coated surfaces. Multiple piping and supports on this elevation have surface rusting and require a coating system.

Elevation 401' Structures and Components (OMB)

The Elev. 401' liner plate surface is in fair condition. Areas of mechanical impact damage with exposed primer were identified. The liner coating system is tightly bonded in most areas but has random top coat disbondment.

Elevation 412' Structures and Components (OMB)

The interior containment liner on Elev. 412' has large areas of top coat disbonding and mechanical impact damage. These primer exposed areas should be addressed with an approved coating system. The coating on piping and support hangers are generally in fair condition.

Elevation 426' Structures and Components (OMB)

The interior liner on Elev. 426' is in good condition with minor random areas of disbonding top coat and mechanical impact damage. Loose coatings were scraped to sound coating, the chips bagged and properly removed. The coating on the concrete floors was in good condition with minimal

mechanical impact damage. The upper areas appeared to be in good condition, including the dome and the polar crane.

Elevations 377', 390' and 401' Structures and Components (IMB)

The degraded coating on Elevations 377', 390' and 401' was generally minor mechanical impact damage, reconfigurations and equipment modifications, uncoated piping, uncoated support hangers. Observed coated surfaces in the IMB were tightly adhered and due to the limited accessibility for personnel and equipment movement, the mechanical impact damage was minimal.

Elevation 377', Moisture Barrier Seal UT Box Process (OMB)

Upon completion of the UT readings by the BRW NDE engineering staff, the re-coating of 216 indications began.

Primary Containment Interior Liner Plate (OMB), All Elevations, Conclusion

Most of the delaminated top coat chips have a light coating of zinc primer or other type of dark substance attached to the topcoat/primer interface. This condition is typically caused by the top coat being applied over dry zinc overspray or possible weld residue. As the epoxy coating cures and shrinks from age, areas not tightly bonded delaminate and curl from the primer coat. Loosely bonded top coating areas were scrapped to sound coating and properly disposed of. All identified areas requiring loose coating removal, which was less than 7' in vertical height, was removed. The condition of the upper elevations of containment to the dome had no visual mechanical damage or topcoat disbonding from the primer. A considerable amount of mechanical damage to the liner remains but is localized from floor levels up to about 6' in vertical height and only in areas of heavy traffic; such as areas near stairs, doorways and areas where the walkways narrow. These areas should be scheduled for repair during future outages. There were no coating application repairs performed on the liner, outside the MB repairs, during the A2R19 outage. The loose coating was removed by hand scraping. Repair work should be planned in future outages to address the areas of coating degradation identified. Such repairs will reduce radiation levels resulting from fixed contamination on exposed substrates, mitigate progressive coating degradation, and prevent damage to exposed steel and concrete substrates. No current coating conditions were identified that appear to impact structural integrity, plant operations, or the safe shutdown of the plant.

Recommendations and Conclusions

The areas on the Primary Containment liner where the protective coating system has degraded, exposing the carbon steel substrate, should be identified to the system planners for repair during the next scheduled outage. Mechanical damage where the inorganic zinc primer is intact is providing corrosion protection to the steel substrate and do not require immediate action. Exposed areas of corrosion on piping should be repaired per procedure. Any loose, flaking coating that was not removed to sound coating during the current outage should be scheduled for removal next outage to assure that licensing commitments are in compliance.

The A2R19 outage Primary Containment Service Level I coatings assessment identified areas of degraded coating that require repair. No current coating conditions were identified that appear to impact structural integrity, plant operations, or the safe shutdown of the plant. Repair work should be planned for future outages to address the degraded coating areas identified. Repairs will mitigate corrosion of exposed steel substrates and improve surface decontaminability. These

documented areas should be continuously monitored and ultimately addressed. Areas with exposed, rusting carbon steel should be repaired. Bare concrete and grout should also be considered for repair for decontaminability.

3.7.4 Primary Containment Coatings Condition Assessment, Unit 2 RFO A2R20, Fall 2018

Safety-related coatings assessment of the Service Level I Primary Containment coated surfaces was conducted at BRW Unit 2 during the 2018 A2R20 RFO.

Interior surfaces of the primary containment, components, and equipment were inspected and assessed.

Inspection Findings:

Containment Liner Plate, All Elevations, OMB

The Containment liner plate (liner) is inspected every outage to assess the overall condition of the safety-related protective coatings. The liner was originally coated with Carbozinc 11, an inorganic zinc primer and top coated with Carboline Phenoline 305, a phenolic epoxy. Areas of coating degradation identified on the liner consist of general mechanical damage and areas of disbondment. Every outage, the number of areas identified as disbondment, was generally the same. The number of areas of disbondment of the top coat of Carboline Phenoline 305 from the prime coat of Carbozinc 11 identified in this outage has accelerated in amount and size. Most of the areas of Disbondment found were on the 401', 412', and 426' elevations. It was also noted that 8 of the 15 coated steel test panels on Elev. 377' IMB have coating disbondment of the top coat of Phenoline 305 from the prime coat of Carbozinc 11.

The degraded areas of loose coating on the liner are typically repaired, or hand tool cleaned with a paint scraper to remove loose top coat, back to sound, intact coating. This is a routine outage coating maintenance item that does not impact operability. The coating damaged areas (were observed in all areas of containment except for the very top areas of the 426' elevation (Dome Area), which is Carbozinc 11 with no top coat. Most of the mechanical damaged areas are on the 401' and 377' elevation. Mechanical damage to the liner (from equipment and tool transportation during outages) was the primary coating defect observed. Mechanical damage on each of the elevations identified is located from containment floor/grating levels up to about 6'. This type of damage typically results in loss of the topcoat material, due to cracking and chipping. Any loose or delamination coating material found throughout the containment was stabilized (scraped back to sound, tightly adhered material, with the chips contained and properly disposed of).

377', 390', and 401' Elevations (IMB)

Most of the coating deficiencies on elevations 377', 390' and 401' consist of uncoated piping, support hangers or damage to coatings on inner concrete walls, resulting from the modification or removal of supports. These areas should be scheduled for repair during the next outage.

377', 401', and 412' Elevations Structures and Components (OMB)

The safety-related coatings on structural steel and components on Elev. 377' are in good condition. The coatings on all SRV piping are unqualified and degraded. Repairs have been

made to most of the welds and to some of the check valves. The rest of the piping has been left unrepaired but future repairs should be made to the rest of the SRV piping. The containment liner on Elev. 401' has many areas of mechanical damage and top coat disbondment has increased. The liner on Elev. 412' has also seen an increase in top coat disbondment to the liner, but few areas of mechanical damage. The areas of loose coating were scraped to sound coating and coating chips were bagged and properly removed. The concrete floor coating areas were in good condition with minimal mechanical damage. The Reactor Coolant Fan Chiller (RCFC) B, C, and D boxes were unavailable for inspection. RCFC box A was inspected and graffiti removed. There were a few areas needing repairs.

426' Elevation Structures and Component (OMB)

The upper areas of the liner plate appeared to be in good condition, including the Dome and the Polar Crane. The Vent pipes and Accumulators all have many areas of top coat disbondment with the Accumulators almost completely without any top coat left. The primer coat of Carbozinc 11 is intact and in good condition. The lower areas of the liner had some mechanical damage with most within the lower 6' area. The areas of the liner near the equipment hatch and including the hatch have many areas of mechanical damage.

Test Panels Coupons on Elevation 377' (IMB)

The steel and concrete test coupons are located on Elev. 377' IMB. The test panels are coated with the common safety-related coating systems used throughout the containment. Carbozinc 11, inorganic zinc as a primer (not top coated) for carbon steel, inorganic zinc with a Carboline Phenoline 305 epoxy topcoat for the carbon steel liner plate, and sealed concrete coated with an epoxy surface and top coated with an epoxy finish coat (coating system for concrete not identified to UESI). Examination of the coupons is a standard requirement of the inspection walk down. The zinc coated steel coupons are in fair condition. The steel coupons with zinc primer and epoxy topcoat were in poor condition as 8 of the 15 coupons have top coat disbondment. Two of the eight also have mechanical damage. These are the same two from last outage. The concrete coupons were in good condition, although there are 8 that have slight mechanical damage to them.

Recommendations and Conclusions

Areas of mechanical damage with inorganic zinc primer intact are providing corrosion protection to the steel substrate and do not require immediate action. Areas on the containment liner where the protective coating has disbonded, exposing the steel substrate, should be scheduled for repair during the next outage. Also, areas of rusting on piping should be repaired to mitigate corrosion. Any loose, flaking coating that was not removed to sound coating during the current outage should be scheduled for removal next outage to assure that licensing commitments are in compliance.

The A2R20 outage coating assessment identified areas of degraded coating that require repair. No current coating conditions were identified that appear to impact structural integrity, plant operations, or the safe shutdown. Repair work should be planned for future outages to address the degraded coating areas identified. Such repairs will reduce radiation levels resulting from fixed contamination on exposed substrates, mitigate progressive coating degradation, and prevent damage to exposed steel and concrete substrates. There were many new areas of coating disbondment identified this outage. These areas should be continuously monitored and ultimately repaired. Exposed, rusting carbon steel areas should be repaired. Bare concrete and grout should also be coated for decontaminability issues.

Coating Repairs Made During A2R20

During the A2R20 outage, areas in containment were identified for coating stabilization (scraping loose coating), coating repair, and for initial coating application. Six (6) interferences associated with the replacement of the Reactor Coolant Pump Motor "C" were identified for coating repair and were located on Elev. 401' R-31, IMB.

3.7.5 Unit 1 IWE Examination RFO A1R19, Fall 2016

The purpose of this inspection is to ensure that the structural integrity of ASME Class MC pressure retaining surfaces and Class CC metallic shell and penetration liners are maintained. Condition Assessment of Class MC and CC components is achieved by performing examinations of the accessible surfaces. All examinations were performed so as to comply with Article IWE of the ASME Boiler and Pressure Vessel Code, Section XI, 2001 Edition through the 2003 Addenda.

The results of previous examinations were reviewed to identify any areas or components that required an augmented or focused examination.

The examination results of the Class MC pressure retaining surfaces and CC shell and penetration liners (including pressure retaining bolting) and MB(s) were reviewed, compared to acceptance standards specified in IWE-3500 of ASME Section XI, 2001 Edition through the 2003 Addenda, and evaluated by the appropriate personnel.

A General Visual (GV) inspection was performed on the interior and exterior surfaces of the containment liner. General Visual examinations of Unit 1 Liner Pressurization Pipe Caps located inside containment at Elev. 377' at R5, R7, R13, and R20 were performed. VT-3 examinations of the disassembled bolted connections were performed for 1PC-064M, 1PC-074M, 1PC-098M, and 1PC-103M. Electrical Penetration 53 was recoated.

Augmented examinations were performed on 137 locations. Approximately 174' of MB were removed for VT-1 and UT examinations. A new MB was installed in Areas 1-14. An Engineering Evaluation was issued for acceptability of liner condition with the conclusion that Unit 1 is acceptable for service through the next operating cycle without any repair/replacement.

The General Visual and Augmented Examinations were completed satisfactorily for CISI Interval 2, Period 3, Outage A1R19. The results of the visual examination of IWE surfaces are detailed in Table 3.7.5-2 below. Note that the contents of Table 3.7.5-2 do not include the results of inspections where there were No Reportable Indications (NRIs).

Moisture Barrier Technical Evaluation

This Engineering Evaluation was prepared to address the resolution of concerns associated with the execution of corrective actions coming from refueling outage A1R18 regarding degraded conditions of the containment liner plate under the MB. The corrective actions for A1R19 were prescribed in a previous evaluation from A1R18 and are as follows:

Schedule VT-1 and UT examinations of all containment liner plate directly below MB that exhibited metal thickness losses greater than 1/64" in A1R16 that were not repaired in A1R17

and any new augmented areas found as a result of UTs during A1R17 or were repaired and still remain augmented.

During the performance of examinations for the Unit 1 containment liner plate in areas resulting from corrective actions identified in the previous evaluation from A1R18, additional degradation was found that was not repaired as part of A1R19 on the containment liner in other normal inaccessible areas below the MB at elevation 377'-0". These areas were identified through ultrasonic testing (UT) reports of previously identified augmented areas. The maximum metal loss found through the UT exams was 0.035" or approximately 14%. The maximum pit depth measured through VT-1 was 4/64".

The degraded conditions are defined as areas of the liner plate that exhibit metal loss in excess of 10% of the nominal thickness as provided in Section IWE-3122.3(a) of 2001 Edition of ASME Code Section XI through 2003 Addenda. All areas identified in outages A1R14, A1R15 or A1R16 to have a metal loss greater than 4/64" were repaired in A1RI7. The degraded liner conditions below the MB examined in A1R19 were likely the result of poor liner surface preparation prior to the application of Service Level I coatings in the year 2000. Also, the coating used was Carbozinc 11 at that time and it was probably not the best choice for the prepared liner surface conditions. Keeler and Long 9600 Series would have been a better choice for year 2000 surface conditions.

This evaluation addresses the worst-case liner degradation condition found (4/64" metal loss) and applies to all existing degraded surfaces on the liner plate below the MB examined in A1R19.

Description of Containment Liner and Moisture Barrier

The containment Class CC liner plate is made of ¼" thick SA 516, Grade 60 or equivalent carbon steel and protected by a DBA-qualified Service Level I Carbozinc 11 primer with Carboline Phenoline 305 finish. The containment atmosphere has a relative humidity of 50% during normal operation. The containment interior experiences an average maximum temperature of 120°F during normal operations. Local hot spot temperatures in excess of the 120°F average temperature are possible.

The containment MB is located at the bottom of the interior of the containment structure at Elev. 377'-0". The temperatures in this area are much below the average. The MB is the interface between the containment liner and containment interior concrete base mat, which extends almost the entire circumference of the liner at this elevation.

The interface contains an epoxy MB to preclude intrusion of water into an inaccessible area of the liner surface just below the concrete floor at Elev. 377'. The inaccessible area is characterized by a 2" gap between the liner and concrete base mat.

Summary of the Conditions for this Evaluation

The containment liner plate condition is required to be assessed periodically based on the requirements of Subsection IWE of Section XI of the ASME Code. Prior liner plate examinations at BRW have resulted in identification of liner plate areas where the metal thickness had losses in excess of the 10% of its nominal thickness (Note: Section IWE-3510.1, "Visual Examination – General," permits establishment of owner-defined acceptance criteria for the Category E-A visual examinations of the containment surfaces).

The affected areas are approximately 4" in height adjacent to a 3" thick Cerablanket material (part of the MB at Elev. 377'). A previous evaluation from A1R18, performed to show acceptability of the areas of the containment liner plate and to determine the extent of conditions, in compliance with the requirements of 2001 Edition of ASME Section XI, Subsection IWE through 2003 Addenda, has resulted in corrective actions for A1R19.

The following actions were then taken in A1R19 and results listed in this evaluation to address the above corrective actions:

> Approximately 174' of the MB were removed to perform visual examinations and ultrasonic testing on the normally inaccessible areas of the liner directly below the MB at Elev. 377'-0". The degraded areas of the liner plate were designated by "Area" numbers 1-14.
>
> VT-1 and UT examinations were performed at approximately 137 augmented locations, to find if any additional metal loss has occurred since the previous exams in A1R16 and A1R17.
>
> The VT-1 examination results showed no change in the pit depths from previous exams. The maximum pit depth measured through VT-1 was 4/64".
>
> The UT examination results gave minimum liner plate thickness of 0.215" or metal loss of 14% nominal liner wall thickness (¼") at three locations 20.11, 20.12, and 20.13.
>
> All examined areas during A1R19 were found dry with no active corrosion; however, there were minor changes in coating conditions as compared to previous exams.
>
> None of the pit depths exceeded 4/64" and did not require any repairs in A1R19. It should be noted that all areas documented in A1R14, A1R15, or A1R16 having metal loss of greater than 4/64" were repaired in A1R17.

<u>Detailed Analysis</u>

Item 1 – Describe the actions taken to implement the corrective actions prescribed in the previous evaluation from A1R18.

Resolution:

Schedule VT-1 and UT examinations of all containment liner plate directly below MB that exhibited metal thickness losses greater than 1/64" in A1R16 that were not repaired in A1R17 and any new augmented areas found as a result of UTs during A1R17 or were repaired and still remain augmented.

The scope of IWE augmented exams in A1R19 was developed through the review of previous evaluations from A1R18, A1R17, and A1R16. The scope of augmented exams for A1R19 included 137 locations previously examined in A1R16 or A1R17 which had pit depths from 2/64" to 4/64". Seven of these augmented locations (1-609, 20.13, 13.19, 20.2-1, 20.2-2, 20.2-3, and 20.2-4) were repaired in A1R17 but their post-repair UT results showed metal losses of greater than 8% of Nominal Liner Thickness, therefore they remained augmented for A1R19.

Item 2 – Evaluate and accept the degraded conditions of the liner plate below the MB in Unit 1 Containment that were examined and not repaired during the performance of the corrective actions during the A1R19 outage. This evaluation is in accordance with the requirements of Section IWE-3122.3 of 2001 Edition of ASME Code Section XI, with 2003 Addenda.

Resolution:

VT-1 examinations were performed using the Detailed Visual method to document the condition of the Service Level I coating, and any additional degradation of the liner since it was last coated. The results of VT-1 examinations on 137 augmented locations during A1R19 showed no change in pit depths from previous inspections. The maximum pit depth measured through VT-1 was 4/64". The coating was intact, and the areas were dry, which indicated the pits were not active. The seven repaired locations from A1R17 (1-609, 20.13, 13.19, 20.2-1, 20.2-2, 20.2-3, and 20.2-4) did not show any pits.

The results of UT examinations on 137 augmented locations during A1R19 identified three locations (20.11, 20.12, and 20.13) exceeding 10% nominal metal thickness loss and three additional locations (4-610-1, 20.4, and 20.6) projected to exceed 10% nominal metal thickness loss by next exam in A1R21 or A1R22.

The minimum liner plate UT thickness of 0.215" was obtained at three locations between Column R20 and R21 in Area #13 (20.11, 20.12, and 20.13), representing a metal loss of approximately 14% of the liner plate nominal wall thickness (1/4"). Additionally, there were three more locations projected to exceed material loss of 10% Nominal Thickness by next exam in A1R21 or A1R22. One of the three locations was between Columns R4 and R5 in Area #2 (4-610-1) and had material loss of 8.8% of Nominal Liner Thickness. The other two locations were between Columns R20 and R21 in Area #13 (20.4 and 20.6) and had material loss of 8.4% of Nominal Liner Thickness.

The following UT results in Table 3.7.5-1 are for the augmented locations from A1R19 where the liner plate thickness measurements fell below the 0.250" nominal thickness by 5% or more.

Table 3.7.5-1: UT Exam Results for Augmented Locations from A1R19 Where the Liner Plate Thickness Measurements Fell Below the 0.25" Nominal Thickness by 5% or More

Area	Location	Minimum Thickness (inches)	% Reduction	To Remain Augmented?
1	1-508	0.234	6.4%	No
2	4-610-1	0.228	8.8%	Yes
2	5-603	0.235	6.0%	No
4	7-611	0.237	5.2%	No
13	20.13	0.215	14.0%	Yes
13	20.12	0.215	14.0%	Yes
13	20.11	0.215	14.0%	Yes
13	20.6	0.229	8.4%	Yes
13	20.4	0.229	8.4%	Yes

According to a detailed technical analysis, the containment liner plate is qualified for a maximum metal loss of 10/64" for the liner plate. There is still a margin of 0.12125" (0.15625" minus 0.035") left until the liner condition becomes unacceptable and requires an engineering evaluation or repairs for disposition. Since the maximum measured metal loss examined during A1R19 did not

exceed 10/64" (0.15625"), the liner plate conditions as documented in this evaluation are acceptable for all degradations found during A1R19 and the containment remains operational.

The evaluation is the preferred method to address the degraded conditions of the containment liner plate since repair or replacement activities would cause an undue burden in the A1R19 outage schedule and is not required at this time. Any future liner weld repairs considered should be planned during a refueling outage when an Appendix J Type A ILRT is performed.

Item 3 – Accept Unit 1 operation with the liner plate degradation without additional repair or replacement.

Resolution:

Based on the information provided in this evaluation, it may be concluded that the corrosion on the liner is inactive (i.e., as-found dry conditions, very small affected areas, inconsistent distribution pattern of the pitted areas, etc.) and its degradation rate on the coated surfaces of the liner plate has stopped or has been reduced significantly to the point of being negligible.

The surfaces of all areas of the liner plate that were exposed below the MB in A1R19 were prepared for application of Keeler and Long 9600 Series coating used for Level I coating in containment. The protective coating is applied to prevent any additional corrosion from taking place. A new MB was installed over these areas to prevent any water intrusion. A GV examination was also performed on the entire MB and no cuts or voids (minor imperfections on the MB surfaces remain locally) were left in MB after its installation in A1R19.

Therefore, based on the above, the Unit 1 containment liner is acceptable for full operation until the next CISI period and areas with UTs showing metal losses of up to 0.035". Future augmented exams and corrective actions are specified for future outages.

Supplemental Examinations (per Section IWE-3200)

No supplemental examinations were required during A1R19.

Augmented Examinations (per Section IWE-3122.3)

The augmented areas identified in A1R16 and A1R17 were re-examined during A1R19 to ensure no additional degradation had taken place. Based on the results of VT-1 and UT examinations, the six degraded locations (4-610-1, 20.13, 20.12, 20.11, 20.6, and 20.4) will remain augmented for the next ISI period. The rest of the degraded locations examined in A1R19 remain essentially unchanged from the last inspection period and will no longer require augmented examinations in accordance with Section IWE-2420(c).

Corrective Actions in A1R19

Ultrasonic thickness readings were performed at approximately 137 locations to document actual liner plate thicknesses in the vicinity of the pitted areas with significant pitting that were classified as augmented in A1R16 or A1R17. This evaluation was completed to provide justification for the acceptability of the containment liner plate at its thinnest location without any further repair or replacement, and for operation of Unit 1 until the next ISI period.

The liner surfaces at all the exposed locations where the MB had been removed were coated with Keeler and Long 9600 Series coating (used for Level I coating applications in containment) that was applied during A1R19 along with new Cerafibre and new MB.

A new MB was installed at all areas where the MB was removed. GV exam was performed after the installation of new MB and no cracks or voids were found to allow water intrusion (minor imperfections on the MB surfaces remain locally with no voids).
Portions of Class CC liner below the MB have been categorized as Category E-C in ISI schedule.

Corrective Actions for A1R21 or A1R22

Schedule VT-1 and UT examinations of augmented locations 20.11, 20.12, 20.13, 20.4, 20.6, and 4-610-1 on containment liner plate directly below MB during A1R21 or A1R22.

Extent of Condition

Per 10 CFR 50.55(a), 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. As described earlier, all containment liner plate areas directly below the MB have now been examined directly by VT-1 examination method in outages A1R14 through A1R19. There are no remaining inaccessible areas of the containment liner plate directly below the MB that were not examined in these outages. All areas examined in these outages were found dry and no active corrosion was found. Areas found in outages A1R14, A1R15 or A1R16, to have a loss of metal greater than 4/64" were repaired in A1R17. All remaining augmented areas from A1R14 and A1R15 were examined in A1R18. All remaining augmented areas from A1R16 and A1R17 were examined in A1R19.

Table 3.7.5-2: Unit 1 ISI Containment Inspection Listing, Outage A1R19								
Component ID	**Description**	**ASME Class**	**ASME Category**	**ASME Item No.**	**Required Exam**	**Actual Exam**	**Results (1)**	**Comments**
1LINER-SURFACE	METAL LINER	CC	E-A	E01.11	GV	GV, GV, GV, GV, GV, GV, GV, GV	IO, IO, IO, NRI, NRI, NRI, NRI, NRI	GV performed on 09/26/2016, 09/27/2016, 09/29/2016, and 09/30/2016 was for surfaces inside containment. Area of surface corrosion top of landing at R-5 on Elev. 377'. Minor coating damage, primer still intact. Found a bulge at liner plate on Elev. 401' between R-9 and R-10 approximately 1-1/4" high. Spot of surface corrosion by beam near R-15 on Elev. 412', no wastage. Acceptable per Responsible Individual.
1EH-ASSEMBLY-SURFACE	EQUIPMENT HATCH SURFACE	MC	E-A	E01.11	GV	GV, VT-3	NRI, IO	GV performed on 09/27/2016 was for surfaces outside and inside containment. Connection was disassembled for replacing equipment hatch O-rings. VT-3 performed on the disassembled flange surface on 10/03/2016. Minor scratches at the 6 o'clock location, not in the seating area. Acceptable per Responsible Individual.
1E-026-SURFACE	ELEC PENETRATION	MC	E-A	E01.11	GV	GV, GV	NRI, IO	GV performed on 09/28/2016 was for surfaces outside containment. GV performed on 09/26/2016 and 09/29/2016 was for surfaces inside containment. Surface corrosion inside E26, no wastage. Acceptable per Responsible Individual.
1E-053-SURFACE	ELEC PENETRATION	MC	E-A	E01.11	GV	GV, GV	RI, NRI	GV performed on 09/28/2016 was for surfaces outside containment. Pit at bottom of E53 surface 3/64 inches deep, missing paint, surface corrosion. Surface of E53 was coated in A1R19. GV performed on 09/26/2016 and 09/29/2016 was for surfaces inside containment. Acceptable per Responsible Individual.
1PC-006-SURFACE	PIPE PENETRATION	MC	E-A	E01.11	GV	GV, GV	IO, NRI	GV performed on 09/29/2015 was for surfaces outside containment. Surface corrosion, no evidence of wastage or material loss. GV performed on 09/26/2016 was for surfaces inside containment. Acceptable per Responsible Individual.

Table 3.7.5-2: Unit 1 ISI Containment Inspection Listing, Outage A1R19								
Component ID	**Description**	**ASME Class**	**ASME Category**	**ASME Item No.**	**Required Exam**	**Actual Exam**	**Results (1)**	**Comments**
1PC-076-SURFACE	PIPE PENETRATION	MC	E-A	E01.11	GV	GV, GV	IO, NRI	GV performed on 09/27/2016 was for surfaces outside containment. Evidence of surface rust on all penetrations, no evidence of flaking or loss of material. On surfaces that are coated, evidence of coating degradation due to heat. GV performed on 09/26/2016 was for surfaces inside containment. Acceptable per Responsible Individual.
1PC-077-SURFACE	PIPE PENETRATION	MC	E-A	E01.11	GV	GV, GV	IO, NRI	GV performed on 09/27/2016 was for surfaces outside containment. Evidence of surface rust on all penetrations, no evidence of flaking or loss of material. On surfaces that are coated, evidence of coating degradation due to heat. GV performed on 09/26/2016 was for surfaces inside containment. Acceptable per Responsible Individual.
1PC-078-SURFACE	PIPE PENETRATION	MC	E-A	E01.11	GV	GV, GV	IO, NRI	GV performed on 09/27/2016 was for surfaces outside containment. Evidence of surface rust on all penetrations, no evidence of flaking or loss of material. On surfaces that are coated, evidence of coating degradation due to heat. GV performed on 09/26/2016 was for surfaces inside containment. Acceptable per Responsible Individual.
1PC-079-SURFACE	PIPE PENETRATION	MC	E-A	E01.11	GV	GV, GV	IO, NRI	GV performed on 09/27/2016 was for surfaces outside containment. Evidence of surface rust on all penetrations, no evidence of flaking or loss of material. On surfaces that are coated, evidence of coating degradation due to heat. GV performed on 09/26/2016 was for surfaces inside containment. Acceptable per Responsible Individual.
1PC-080-SURFACE	PIPE PENETRATION	MC	E-A	E01.11	GV	GV, GV	IO, NRI	GV performed on 09/27/2016 was for surfaces outside containment. Evidence of surface rust on all penetrations, no evidence of flaking or loss of material. On surfaces that are coated, evidence of coating degradation due to heat. GV performed on 09/26/2016 was for surfaces inside containment. Acceptable per Responsible Individual.

ATTACHMENT 1a
Description and Assessment

Table 3.7.5-2: Unit 1 ISI Containment Inspection Listing, Outage A1R19								
Component ID	Description	ASME Class	ASME Category	ASME Item No.	Required Exam	Actual Exam	Results (1)	Comments
1PC-081-SURFACE	PIPE PENETRATION	MC	E-A	E01.11	GV	GV, GV	IO, NRI	GV performed on 09/27/2016 was for surfaces outside containment. Evidence of surface rust on all penetrations, no evidence of flaking or loss of material. On surfaces that are coated, evidence of coating degradation due to heat. GV performed on 09/26/2016 was for surfaces inside containment. Acceptable per Responsible Individual.
1PC-082-SURFACE	PIPE PENETRATION	MC	E-A	E01.11	GV	GV, GV	IO, NRI	GV performed on 09/27/2016 was for surfaces outside containment. Evidence of surface rust on all penetrations, no evidence of flaking or loss of material. On surfaces that are coated, evidence of coating degradation due to heat. GV performed on 09/26/2016 was for surfaces inside containment. Acceptable per Responsible Individual.
1PC-083-SURFACE	PIPE PENETRATION	MC	E-A	E01.11	GV	GV, GV	IO, NRI	GV performed on 09/27/2016 was for surfaces outside containment. Evidence of surface rust on all penetrations, no evidence of flaking or loss of material. On surfaces that are coated, evidence of coating degradation due to heat. GV performed on 09/26/2016 was for surfaces inside containment. Acceptable per Responsible Individual.
1PC-084-SURFACE	PIPE PENETRATION	MC	E-A	E01.11	GV	GV, GV	IO, NRI	GV performed on 09/27/2016 was for surfaces outside containment. Evidence of surface rust on all penetrations, no evidence of flaking or loss of material. On surfaces that are coated, evidence of coating degradation due to heat. GV performed on 09/26/2016 was for surfaces inside containment. Acceptable per Responsible Individual.
1PC-085-SURFACE	PIPE PENETRATION	MC	E-A	E01.11	GV	GV, GV	IO, NRI	GV performed on 09/27/2016 was for surfaces outside containment. Evidence of surface rust on all penetrations, no evidence of flaking or loss of material. On surfaces that are coated, evidence of coating degradation due to heat. GV performed on 09/26/2016 was for surfaces inside containment. Acceptable per Responsible Individual.

Table 3.7.5-2: Unit 1 ISI Containment Inspection Listing, Outage A1R19								
Component ID	**Description**	**ASME Class**	**ASME Category**	**ASME Item No.**	**Required Exam**	**Actual Exam**	**Results (1)**	**Comments**
1PC-086-SURFACE	PIPE PENETRATION	MC	E-A	E01.11	GV	GV, GV	IO, NRI	GV performed on 09/27/2016 was for surfaces outside containment. Evidence of surface rust on all penetrations, no evidence of flaking or loss of material. On surfaces that are coated, evidence of coating degradation due to heat. GV performed on 09/26/2016 was for surfaces inside containment. Acceptable per Responsible Individual.
1PC-087-SURFACE	PIPE PENETRATION	MC	E-A	E01.11	GV	GV, GV	IO, NRI	GV performed on 09/27/2016 was for surfaces outside containment. Evidence of surface rust on all penetrations, no evidence of flaking or loss of material. On surfaces that are coated, evidence of coating degradation due to heat. GV performed on 09/26/2016 was for surfaces inside containment. Acceptable per Responsible Individual.
1PC-088-SURFACE	PIPE PENETRATION	MC	E-A	E01.11	GV	GV, GV	IO, NRI	GV performed on 09/27/2016 was for surfaces outside containment. Evidence of surface rust on all penetrations, no evidence of flaking or loss of material. On surfaces that are coated, evidence of coating degradation due to heat. GV performed on 09/26/2016 was for surfaces inside containment. Acceptable per Responsible Individual.
1PC-089-SURFACE	PIPE PENETRATION	MC	E-A	E01.11	GV	GV, GV	IO, NRI	GV performed on 09/27/2016 was for surfaces outside containment. Evidence of surface rust on all penetrations, no evidence of flaking or loss of material. On surfaces that are coated, evidence of coating degradation due to heat. GV performed on 09/26/2016 was for surfaces inside containment. Acceptable per Responsible Individual.
1PC-090-SURFACE	PIPE PENETRATION	MC	E-A	E01.11	GV	GV, GV	IO, NRI	GV performed on 09/27/2016 was for surfaces outside containment. Evidence of surface rust on all penetrations, no evidence of flaking or loss of material. On surfaces that are coated, evidence of coating degradation due to heat. GV performed on 09/26/2016 was for surfaces inside containment. Acceptable per Responsible Individual.

Table 3.7.5-2: Unit 1 ISI Containment Inspection Listing, Outage A1R19								
Component ID	**Description**	**ASME Class**	**ASME Category**	**ASME Item No.**	**Required Exam**	**Actual Exam**	**Results (1)**	**Comments**
1PC-091-SURFACE	PIPE PENETRATION	MC	E-A	E01.11	GV	GV, GV	IO, NRI	GV performed on 09/27/2016 was for surfaces outside containment. Evidence of surface rust on all penetrations, no evidence of flaking or loss of material. On surfaces that are coated, evidence of coating degradation due to heat. GV performed on 09/26/2016 was for surfaces inside containment. Acceptable per Responsible Individual.
1PC-099-SURFACE	PIPE PENETRATION	MC	E-A	E01.11	GV	GV, GV	IO, NRI	GV performed on 09/27/2016 was for surfaces outside containment. Evidence of surface rust on all penetrations, no evidence of flaking or loss of material. On surfaces that are coated, evidence of coating degradation due to heat. GV performed on 09/26/2016 was for surfaces inside containment. Acceptable per Responsible Individual.
1PC-100-SURFACE	PIPE PENETRATION	MC	E-A	E01.11	GV	GV, GV	IO, NRI	GV performed on 09/27/2016 was for surfaces outside containment. Evidence of surface rust on all penetrations, no evidence of flaking or loss of material. On surfaces that are coated, evidence of coating degradation due to heat. GV performed on 09/26/2016 was for surfaces inside containment. Acceptable per Responsible Individual.
1PC-101-SURFACE	PIPE PENETRATION	MC	E-A	E01.11	GV	GV, GV	IO, NRI	GV performed on 09/27/2016 was for surfaces outside containment. Evidence of surface rust on all penetrations, no evidence of flaking or loss of material. On surfaces that are coated, evidence of coating degradation due to heat. GV performed on 09/26/2016 was for surfaces inside containment. Acceptable per Responsible Individual.
1PC-102-SURFACE	PIPE PENETRATION	MC	E-A	E01.11	GV	GV, GV	IO, NRI	GV performed on 09/27/2016 was for surfaces outside containment. Evidence of surface rust on all penetrations, no evidence of flaking or loss of material. On surfaces that are coated, evidence of coating degradation due to heat. GV performed on 09/26/2016 was for surfaces inside containment. Acceptable per Responsible Individual.

Table 3.7.5-2: Unit 1 ISI Containment Inspection Listing, Outage A1R19								
Component ID	**Description**	**ASME Class**	**ASME Category**	**ASME Item No.**	**Required Exam**	**Actual Exam**	**Results (1)**	**Comments**
1LINER-MOISTURE-BARRIER	CONTAINMENT LINER MOISTURE BARRIER	CC	E-A	E01.30	GV	GV, GV	IO, NRI	GV performed on 09/26/2016 and 09/27/2016 was prior to removal of portion of the moisture barrier for augmented exams. Soft area found 10 feet to the left of R-8 seam weld. The area was removed for A1R19 augmented exams and then replaced. GV performed on 10/13/2016 was after the re-installation of the moisture barrier.
1LINER-SURFACE (AUGMENTED) R-1-R-2	CONTAINMENT METALLIC LINER SURFACE	MC	E-C	E04.11, E04.12	VT-1, UT	VT-1, UT	RI, NRI	VT-1 and UT exams were performed upon removal of MB areas and paint. Locations (1-600-2, 1-600-1, 2-612-2, 2-611-2, 2-610, 2-609, 1-508, 1-510) remained essentially unchanged from last inspection period, therefore no longer require augmented exams per IWE-2420(c). RIs were evaluated and accepted by the Responsible Individual without repair.
1LINER-SURFACE (AUGMENTED) R-2-R-3	CONTAINMENT METALLIC LINER SURFACE	MC	E-C	E04.11, E04.12	VT-1, UT	VT-1, UT	RI, NRI	VT-1 and UT exams were performed upon removal of MB areas and paint. Locations (2-608-3, 2-608-2, 2-606-2, 2-606-1, 2-605-2, 2-605-1, 2-604-2, 2-604-1, 2-603, 2-602-2, 2-601, 2-600-1, 2-600-2, 2-503) remained essentially unchanged from last inspection period, therefore, no longer require augmented exams per IWE- 2420(c). RIs were evaluated and accepted by the Responsible Individual without repair.
1LINER-SURFACE (AUGMENTED) R-4-R-5	CONTAINMENT METALLIC LINER SURFACE	MC	E-C	E04.11, E04.12	VT-1, UT	VT-1, UT	RI, RI	VT-1 and UT exams were performed upon removal of MB areas and paint. Locations (4-600, 4-601, 4-602, 4-603, 4-604, 4-605, 4-606, 4-607-1, 4-609-1, 4-609-2, 4-609-3, 4-610-3, 5-600, 5-601-1, 5-601-2, 5-601-3, 5-602, 5-603, 5-604, 5-605) remained essentially unchanged from last inspection period, therefore no longer require augmented exams per IWE- 2420(c). Location (4-610-1) did not meet acceptance standard of IWE- 3511.3 and will remain augmented after A1R19. RIs were evaluated and accepted by the Responsible Individual without repair.

Table 3.7.5-2: Unit 1 ISI Containment Inspection Listing, Outage A1R19								
Component ID	**Description**	**ASME Class**	**ASME Category**	**ASME Item No.**	**Required Exam**	**Actual Exam**	**Results [1]**	**Comments**
1LINER-SURFACE (AUGMENTED) R-6-R-7	CONTAINMENT METALLIC LINER SURFACE	MC	E-C	E04.11, E04.12	VT-1, UT	VT-1, UT	RI, NRI	VT-1 and UT exams were performed upon removal of MB areas and paint. Locations (R6.1, 6-601, 6-602, 6-603, 6-604-1, 6-604-2, 6-605, 6-606, 6-607) remained essentially unchanged from last inspection period, therefore no longer require augmented exams per IWE-2420(c). RIs were evaluated and accepted by the Responsible Individual without repair.
1LINER-SURFACE (AUGMENTED) R-7-R-8	CONTAINMENT METALLIC LINER SURFACE	MC	E-C	E04.11, E04.12	VT-1, UT	VT-1, UT	RI, NRI	VT-1 and UT exams were performed upon removal of MB areas and paint. Locations (7-602, 7-603, 7-604, 7-605, 7-606, 7-607, 7-608, 7-609, 7-610, 7-611, 7-612) remained essentially unchanged from last inspection period, therefore no longer require augmented exams per IWE- 2420(c). RIs were evaluated and accepted by the Responsible Individual without repair.
1LINER-SURFACE (AUGMENTED) R-9-R-10	CONTAINMENT METALLIC LINER SURFACE	MC	E-C	E04.11, E04.12	VT-1, UT	VT-1, UT	RI, NRI	VT-1 and UT exams were performed upon removal of MB areas and paint. Locations (R9.5, 10-601-2, 10-602-2, 10-603-2) remained essentially unchanged from last inspection period, therefore no longer require augmented exams per IWE-2420(c). RIs were evaluated and accepted by the Responsible Individual without repair.
1LINER-SURFACE (AUGMENTED) R-10-R-11	CONTAINMENT METALLIC LINER SURFACE	MC	E-C	E04.11, E04.12	VT-1, UT	VT-1, UT	RI, NRI	VT-1 and UT exams were performed upon removal of MB areas and paint. Locations (10-610, 10-611, 10-612, 10-613, 10-614, 10-615, 10-616) remained essentially unchanged from last inspection period, therefore no longer require augmented exams per IWE-2420(c). RIs were evaluated and accepted by the Responsible Individual without repair.

Table 3.7.5-2: Unit 1 ISI Containment Inspection Listing, Outage A1R19								
Component ID	**Description**	**ASME Class**	**ASME Category**	**ASME Item No.**	**Required Exam**	**Actual Exam**	**Results [(1)]**	**Comments**
1LINER-SURFACE (AUGMENTED) R-11-R-12	CONTAINMENT METALLIC LINER SURFACE	MC	E-C	E04.11, E04.12	VT-1, UT	VT-1, UT	RI, NRI	VT-1 and UT exams were performed upon removal of MB areas and paint. Locations (11-600, 11-601, 11-602, 11-603, 11-604, 11-605, 11-606, 12-504) remained essentially unchanged from last inspection period, therefore no longer require augmented exams per IWE-2420(c). RIs were evaluated and accepted by the Responsible Individual without repair.
1LINER-SURFACE (AUGMENTED) R-12-R-13	CONTAINMENT METALLIC LINER SURFACE	MC	E-C	E04.11, E04.12	VT-1, UT	VT-1, UT	RI, NRI	VT-1 and UT exams were performed upon removal of MB areas and paint. Location (13-511) remained essentially unchanged from last inspection period, therefore no longer require augmented exams per IWE-2420(c). RIs were evaluated and accepted by the Responsible Individual without repair.
1LINER-SURFACE (AUGMENTED) R-13-R-14	CONTAINMENT METALLIC LINER SURFACE	MC	E-C	E04.11, E04.12	VT-1, UT	VT-1, UT	RI, NRI	VT-1 and UT exams were performed upon removal of MB areas and paint. Locations (13.15, 13.18, 13.19, 13.20, 13.21, 13.22, 13.23) remained essentially unchanged from last inspection period, therefore no longer require augmented exams per IWE-2420(c). RIs were evaluated and accepted by the Responsible Individual without repair.
1LINER-SURFACE (AUGMENTED) R-14-R-15	CONTAINMENT METALLIC LINER SURFACE	MC	E-C	E04.11, E04.12	VT-1, UT	VT-1, UT	RI, NRI	VT-1 and UT exams were performed upon removal of MB areas and paint. Locations (14-603-2, 14-603-1, 14-604-1, 14-604-2) remained essentially unchanged from last inspection period, therefore no longer require augmented exams per IWE-2420(c). RIs were evaluated and accepted by the Responsible Individual without repair.
1LINER-SURFACE (AUGMENTED) R-15-R-16	CONTAINMENT METALLIC LINER SURFACE	MC	E-C	E04.11, E04.12	VT-1, UT	VT-1, UT	RI, NRI	VT-1 and UT exams were performed upon removal of MB areas and paint. Locations (15-600, 15-601, 15-602, 15-603, 15-604-2, 15-605-2, 15-606-2, 15-505, 16-511, 16-510, R16.2) remained essentially unchanged from last inspection period, therefore no longer require augmented exams per IWE-2420(c). RIs were evaluated and accepted by the Responsible Individual without repair.

ATTACHMENT 1a
Description and Assessment

Table 3.7.5-2: Unit 1 ISI Containment Inspection Listing, Outage A1R19								
Component ID	**Description**	**ASME Class**	**ASME Category**	**ASME Item No.**	**Required Exam**	**Actual Exam**	**Results [1]**	**Comments**
1LINER-SURFACE (AUGMENTED) R-16-R-17	CONTAINMENT METALLIC LINER SURFACE	MC	E-C	E04.11, E04.12	VT-1, UT	VT-1, UT	RI, NRI	VT-1 and UT exams were performed upon removal of MB areas and paint. Locations (16-604, 16-605, 17-605, 17-604, 17-603, 17-601, 17-600) remained essentially unchanged from last inspection period, therefore no longer require augmented exams per IWE-2420(c). RIs were evaluated and accepted by the Responsible Individual without repair.
1LINER-SURFACE (AUGMENTED) R-19-R-20	CONTAINMENT METALLIC LINER SURFACE	MC	E-C	E04.11, E04.12	VT-1, UT	VT-1, UT	RI, NRI	VT-1 and UT exams were performed upon removal of MB areas and paint. Location (19-503) remained essentially unchanged from last inspection period, therefore no longer require augmented exams per IWE-2420(c). RIs were evaluated and accepted by the Responsible Individual without repair.
1LINER-SURFACE (AUGMENTED) R-20-R-21	CONTAINMENT METALLIC LINER SURFACE	MC	E-C	E04.11, E04.12	VT-1, UT	VT-1, UT	RI, RI	VT-1 and UT exams were performed upon removal of MB areas and paint. Locations (20.8, 20.7, 20.5, 20.3, 20.2-1, 20.2-2, 20.2-3, 20.2-4, 20-501, 21-507) remained essentially unchanged from last inspection period, therefore, no longer require augmented exams per IWE-2420(c). Locations (20.13, 20.12, 20.11, 20.6, 20.4) did not meet acceptance standard of IWE-3511.3 and will remain augmented after A1R19. RIs were evaluated and accepted by the Responsible Individual without repair.
1LINER-SURFACE (AUGMENTED) R-21-R-1	CONTAINMENT METALLIC LINER SURFACE	MC	E-C	E04.11, E04.12	VT-1, UT	VT-1, UT	RI, NRI	VT-1 and UT exams were performed upon removal of MB areas and paint. Locations (1-609, 1-608-1, 1-607, 1-606, 1-605, 1-604, 1-603, 1-602, 1-601) remained essentially unchanged from last inspection period, therefore no longer require augmented exams per IWE-2420(c). RIs were evaluated and accepted by the Responsible Individual without repair.

Note 1: RI – Recordable Indication; NRI – No Recordable Indication; IO – Information Only

3.7.6 Unit 1 IWE Examination RFO A1R20, Spring 2018

The purpose of this inspection is to ensure that the structural integrity of ASME Class MC pressure retaining surfaces and Class CC metallic shell and penetration liners are maintained. Condition Assessment of Class MC and CC components is achieved by performing examinations of the accessible surfaces. All examinations were performed so as to comply with Article IWE of the ASME Boiler and Pressure Vessel Code, Section XI, 2001 Edition through the 2003 Addenda.

The results of previous examinations were reviewed to identify any areas or components that required an augmented or focused examination.

The examination results of the Class MC pressure retaining surfaces and CC shell and penetration liners (including pressure retaining bolting) and MB(s) were reviewed, compared to acceptance standards specified in IWE-3500 of ASME Section XI, 2001 Edition through the 2003 Addenda, and evaluated by the appropriate personnel.

All examinations were completed with satisfactory results as scheduled. No recordable indications (RIs) were found. Performed VT-3 examination of pressure retaining bolted connections in Item E1.11 of Table IWE-2500-1 for 3rd ISI Interval/2nd CISI Interval, 3rd Period, Outage A1R20.

Performed General Visual Examination of Unit 1 liner pressurization pipe caps inside containment at elevation 377' R5, R7, R13, and R20. No recordable indications were found, and caps were found tight.

3.7.7 Unit 2 IWE Examination RFO A2R19, Spring 2017

The purpose of this inspection is to ensure that the structural integrity of ASME Class MC pressure retaining surfaces and Class CC metallic shell and penetration liners are maintained. Condition Assessment of Class MC and CC components is achieved by performing examinations of the accessible surfaces. All examinations were performed so as to comply with Article IWE of the ASME Boiler and Pressure Vessel Code, Section XI, 2001 Edition through the 2003 Addenda.

The results of previous examinations were reviewed to identify any areas or components that required an augmented or focused examination.

The examination results of the Class MC pressure retaining surfaces and CC shell and penetration liners (including pressure retaining bolting) and MB(s) were reviewed, compared to acceptance standards specified in IWE-3500 of ASME Section XI, 2001 Edition through the 2003 Addenda, and evaluated by the appropriate personnel.

A General Visual (GV) inspection was performed on the interior and exterior surfaces of the containment liner. GV examinations of Unit 2 Liner Pressurization Pipe Caps located inside containment at elevation 377' at R26, R28, R34, and R41 were performed. VT-3 examinations of the disassembled bolted connections were performed for 2PC-064M, 2PC-074M, 2PC-098M, 2PC-103M, and 2PC-104M.

Augmented examinations were performed on 110 locations. Approximately 184' of MB was removed for VT-1 and UT examinations. A new MB was installed in Areas 1-17. An Engineering Evaluation was issued for acceptability of liner condition with the conclusion that Unit 2 is acceptable for service through the next operating cycle without any repair/replacement.

The General Visual and Augmented Examinations were completed satisfactorily for CISI Interval 2, Period 3, Outage A2R19. The results of the visual examination of IWE surfaces are detailed in Table 3.7.7-3 below. Note that the contents of Table 3.7.7-3 do not include the results of inspections where there were No Reportable Indications (NRIs).

Moisture Barrier Technical Evaluation

This Engineering Evaluation was prepared to address the resolution of concerns associated with the degraded conditions of the BRW Unit 2 containment liner plate behind the MB identified in A2R16 or A2R17 and re-examined in A2R19 per the corrective actions from refueling outage A2R17. The corrective actions for A2R19 were prescribed in the previous evaluation from A2R17 and are as follows:

> Schedule VT-1 and UT examinations of all containment liner plate indications directly below MB that exhibited metal thickness losses greater than 1/64" in A2R16 and any new indications identified during augmented inspections found during A2R17 that exhibited metal thickness losses greater than 1/64", that were not repaired in A2R17.

During the performance of Augmented Exams (VT-1 and UT) on Unit 2 containment liner indications provided in the previous evaluation from A2R17, additional degradation was found in normally inaccessible areas of liner directly below the MB at elevation 377'-0" that was not repaired as a part of A2R19. The maximum pit depth measured through VT-1 was 4/64". The minimum liner thickness found through UT was 0.197".

Per ASME Section XI Subsection IWE-3511.3, any location with metal loss exceeding or projected to exceed 10% nominal thickness by next exam shall be documented and accepted by engineering evaluation or corrected by repair/replacement. Additionally, ASME Section XI, Subsections IWE-3510.1 and IWE-3511.1, permit establishment of owner-defined acceptance criteria for the Category E-A and E-C visual examinations of the containment surfaces, respectively. BRW's owner-defined acceptance criteria for the liner inspection allow a maximum metal loss of 10/64".

Degraded conditions are defined as areas of the liner plate that exhibit metal loss in excess of 10% of the nominal thickness (i.e., > 1/64") as provided in Section IWE-3122.3(a) of 2001 Edition of ASME Code Section XI through 2003 Addenda. This evaluation addresses the worst-case liner degradation condition found (4/64" metal loss) and applies to all existing degraded surfaces on the liner plate below the MB examined in A2R19. It also provides the scope of future actions and inspection for augmented locations.

Description of Containment Liner and Moisture Barrier

The containment Class CC liner plate is made of ¼" thick SA 516, Grade 60 or equivalent carbon steel and protected by a DBA-qualified Service Level I Carbozinc 11 primer with Carboline Phenoline 305 finish. The containment atmosphere has a relative humidity of 50% during normal operation. The containment interior experiences an average maximum temperature of 120°F during normal operations. Local hot spot temperatures in excess of the 120°F average temperature are possible.

The containment MB is located at the bottom of the interior of the containment structure at Elev. 377'-0". The temperatures in this area are much below the average. The MB is the interface between the containment liner and containment interior concrete base mat, which extends almost the entire circumference of the liner at this elevation. The interface contains an epoxy MB to preclude intrusion of water into an inaccessible area of the liner surface just below the concrete floor at Elev. 377'. The inaccessible area is characterized by a 2" gap between the liner and concrete base mat.

Summary of the Conditions for this Evaluation

The containment liner plate condition is required to be assessed periodically based on the requirements of Sub-Section IWE of Section XI of the ASME Code. Prior liner plate examinations at BRW have resulted in identification of liner plate areas where the metal thickness had losses in excess of the 10% of its nominal thickness and have required evaluation for acceptability. An engineering evaluation was performed in A2R17 to show acceptability of liner plate areas that exceeded the acceptance standard of a maximum 10% nominal metal thickness loss, determine the extent of conditions, and provide corrective actions for A2R19, in compliance with the requirements of 2001 Edition of ASME Code Section XI, Subsection IWE with 2003 Addenda and 10 CFR 50.55(a).

The following actions were taken in A2R19 refueling outage:

1) Approximately 184' of the MB was removed to perform visual examinations and ultrasonic testing on the normally inaccessible areas of the liner directly below the MB at Outside Missile Barrier (OMB) Elev. 377'. The degraded areas of the liner plate were designated by "Area" numbers 1-17.

2) Detailed Visual (VT-1) and Ultrasonic Testing (UT) were performed at 110 augmented locations previously identified in A2R16 or A2R17 that exhibited metal losses from 2/64" deep to 4/64" deep.

3) Detailed Visual (VT-1) exams were performed to validate if any additional degradation (change in pit depths) has occurred since the previous exams in A2R16 and A2R17. The metal loss was measured as pit depths using a pit gauge.

4) The VT-1 examination results showed additional degradation at only one augmented location (R16-LR33) between Column R35 and R36. The pit depth of the augmented location (R16-LR33) changed from 2/64" (in A2R16) to 3/64" (in A2R19). The remaining 109 augmented locations did not show any change in the pit depths from previous inspections.

5) None of the metal losses exceeded 4/64" and did not require repairs in A2R19. It should be noted that all locations identified in outages A2R14, A2R15, A2R16, or A2R17 to have a metal loss greater than 4/64" were repaired in A2R17.

6) Ultrasonic Testing (UT) was performed to ensure there is no metal degradation on the exterior of the containment liner. UT thickness readings were taken on four spots within a one-by-one-foot grid marked around each augmented location.

7) The UT examination results gave minimum liner plate thickness of 0.197" at augmented location (7-15) between Column R34 and R35. The remaining 109 augmented locations had UT thickness readings of greater than 0.225".

8) All areas examined during A2R19 were found dry with minor changes in coating conditions as compared to previous exams.

Detailed Analysis

Item 1 – Describe the actions taken to implement the corrective actions prescribed in the previous evaluation from A1R18.

Resolution:

Perform VT-1 and UT examinations of all indications identified during augmented inspections discovered in A2R16 and A2R17 and not repaired in A2R17 (See Table 3.7.7-1).

Table 3.7.7-1: Indications Identified during Augmented Inspections Requiring VT-1 and IT Exams during A2R19

Outage	Indications
A2R16	R16-LR12, R16-LR13, R16-LR15, R16-LR16, R16-LR17, R16-LR18, R16-LR20, R16-LR21, R16-LR22, R16-LR23, R16-LR24, R16-LR25, R16-LR26B, R16-R30, R16-LR31, R16-LR32, R16-LR33, R16-LR34, R16-LR35, R16-LR36, R16-LR37, R16-LR39, R16-LR42, R16-LR43, R16-LR50, R16-LR51, R16-LR52, R16-LR54b, R16-LR55, R16-LR56b, R16-LR58, R16-LR59, R16-LR61, R16-LR62, R16-LR63a, R16-LR63b, R16-LR65, R16-LR67, R16-LR68, R16-LR71, R16-LR72a, R16-LR75a, R16-LR75b, R16-LR75c
A2R17	1-2, 1-3, 1-4, 1-5, 1-6, 1-8, 1-9, 1-10, 1-11, 1-12, 2-1, 2-3, 2-4, 2-5, 2-6, 2-7, 3a, 3b, 3c, 3d, 3f, 3g, 3h, 5-1, 6-1, 6-2, 6-3, 6-4, 7-2, 7-4, 7-9, 7-10, 7-11, 7-12, 7-13, 7-14, 7-15, 7-16, 7-17, 7-18, 7-19, 7-20, 7-21, 7-22, 8-1, 8-4, 8-5, 9-1, 9-2, 9-3, 9-4, 9-5, 12-1, 12-3, 12-4, 12-5, 12-6, 12-7, 12-8, 12-9, 12-10, 12-11, 12-12,12-13, 12-14, 12-15

The scope of IWE augmented exams in A2R19 was developed through the review of previous evaluations from A2R16 and A2R17. VT-1 and UT examinations were performed at 110 augmented locations (as shown above in Table 3.7.7-1), which were previously examined in A2R16 or A2R17, had pit depths from 2/64" to 4/64", and were not repaired in A2R17.

Item 2 – Evaluate and accept the degraded conditions of the liner plate below the MB in the Unit 2 Containment that were identified and not repaired during the performance of the corrective actions during the A2R19 outage. This evaluation is in accordance with the requirements of Section IWE-3122.3 of the 2001 Edition of ASME Code Section XI, with 2003 Addenda.

Resolution:

Results of the VT-1 exams showed additional metal loss of 1/64" at augmented location (R16-LR33) between Columns R35 and R36. The pit depth of the augmented location (R16-LR33) changed from 2/64" in A2R16 to 3/64" in A2R19. Based on the change in measured pit depth, this location will remain as augmented and be scheduled for examination again next CISI inspection period. The remaining 109 augmented locations did not show any change in the pit depths from previous inspections and will no longer require augmented examinations. The metal losses of 2/64" to 4/64" measured through VT-1 were acceptable and did not require any repair.

The minimum liner plate thickness of 0.197" was obtained at augmented location (7-15) between Columns R34 and R35. The metal loss at augmented location (7-15) exceeded the Acceptance Standard of maximum 10% nominal thickness for Ultrasonic Examination (IWE-3511.3). The reason why the UT reading came out less than 0.225" was due to the previously identified pitting on the interior of the liner, which was 2/64" deep to 4/64" deep. Adding this known pitting to the UT measurement gave the liner thickness between 0.228" to 0.260", which was in the acceptable range. Therefore, it was not indicative of metal degradation from the exterior of the liner. The remaining 109 augmented locations had UT thickness readings of greater than 0.225".

The following UT results in Table 3.7.7-2 are for the augmented locations from A2R19 where the liner plate thickness measurements fell below the nominal thickness by 5% or more.

Table 3.7.7-2: UT Exam Results for Augmented Locations from A2R19 where the Liner Plate Thickness Measurements Fell Below the Nominal Thickness by 5% or More

Area	Radius	Location	Minimum Thickness (inches)	% Reduction
10	R34-R35	7-15	0.197	21.2%
10	R35-R36	R16-LR32	0.236	5.6%
10	R35-R36	R16-LR33	0.236	5.6%

The maximum metal loss measured through VT-1 and UT exams in A2R19 was 4/64" (0.0625") and is acceptable per the evaluation, which allows for a maximum metal loss of 10/64" (0.15625"). There is still a margin of 0.09375" (0.15625" minus 0.0625") left until the liner condition becomes unacceptable and requires another engineering evaluation or repairs for disposition. Since the maximum measured metal loss examined during A2R19 did not exceed 10/64", the liner plate conditions as documented in this evaluation are acceptable for all degradations found during A2R19 and the containment remains operational.

The evaluation is the preferred method to address the degraded conditions of the containment liner plate since repair or replacement activities would cause an undue burden in the A2R19 outage schedule and is not required at this time. Any future liner weld repairs considered should be planned during a refueling outage when an Appendix J Type A ILRT is performed.

Item 3 – Accept Unit 2 operation with the liner plate degradation, without additional repair or replacement.

Resolution:

Based on the information provided in this evaluation, it may be concluded that the corrosion on the liner is inactive (i.e., as-found dry conditions, very small affected areas, inconsistent distribution pattern of the pitted areas, etc.) and its degradation rate on the coated surfaces of the liner plate has been reduced to the point of being negligible.

The surfaces of all areas of the liner plate that were exposed below the MB in A2R19 were prepared for application of Keeler and Long 9600 Series coating used for Level I coating in containment. The protective coating is applied to prevent any additional corrosion from taking place. A new MB was installed over these areas to prevent any water intrusion. A GV examination was also performed on the entire MB and no cuts or voids were left in the MB after its installation in A2R19.

Therefore, based on the above, the Unit 2 containment liner is acceptable for full operation until the next CISI inspection period and areas with UTs showing metal losses of up to 0.053". Future augmented exams and corrective actions are specified for future outages.

Supplemental Examinations (per Section IWE-3200)

No supplemental examinations were required during A2R19.

Augmented Examinations (per Section IWE-3122.3)

The augmented locations identified in A2R16 and A2R17 were re-examined during A2R19 to ensure no additional degradation had taken place. Based on the results of VT-1 and UT examinations, only one augmented location (R16-LR33) showed additional degradation and, therefore, will remain augmented for the next CISI inspection period. The remaining 109 locations examined in A2R19 remain essentially unchanged from the last CISI inspection period and will no longer require augmented examinations in accordance with Section IWE-2420(c).

Corrective Actions in A2R19

1) Approximately 184" of liner plate directly below the MB was examined through Detailed Visual (VT-1) after the MB was removed.

2) Ultrasonic Testing (UT) was performed to provide actual liner plate thicknesses in the vicinity of the pitted areas that were classified as augmented in A2R16 or A2R17.

3) This evaluation was completed to provide justification for the acceptability of the containment liner plate at its thinnest location without any further repair or replacement, and for operation of Unit 2 until the next CISI inspection period.

4) The liner surfaces at all the exposed locations where the MB had been removed were coated with Keeler and Long 9600 Series Level I coating along with new Cerafibre.

5) A new MB was installed at all areas where the previous MB was removed. A VT-3 exam was performed after the installation of new MB and no cracks or voids were found to allow water intrusion.

6) Portions of Class CC liner below the MB have been categorized as Category E-C in ISI schedule.

Corrective Actions for A2R21 or A2R22

Schedule VT-1 and UT examinations of augmented location (R16-LR33) between Columns R35 and R36 on containment liner plate directly below MB during outage A2R21 or A2R22.

Extent of Condition

Per 10 CFR 50.55(a), paragraph (b)(2)(ix)(A)(1), 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.

As described earlier, all containment liner plate degraded areas directly below the MB have now been examined directly by the VT-1 examination method in outages A2R14 through A2R19. There are no remaining inaccessible areas of the containment liner plate directly below the MB that were not examined in these outages. All areas examined in these outages were found dry with no active corrosion. Areas found in outages A2R14, A2R15, A2R16, and A2R17 to have a metal loss of greater than 4/64" were repaired in A2R17. All remaining augmented areas from A2R16 and A2R17 were examined in A2R19.

ATTACHMENT 1a
Description and Assessment

Table 3.7.7-3: Unit 2 ISI Containment Inspection Listing, Outage A2R19								
Component ID	**Description**	**ASME Class**	**ASME Category**	**ASME Item No.**	**Required Exam**	**Actual Exam**	**Results (1)**	**Comments**
2LINER-SURFACE	CONTAINMENT METALLIC LINER SURFACE	CC	E-A	E01.11	GV	GV, GV, GV, GV, GV, GV, GV, GV	IO, NRI, NRI, IO, NRI, NRI, IO, IO	GV performed on 04/24/2017, 04/25/2017, 04/27/2017, 04/28/2017 and 04/29/2017 was for surfaces inside containment. Peeling paint in localized spots, primer remains intact. Surface rust to the right of R-38 at Elev. 426', no loss of metal. One spot behind drain pipe at Elev. 377' with surface corrosion, no loss of material. Surface corrosion at 183°, 203° Elev. 494' and 90° Elev. 520', no loss of metal. Acceptable per Responsible Individual.
2EH-ASSEMBLY-SURFACE	EQUIPMENT HATCH - SURFACE	MC	E-A	E01.11	GV	GV, VT-3	NRI, IO	GV performed on 04/28/2017 was for surface outside and inside containment. VT-3 performed on the disassembled flange surface on 04/29/2017. Minor scratches at 6 o'clock, not in seating area. Acceptable per Responsible Individual.
2EPALID-ASSEMBLY-SURFACE	EMERGENCY PERSONNEL AIR LOCK INTERIOR DOOR	MC	E-A	E01.11	GV	GV	IO	GV performed on 04/28/2017 was for surfaces outside and inside containment. Surface rust and missing coating around upper and lower test penetrations. Acceptable per Responsible Individual.
2E-049-SURFACE	ELECTRICAL PENETRATION	MC	E-A	E01.11	GV	GV, GV	IO, NRI	GV performed on 04/26/2017 was for surfaces outside containment. Surface corrosion on bottom center under the support of Electrical Pen. 49; no loss of material. GV performed on 04/27/2017 was for surfaces inside containment. Acceptable per Responsible Individual.
2PC-001-SURFACE	PIPE PENETRATION	MC	E-A	E01.11	GV	GV, GV	IO, NRI	GV performed on 04/27/2017 was for surfaces outside containment. Missing coating in various places with surface corrosion; no loss of material. GV performed on 04/24/2017 was for surfaces inside containment. Acceptable per Responsible Individual.
2PC-002-SURFACE	PIPE PENETRATION	MC	E-A	E01.11	GV	GV, GV	IO, NRI	GV performed on 04/27/2017 was for surfaces outside containment. Missing coating in various places with surface corrosion; no loss of material. GV performed on 04/24/2017 was for surfaces inside containment. Acceptable per Responsible Individual.

Table 3.7.7-3: Unit 2 ISI Containment Inspection Listing, Outage A2R19								
Component ID	**Description**	**ASME Class**	**ASME Category**	**ASME Item No.**	**Required Exam**	**Actual Exam**	**Results [1]**	**Comments**
2PC-003-SURFACE	PIPE PENETRATION	MC	E-A	E01.11	GV	GV, GV	IO, NRI	GV performed on 04/27/2017 was for surfaces outside containment. Missing coating in various places with surface corrosion; no loss of material. GV performed on 04/24/2017 was for surfaces inside containment. Acceptable per Responsible Individual.
2PC-004-SURFACE	PIPE PENETRATION	MC	E-A	E01.11	GV	GV, GV	IO, NRI	GV performed on 04/27/2017 was for surfaces outside containment. Missing coating in various places with surface corrosion; no loss of material. GV performed on 04/24/2017 was for surfaces inside containment. Acceptable per Responsible Individual.
2PC-005-SURFACE	PIPE PENETRATION	MC	E-A	E01.11	GV	GV, GV	IO, NRI	GV performed on 04/27/2017 was for surfaces outside containment. Missing coating in various places with surface corrosion; no loss of material. GV performed on 04/24/2017 was for surfaces inside containment. Acceptable per Responsible Individual.
2PC-006-SURFACE	PIPE PENETRATION	MC	E-A	E01.11	GV	GV, GV	IO, NRI	GV performed on 04/27/2017 was for surfaces outside containment. Missing coating in various places with surface corrosion; no loss of material. GV performed on 04/24/2017 was for surfaces inside containment. Acceptable per Responsible Individual.
2PC-007-SURFACE	PIPE PENETRATION	MC	E-A	E01.11	GV	GV, GV	IO, NRI	GV performed on 04/27/2017 was for surfaces outside containment. Missing coating in various places with surface corrosion; no loss of material. GV performed on 04/24/2017 was for surfaces inside containment. Acceptable per Responsible Individual.
2PC-008-SURFACE	PIPE PENETRATION	MC	E-A	E01.11	GV	GV, GV	IO, NRI	GV performed on 04/27/2017 was for surfaces outside containment. Missing coating in various places with surface corrosion; no loss of material. GV performed on 04/24/2017 was for surfaces inside containment. Acceptable per Responsible Individual.
2PC-009-SURFACE	PIPE PENETRATION	MC	E-A	E01.11	GV	GV, GV	IO, NRI	GV performed on 04/27/2017 was for surfaces outside containment. Missing coating in various places with surface corrosion; no loss of material. GV performed on 04/24/2017 was for surfaces inside containment. Acceptable per Responsible Individual.

Table 3.7.7-3: Unit 2 ISI Containment Inspection Listing, Outage A2R19								
Component ID	**Description**	**ASME Class**	**ASME Category**	**ASME Item No.**	**Required Exam**	**Actual Exam**	**Results** (1)	**Comments**
2PC-010-SURFACE	PIPE PENETRATION	MC	E-A	E01.11	GV	GV, GV	IO, NRI	GV performed on 04/27/2017 was for surfaces outside containment. Missing coating in various places with surface corrosion; no loss of material. GV performed on 04/24/2017 was for surfaces inside containment. Acceptable per Responsible Individual.
2PC-011-SURFACE	PIPE PENETRATION	MC	E-A	E01.11	GV	GV, GV	IO, NRI	GV performed on 04/27/2017 was for surfaces outside containment. Missing coating in various places with surface corrosion; no loss of material. GV performed on 04/24/2017 was for surfaces inside containment. Acceptable per Responsible Individual.
2PC-012-SURFACE	PIPE PENETRATION	MC	E-A	E01.11	GV	GV, GV	IO, NRI	GV performed on 04/27/2017 was for surfaces outside containment. Missing coating in various places with surface corrosion, no loss of material. GV performed on 04/24/2017 was for surfaces inside containment. Acceptable per Responsible Individual.
2PC-013-SURFACE	PIPE PENETRATION	MC	E-A	E01.11	GV	GV, GV	IO, NRI	GV performed on 04/27/2017 was for surfaces outside containment. Missing coating in various places with surface corrosion; no loss of material. GV performed on 04/24/2017 was for surfaces inside containment. Acceptable per Responsible Individual.
2PC-014-SURFACE	PIPE PENETRATION	MC	E-A	E01. 11	GV	GV, GV	IO, NRI	GV performed on 04/27/2017 was for surfaces outside containment. Missing coating in various places with surface corrosion; no loss of material. GV performed on 04/24/2017 was for surfaces inside containment. Acceptable per Responsible Individual.
2PC-015-SURFACE	PIPE PENETRATION	MC	E-A	E01.11	GV	GV, GV	IO, NRI	GV performed on 04/27/2017 was for surfaces outside containment. Missing coating in various places with surface corrosion; no loss of material. GV performed on 04/24/2017 was for surfaces inside containment. Acceptable per Responsible Individual.
2PC-016-SURFACE	PIPE PENETRATION	MC	E-A	E01. 11	GV	GV, GV	IO, NRI	GV performed on 04/27/2017 was for surfaces outside containment. Missing coating in various places with surface corrosion; no loss of material. GV performed on 04/24/2017 was for surfaces inside containment. Acceptable per Responsible Individual.

Table 3.7.7-3: Unit 2 ISI Containment Inspection Listing, Outage A2R19								
Component ID	**Description**	**ASME Class**	**ASME Category**	**ASME Item No.**	**Required Exam**	**Actual Exam**	**Results [1]**	**Comments**
2PC-018-SURFACE	PIPE PENETRATION	MC	E-A	E01.11	GV	GV, GV	IO, NRI	GV performed on 04/27/2017 was for surfaces outside containment. Missing coating in various places with surface corrosion; no loss of material. GV performed on 04/24/2017 was for surfaces inside containment. Acceptable per Responsible Individual.
2PC-019-SURFACE	PIPE PENETRATION	MC	E-A	E01.11	GV	GV, GV	IO, NRI	GV performed on 04/27/2017 was for surfaces outside containment. Missing coating in various places with surface corrosion; no loss of material. GV performed on 04/24/2017 was for surfaces inside containment. Acceptable per Responsible Individual.
2PC-021-SURFACE	PIPE PENETRATION	MC	E-A	E01.11	GV	GV, GV	IO, NRI	GV performed on 04/27/2017 was for surfaces outside containment. Missing coating in various places with surface corrosion; no loss of material. GV performed on 04/24/2017 was for surfaces inside containment. Acceptable per Responsible Individual.
2PC-022-SURFACE	PIPE PENETRATION	MC	E-A	E01.11	GV	GV, GV	IO, NRI	GV performed on 04/27/2017 was for surfaces outside containment. Missing coating in various places with surface corrosion; no loss of material. GV performed on 04/24/2017 was for surfaces inside containment. Acceptable per Responsible Individual.
2PC-023-SURFACE	PIPE PENETRATION	MC	E-A	E01.11	GV	GV, GV	IO, NRI	GV performed on 04/27/2017 was for surfaces outside containment. Missing coating in various places with surface corrosion; no loss of material. GV performed on 04/24/2017 was for surfaces inside containment. Acceptable per Responsible Individual.
2PC-024-SURFACE	PIPE PENETRATION	MC	E-A	E01.11	GV	GV, GV	IO, NRI	GV performed on 04/27/2017 was for surfaces outside containment. Missing coating in various places with surface corrosion; no loss of material. GV performed on 04/24/2017 was for surfaces inside containment. Acceptable per Responsible Individual.
2PC-025-SURFACE	PIPE PENETRATION	MC	E-A	E01.11	GV	GV, GV	IO, NRI	GV performed on 04/27/2017 was for surfaces outside containment. Missing coating in various places with surface corrosion; no loss of material. GV performed on 04/24/2017 was for surfaces inside containment. Acceptable per Responsible Individual.

Table 3.7.7-3: Unit 2 ISI Containment Inspection Listing, Outage A2R19								
Component ID	**Description**	**ASME Class**	**ASME Category**	**ASME Item No.**	**Required Exam**	**Actual Exam**	**Results [1]**	**Comments**
2PC-026-SURFACE	PIPE PENETRATION	MC	E-A	E01.11	GV	GV, GV	IO, NRI	GV performed on 04/27/2017 was for surfaces outside containment. Missing coating in various places with surface corrosion; no loss of material. GV performed on 04/24/2017 was for surfaces inside containment. Acceptable per Responsible Individual.
2PC-027-SURFACE	PIPE PENETRATION	MC	E-A	E01.11	GV	GV, GV	IO, NRI	GV performed on 04/27/2017 was for surfaces outside containment. Missing coating in various places with surface corrosion; no loss of material. GV performed on 04/24/2017 was for surfaces inside containment. Acceptable per Responsible Individual.
2PC-028-SURFACE	PIPE PENETRATION	MC	E-A	E01.11	GV	GV, GV	IO, NRI	GV performed on 04/27/2017 was for surfaces outside containment. Missing coating in various places with surface corrosion; no loss of material. GV performed on 04/24/2017 was for surfaces inside containment. Acceptable per Responsible Individual.
2PC-029-SURFACE	PIPE PENETRATION	MC	E-A	E01.11	GV	GV, GV	IO, NRI	GV performed on 04/27/2017 was for surfaces outside containment. Missing coating in various places with surface corrosion; no loss of material. GV performed on 04/24/2017 was for surfaces inside containment. Acceptable per Responsible Individual.
2PC-030-SURFACE	PIPE PENETRATION	MC	E-A	E01.11	GV	GV, GV	IO, NRI	GV performed on 04/27/2017 was for surfaces outside containment. Missing coating in various places with surface corrosion; no loss of material. GV performed on 04/24/2017 was for surfaces inside containment. Acceptable per Responsible Individual.
2PC-031-SURFACE	PIPE PENETRATION	MC	E-A	E01.11	GV	GV, GV	IO, NRI	GV performed on 04/27/2017 was for surfaces outside containment. Missing coating in various places with surface corrosion; no loss of material. GV performed on 04/24/2017 was for surfaces inside containment. Acceptable per Responsible Individual.
2PC-032-SURFACE	PIPE PENETRATION	MC	E-A	E01.11	GV	GV, GV	IO, NRI	GV performed on 04/27/2017 was for surfaces outside containment. Missing coating in various places with surface corrosion; no loss of material. GV performed on 04/24/2017 was for surfaces inside containment. Acceptable per Responsible Individual.

Table 3.7.7-3: Unit 2 ISI Containment Inspection Listing, Outage A2R19								
Component ID	**Description**	**ASME Class**	**ASME Category**	**ASME Item No.**	**Required Exam**	**Actual Exam**	**Results (1)**	**Comments**
2PC-033-SURFACE	PIPE PENETRATION	MC	E-A	E01.11	GV	GV, GV	IO, NRI	GV performed on 04/27/2017 was for surfaces outside containment. Missing coating in various places with surface corrosion; no loss of material. GV performed on 04/24/2017 was for surfaces inside containment. Acceptable per Responsible Individual.
2PC-034-SURFACE	PIPE PENETRATION	MC	E-A	E01.11	GV	GV, GV	IO, NRI	GV performed on 04/27/2017 was for surfaces outside containment. Missing coating in various places with surface corrosion; no loss of material. GV performed on 04/24/2017 was for surfaces inside containment. Acceptable per Responsible Individual.
2PC-036-SURFACE	PIPE PENETRATION	MC	E-A	E01.11	GV	GV, GV	IO, NRI	GV performed on 04/27/2017 was for surfaces outside containment. Missing coating in various places with surface corrosion; no loss of material. GV performed on 04/24/2017 was for surfaces inside containment. Acceptable per Responsible Individual.
2PC-037-SURFACE	PIPE PENETRATION	MC	E-A	E01.11	GV	GV, GV	IO, NRI	GV performed on 04/27/2017 was for surfaces outside containment. Missing coating in various places with surface corrosion; no loss of material. GV performed on 04/24/2017 was for surfaces inside containment. Acceptable per Responsible Individual.
2PC-039-SURFACE	PIPE PENETRATION	MC	E-A	E01.11	GV	GV, GV	IO, NRI	GV performed on 04/27/2017 was for surfaces outside containment. Missing coating in various places with surface corrosion; no loss of material. GV performed on 04/24/2017 was for surfaces inside containment. Acceptable per Responsible Individual.
2PC-041-SURFACE	PIPE PENETRATION	MC	E-A	E01.11	GV	GV, GV	IO, NRI	GV performed on 04/27/2017 was for surfaces outside containment. Missing coating in various places with surface corrosion; no loss of material. GV performed on 04/24/2017 was for surfaces inside containment. Acceptable per Responsible Individual.
2PC-042-SURFACE	PIPE PENETRATION	MC	E-A	E01.11	GV	GV, GV	IO, NRI	GV performed on 04/27/2017 was for surfaces outside containment. Missing coating in various places with surface corrosion; no loss of material. GV performed on 04/24/2017 was for surfaces inside containment. Acceptable per Responsible Individual.

Table 3.7.7-3: Unit 2 ISI Containment Inspection Listing, Outage A2R19								
Component ID	**Description**	**ASME Class**	**ASME Category**	**ASME Item No.**	**Required Exam**	**Actual Exam**	**Results [(1)]**	**Comments**
2PC-043-SURFACE	PIPE PENETRATION	MC	E-A	E01.11	GV	GV, GV	IO, NRI	GV performed on 04/27/2017 was for surfaces outside containment. Missing coating in various places with surface corrosion; no loss of material. GV performed on 04/24/2017 was for surfaces inside containment. Acceptable per Responsible Individual.
2PC-044-SURFACE	PIPE PENETRATION	MC	E-A	E01.11	GV	GV, GV	IO, NRI	GV performed on 04/27/2017 was for surfaces outside containment. Missing coating in various places with surface corrosion; no loss of material. GV performed on 04/24/2017 was for surfaces inside containment. Acceptable per Responsible Individual.
2PC-045-SURFACE	PIPE PENETRATION	MC	E-A	E01.11	GV	GV, GV	IO, NRI	GV performed on 04/27/2017 was for surfaces outside containment. Missing coating in various places with surface corrosion; no loss of material. GV performed on 04/24/2017 was for surfaces inside containment. Acceptable per Responsible Individual.
2PC-047-SURFACE	PIPE PENETRATION	MC	E-A	E01.11	GV	GV, GV	IO, NRI	GV performed on 04/27/2017 was for surfaces outside containment. Missing coating in various places with surface corrosion; no loss of material. GV performed on 04/24/2017 was for surfaces inside containment. Acceptable per Responsible Individual.
2PC-048-SURFACE	PIPE PENETRATION	MC	E-A	E01.11	GV	GV, GV	IO, NRI	GV performed on 04/27/2017 was for surfaces outside containment. Missing coating in various places with surface corrosion; no loss of material. GV performed on 04/24/2017 was for surfaces inside containment. Acceptable per Responsible Individual.
2PC-049-SURFACE	PIPE PENETRATION	MC	E-A	E01.11	GV	GV, GV	IO, NRI	GV performed on 04/27/2017 was for surfaces outside containment. Missing coating in various places with surface corrosion; no loss of material. GV performed on 04/24/2017 was for surfaces inside containment. Acceptable per Responsible Individual.
2PC-050-SURFACE	PIPE PENETRATION	MC	E-A	E01.11	GV	GV, GV	IO, NRI	GV performed on 04/27/2017 was for surfaces outside containment. Missing coating in various places with surface corrosion; no loss of material. GV performed on 04/24/2017 was for surfaces inside containment. Acceptable per Responsible Individual.

Table 3.7.7-3: Unit 2 ISI Containment Inspection Listing, Outage A2R19								
Component ID	**Description**	**ASME Class**	**ASME Category**	**ASME Item No.**	**Required Exam**	**Actual Exam**	**Results** (1)	**Comments**
2PC-051-SURFACE	PIPE PENETRATION	MC	E-A	E01.11	GV	GV, GV	IO, NRI	GV performed on 04/27/2017 was for surfaces outside containment. Missing coating in various places with surface corrosion; no loss of material. GV performed on 04/24/2017 was for surfaces inside containment. Acceptable per Responsible Individual.
2PC-052-SURFACE	PIPE PENETRATION	MC	E-A	E01.11	GV	GV, GV	IO, NRI	GV performed on.04/27/2017 was for surfaces outside containment. Missing coating in various places with surface corrosion; no loss of material. GV performed on 04/24/2017 was for surfaces inside containment. Acceptable per Responsible Individual.
2PC-053-SURFACE	PIPE PENETRATION	MC	E-A	E01.11	GV	GV, GV	IO, NRI	GV performed on 04/27/2017 was for surfaces outside containment. Missing coating in various places with surface corrosion; no loss of material. GV performed on 04/24/2017 was for surfaces inside containment. Acceptable per Responsible Individual.
2PC-054-SURFACE	PIPE PENETRATION	MC	E-A	E01.11	GV	GV, GV	IO, NRI	GV performed on 04/27/2017 was for surfaces outside containment. Missing coating in various places with surface corrosion; no loss of material. GV performed on 04/24/2017 was for surfaces inside containment. Acceptable per Responsible Individual.
2PC-055-SURFACE	PIPE PENETRATION	MC	E-A	E01.11	GV	GV, GV	IO, NRI	GV performed on 04/27/2017 was for surfaces outside containment. Missing coating in various places with surface corrosion; no loss of material. GV performed on 04/24/2017 was for surfaces inside containment. Acceptable per Responsible Individual.
2PC-056-SURFACE	PIPE PENETRATION	MC	E-A	E01.11	GV	GV, GV	IO, NRI	GV performed on 04/27/2017 was for surfaces outside containment. Missing coating in various places with surface corrosion; no loss of material. GV performed on 04/24/2017 was tor surfaces inside containment. Acceptable per Responsible Individual.
2PC-057-SURFACE	PIPE PENETRATION	MC	E-A	E01.11	GV	GV, GV	IO, NRI	GV performed on 04/27/2017 was tor surfaces outside containment. Missing coating in various places with surface corrosion; no loss of material. GV performed on 04/24/2017 was tor surfaces inside containment. Acceptable per Responsible Individual.

Table 3.7.7-3: Unit 2 ISI Containment Inspection Listing, Outage A2R19								
Component ID	**Description**	**ASME Class**	**ASME Category**	**ASME Item No.**	**Required Exam**	**Actual Exam**	**Results (1)**	**Comments**
2PC-059-SURFACE	PIPE PENETRATION	MC	E-A	E01.11	GV	GV, GV	IO, NRI	GV performed on 04/27/2017 was tor surfaces outside containment. Missing coating in various places with surface corrosion; no loss of material. GV performed on 04/24/2017 was for surfaces inside containment. Acceptable per Responsible Individual.
2PC-060-SURFACE	PIPE PENETRATION	MC	E-A	E01.11	GV	GV, GV	IO, NRI	GV performed on 04/27/2017 was for surfaces outside containment. Missing coating in various places with surface corrosion; no loss of material. GV performed on 04/24/2017 was for surfaces inside containment. Acceptable per Responsible Individual.
2PC-061-SURFACE	PIPE PENETRATION	MC	E-A	E01.11	GV	GV, GV	IO, NRI	GV performed on 04/27/2017 was for surfaces outside containment. Missing coating in various places with surface corrosion; no loss of material. GV performed on 04/24/2017 was for surfaces inside containment. Acceptable per Responsible Individual.
2PC-063-HDBOLTING	PIPE PENETRATION BOLTING	MC	E-A	E01.11	GV	GV, GV	IO, NRI	GV performed on 04/27/2017 was for surfaces outside containment. Missing coating in various places with surface corrosion; no loss of material. GV performed on 04/24/2017 was for surfaces inside containment. Acceptable per Responsible Individual.
2PC-063-SURFACE	PIPE PENETRATION	MC	E-A	E01.11	GV	GV, GV	IO, NRI	GV performed on 04/27/2017 was for surfaces outside containment. Missing coating in various places with surface corrosion; no loss of material. GV performed on 04/24/2017 was for surfaces inside containment. Acceptable per Responsible Individual.
2PC-064-HDBOLTING	PIPE PENETRATION BOLTING	MC	E-A	E01.11	GV	GV, GV, VT-3	NRI, IO, NRI	GV performed on 04/27/2017 was for bolting outside containment. GV performed on 04/27/2017 was for bolting inside containment. VT-3 performed on the disassembled bolting on 04/24/2017. Acceptable per Responsible Individual.
2PC-065-SURFACE	PIPE PENETRATION	MC	E-A	E01.11	GV	GV, GV	IO, NRI	GV performed on 04/27/2017 was for surfaces outside containment. Missing coating in various places with surface corrosion; no loss of material. GV performed on 04/24/2017 was for surfaces inside containment. Acceptable per Responsible Individual.

Table 3.7.7-3: Unit 2 ISI Containment Inspection Listing, Outage A2R19								
Component ID	**Description**	**ASME Class**	**ASME Category**	**ASME Item No.**	**Required Exam**	**Actual Exam**	**Results (1)**	**Comments**
2PC-066-SURFACE	PIPE PENETRATION	MC	E-A	E01.11	GV	GV, GV	IO, NRI	GV performed on 04/27/2017 was for surfaces outside containment. Missing coating in various places with surface corrosion; no loss of material. GV performed on 04/24/2017 was for surfaces inside containment. Acceptable per Responsible Individual.
2PC-068-SURFACE	PIPE PENETRATION	MC	E-A	E01.11	GV	GV, GV	IO, NRI	GV performed on 04/27/2017 was for surfaces outside containment. Missing coating in various places with surface corrosion; no loss of material. GV performed on 04/24/2017 was for surfaces inside containment. Acceptable per Responsible Individual.
2PC-069-SURFACE	PIPE PENETRATION	MC	E-A	E01.11	GV	GV, GV	IO, NRI	GV performed on 04/27/2017 was for surfaces outside containment. Missing coating in various places with surface corrosion; no loss of material. GV performed on 04/24/2017 was for surfaces inside containment. Acceptable per Responsible Individual.
2PC-070-SURFACE	PIPE PENETRATION	MC	E-A	E01.11	GV	GV, GV	IO, NRI	GV performed on 04/27/2017 was for surfaces outside containment. Missing coating in various places with surface corrosion; no loss of material. GV performed on 04/24/2017 was for surf aces inside containment. Acceptable per Responsible Individual.
2PC-071-SURFACE	PIPE PENETRATION	MC	E-A	E01.11	GV	GV, GV	IO, NRI	GV performed on 04/27/2017 was for surfaces outside containment. Missing coating in various places with surface corrosion; no loss of material. GV performed on 04/24/2017 was for surfaces inside containment. Acceptable per Responsible Individual.
2PC-072-SURFACE	PIPE PENETRATION	MC	E-A	E01.11	GV	GV, GV	IO, NRI	GV performed on 04/27/2017 was for surfaces outside containment. Missing coating in various places with surface corrosion; no loss of material. GV performed on 04/24/2017 was for surfaces inside containment. Acceptable per Responsible Individual.
2PC-073-SURFACE	PIPE PENETRATION	MC	E-A	E01.11	GV	GV, GV	IO, NRI	GV performed on 04/27/2017 was for surfaces outside containment. Missing coating in various places with surface corrosion; no loss of material. GV performed on 04/24/2017 was for surfaces inside containment. Acceptable per Responsible Individual.

Table 3.7.7-3: Unit 2 ISI Containment Inspection Listing, Outage A2R19								
Component ID	**Description**	**ASME Class**	**ASME Category**	**ASME Item No.**	**Required Exam**	**Actual Exam**	**Results [1]**	**Comments**
2PC-075-SURFACE	PIPE PENETRATION	MC	E-A	E01.11	GV	GV, GV	IO, NRI	GV performed on 04/27/2017 was for surfaces outside containment. Missing coating in various places with surface corrosion; no loss of material. GV performed on 04/24/2017 was for surfaces inside containment. Acceptable per Responsible Individual.
2PC-076-SURFACE	PIPE PENETRATION	MC	E-A	E01.11	GV	GV, GV	IO, NRI	GV performed on 04/27/2017 was for surfaces outside containment. Surface rust on Pipe Penetration 76; no loss of metal. GV performed on 04/24/2017 was for surfaces inside containment. Acceptable per Responsible Individual.
2PC-077-SURFACE	PIPE PENETRATION	MC	E-A	E01.11	GV	GV, GV	IO, NRI	GV performed on 04/27/2017 was for surfaces outside containment. Surface rust on Pipe Penetration 77; no loss of metal. GV performed on 04/24/2017 was for surfaces inside containment. Acceptable per Responsible Individual.
2PC-078-SURFACE	PIPE PENETRATION	MC	E-A	E01.11	GV	GV, GV	IO, NRI	GV performed on 04/27/2017 was for surfaces outside containment. Surface rust on Pipe Penetration 78; no loss of metal. GV performed on 04/24/2017 was for surfaces inside containment. Acceptable per Responsible Individual.
2PC-085-SURFACE	PIPE PENETRATION	MC	E-A	E01.11	GV	GV, GV	IO, NRI	GV performed on 04/27/2017 was for surfaces outside containment. Peeling paint in spots on Pipe Penetration 85. GV performed on 04/24/2017 was for surfaces inside containment. Acceptable per Responsible Individual.
2PC-086-SURFACE	PIPE PENETRATION	MC	E-A	E01.11	GV	GV, GV	IO, NRI	GV performed on 04/27/2017 was for surfaces outside containment. Peeling paint in spots on Pipe Penetration 86. GV performed on 04/24/2017 was for surfaces inside containment. Acceptable per Responsible Individual.
2PC-087-SURFACE	PIPE PENETRATION	MC	E-A	E01.11	GV	GV, GV	IO, NRI	GV performed on 04/27/2017 was for surfaces outside containment. Peeling paint in spots on Pipe Penetration 87. GV performed on 04/24/2017 was for surfaces inside containment. Acceptable per Responsible Individual.

Table 3.7.7-3: Unit 2 ISI Containment Inspection Listing, Outage A2R19								
Component ID	**Description**	**ASME Class**	**ASME Category**	**ASME Item No.**	**Required Exam**	**Actual Exam**	**Results** (1)	**Comments**
2LINER-MOISTURE-BARRIER	CONTAINMENT LINER MOISTURE BARRIER	CC	E-A	E01.30	GV	GV, GV	RI, NRI	GV performed on 04/24/17 and 04/27/2017 was prior to removal of portion of the MB for augmented exams. Soft area found 4' to the left of R-35 seam weld. The area was removed for A2R19 augmented exams and replaced. GV performed on 05/12/2017 was after the installation of the MB.
2LINER-SURFACE (AUGMENTED) R24-R25	CONTAINMENT METALLIC LINER SURFACE	MC	E-C	E04.11, E04.12	VT-1, VT-1, UT	VT-1, VT-1, UT	RI, RI, NRI	VT-1 and UT exams were performed upon removal of MB areas and paint. Locations (1-2, 1-3, 1-4, 1-5, 1-6, 1-8, 1-9, 1-10, 1-11, 1-12, and R16-LR65) remained essentially unchanged from last inspection period; therefore, no longer require augmented exams per IWE-2420(c). RIs were evaluated and accepted by the Responsible Individual without repair.
2LINER-SURFACE (AUGMENTED) R25-R26	CONTAINMENT METALLIC LINER SURFACE	MC	E-C	E04.11, E04.12	VT-1, VT-1, UT	VT-1, VT-1, UT	RI, RI, NRI	VT-1 and UT exams were performed upon removal of MB areas and paint. Locations (2-1, R16-LR50, 2-3, 2-4, 2-5, 2-6, 2-7, R16-LR54B, R16-LR58, R16-LR59 and R16-LR61) remained essentially unchanged from last inspection period; therefore, no longer require augmented exams per IWE-2420(c). RIs were evaluated and accepted by the Responsible Individual without repair.
2LINER-SURFACE (AUGMENTED) R26-R27	CONTAINMENT METALLIC LINER SURFACE	MC	E-C	E04.11, E04.12	VT-1, UT	VT-1, UT	RI, NRI	VT-1 and UT exams were performed upon removal of MB areas and paint. Locations (R16-LR55, R16-LR56B, R16- LR62, R16-LR67, R16-LR68, R16-LR71, R16-LR72A, R16-LR75A, R16-LR75B and R16-LR75C) remained essentially unchanged from last inspection period; therefore, no longer require augmented exams per IWE-2420(c). RIs were evaluated and accepted by the Responsible Individual without repair.

Table 3.7.7-3: Unit 2 ISI Containment Inspection Listing, Outage A2R19

Component ID	Description	ASME Class	ASME Category	ASME Item No.	Required Exam	Actual Exam	Results (1)	Comments
2LINER-SURFACE (AUGMENTED) R27-R28	CONTAINMENT METALLIC LINER SURFACE	MC	E-C	E04.11, E04.12	VT-1, UT	VT-1, UT	RI, NRI	VT-1 and UT exams were performed upon removal of MB areas and paint. Location (R16-LR51) remained essentially unchanged from last inspection period; therefore, no longer require augmented exams per IWE-2420(c). RIs were evaluated and accepted by the Responsible Individual without repair.
2LINER-SURFACE (AUGMENTED) R28-R29	CONTAINMENT METALLIC LINER SURFACE	MC	E-C	E04.11, E04.12	VT-1, UT	VT-1, UT	RI, NRI	VT-1 and UT exams were performed upon removal of MB areas and paint. Locations (3a, 3b, 3c, 3d, 3f, 3g, 3h, and R16-LR52) remained essentially unchanged from last inspection period; therefore, no longer require augmented exams per IWE-2420(c). RIs were evaluated and accepted by the Responsible Individual without repair.
2LINER-SURFACE (AUGMENTED) R30-R31	CONTAIN ENT METALLIC LINER SURFACE	MC	E-C	E04.11, E04.12	VT-1, UT	VT-1, UT	RI, NRI	VT-1 and UT exams were performed upon removal of MB areas and paint. Locations (R16-LR43) remained essentially unchanged from last inspection period; therefore, no longer require augmented exams per IWE-2420(c). RIs were evaluated and accepted by the Responsible Individual without repair.
2LINER-SURFACE (AUGMENTED) R31-R32	CONTAINMENT METALLIC LINER SURFACE	MC	E-C	E04.11, E04.12	VT-1, UT	VT-1, UT	RI, NRI	VT-1 and UT exams were performed upon removal of MB areas and paint. Location (5-1) remained essentially unchanged from last inspection period; therefore, no longer require augmented exams per IWE-2420(c). RIs were evaluated and accepted by the Responsible Individual without repair.
2LINER-SURFACE (AUGMENTED) R32-R33	CONTAINMENT METALLIC LINER SURFACE	MC	E-C	E04.11, E04.12	VT-1, UT	VT-1, UT	RI, NRI	VT-1 and UT exams were performed upon removal of MB areas and paint. Locations (6-1, 6-2 and 6-3) remained essentially unchanged from last inspection period; therefore, no longer require augmented exams per IWE-2420(c). RIs were evaluated and accepted by the Responsible Individual without repair.

Table 3.7.7-3: Unit 2 ISI Containment Inspection Listing, Outage A2R19								
Component ID	**Description**	**ASME Class**	**ASME Category**	**ASME Item No.**	**Required Exam**	**Actual Exam**	**Results [1]**	**Comments**
2LINER-SURFACE (AUGMENTED) R33-R34	CONTAINMENT METALLIC LINER SURFACE	MC	E-C	E04.11, E04.12	VT-1, VT-1, UT	VT-1, VT-1, UT	RI, RI, NRI	VT-1 and UT exams were performed upon removal of MB areas and paint. Locations (6-4, R16-LR42, R16-LR63A, R16-LR63B, 7-4, 7-20, 7-21, and 7-22) remained essentially unchanged from last inspection period; therefore, no longer require augmented exams per IWE-2420(c). RIs were evaluated and accepted by the Responsible Individual without repair.
2LINER-SURFACE (AUGMENTED) R34-R35	CONTAINMENT METALLIC LINER SURFACE	MC	E-C	E04.11, E04.12	VT-1, UT	VT-1, UT	RI, RI	VT-1 and UT exams were performed upon removal of MB areas and paint. Locations (7-2, 7-9, 7-10, 7-11, 7-12, 7-13, 7-14, 7-15, 7-16, 7-17, 7-18, 7-19, R16-LR34, R16-LR35, and R16-LR36) remained essentially unchanged from last inspection period; therefore, no longer require augmented exams per IWE-2420(c). Metal loss at Location 7-15 exceeded acceptance standard for UT exam. RIs were evaluated and accepted by the Responsible Individual without repair.
2LINER-SURFACE (AUGMENTED) R35-R36	CONTAINMENT METALLIC LINER SURFACE	MC	E-C	E04.11, E04.12	VT-1, VT-1, UT	VT-1, VT-1, UT	RI, RI, NRI	VT-1 and UT exams were performed upon removal of MB areas and paint. Locations (8-5, R16-LR32 and 8-4) remained essentially unchanged from last inspection period; therefore, no longer require augmented exams per IWE-2420(c). Pit depth at Location R16-LR33 changed from 2/64" to 3/64"; therefore, it will remain augmented for next inspection period. RIs were evaluated and accepted by the Responsible Individual without repair.
2LINER-SURFACE (AUGMENTED) R36-R37	CONTAINMENT METALLIC LINER I SURFACE	MC	E-C	E04.11, E04.12	VT-1, VT-1, UT	VT-1, VT-1, UT	RI, RI, NRI	VT-1 and UT exams were performed upon removal of MB areas and paint. Locations (8-1, R16-LR30, R16-LR31 and 9-1) remained essentially unchanged from last inspection period; therefore, no longer require augmented exams per IWE-2420(c). RIs were evaluated and accepted by the Responsible Individual without repair.

Table 3.7.7-3: Unit 2 ISI Containment Inspection Listing, Outage A2R19								
Component ID	**Description**	**ASME Class**	**ASME Category**	**ASME Item No.**	**Required Exam**	**Actual Exam**	**Results** (1)	**Comments**
2LINER-SURFACE (AUGMENTED) R37-R38	CONTAINMENT METALLIC LINER SURFACE	MC	E-C	E04.11, E04.12	VT-1, VT-1, UT	VT-1, VT-1, UT	RI, RI, NRI	VT-1 and UT exams were performed upon removal of MB areas and paint. Locations (9-2, 9-3, 9-4, 9-5, R16-LR13, and R16-LR15) remained essentially unchanged from last inspection period; therefore, no longer require augmented exams per IWE-2420(c). RIs were evaluated and accepted by the Responsible Individual without repair.
2LINER-SURFACE (AUGMENTED) R38-R39	CONTAINMENT METALLIC LINER SURFACE	MC	E-C	E04.11, E04.12	VT-1, UT	VT-1, UT	RI, NRI	VT-1 and UT exams were performed upon removal of MB areas and paint. Locations (R16-LR12, R16-LR16, R16-LR17, and R16-LR18) remained essentially unchanged from last inspection period; therefore, no longer require augmented exams per IWE-2420(c). RIs were evaluated and accepted by the Responsible Individual without repair.
2LINER-SURFACE (AUGMENTED) R39-R40	CONTAINMENT METALLIC LINER SURFACE	MC	E-C	E04.11, E04.12	VT-1, UT	VT-1, UT	RI, NRI	VT-1 and UT exams were performed upon removal of MB areas and paint. Locations (R16-LR20 and R16-LR37) remained essentially unchanged from last inspection period; therefore, no longer require augmented exams per IWE-2420(c). RIs were evaluated and accepted by the Responsible Individual without repair.
2LINER-SURFACE (AUGMENTED) R40-R41	CONTAINMENT METALLIC LINER SURFACE	MC	E-C	E04.11, E04.12	VT-1, UT	VT-1, UT	RI, NRI	VT-1 and UT exams were performed upon removal of MB areas and paint. Locations (R16-LR21, R16-LR22, and R16-LR39) remained essentially unchanged from last inspection period; therefore, no longer require augmented exams per IWE-2420(c). RIs were evaluated and accepted by the Responsible Individual without repair.
2LINER-SURFACE (AUGMENTED) R41-R42	CONTAINMENT METALLIC LINER SURFACE	MC	E-C	E04.11, E04.12	VT-1, UT	VT-1, UT	RI, NRI	VT-1 and UT exams were performed upon removal of MB areas and paint. Locations (R16-LR23, R16-LR24, R16-LR25, and R16-LR26B) remained essentially unchanged from last inspection period; therefore, no longer require augmented exams per IWE-2420(c). RIs were evaluated and accepted by the Responsible Individual without repair.

Table 3.7.7-3: Unit 2 ISI Containment Inspection Listing, Outage A2R19								
Component ID	**Description**	**ASME Class**	**ASME Category**	**ASME Item No.**	**Required Exam**	**Actual Exam**	**Results (1)**	**Comments**
2LINER-SURFACE (AUGMENTED) R42-R22	CONTAINMENT METALLIC LINER SURFACE	MC	E-C	E04.11, E04.12	VT-1, UT	VT-1, UT	RI, NRI	VT-1 and UT exams were performed upon removal of MB areas and paint. Locations (12-1, 12-3, 12-4, 12-5, 12-6, 12-7, 12-8, 12-9, 12-10, 12-11, 12-12, 12-13, 12-14, and 12-15) remained essentially unchanged from last inspection period; therefore, no longer require augmented exams per IWE-2420(c). RIs were evaluated and accepted by the Responsible Individual without repair.

Note 1: RI – Recordable Indication; NRI – No Recordable Indication; IO – Information Only

3.7.8 Unit 2 IWE Examination RFO A2R20, Fall 2018

The purpose of this inspection is to ensure that the structural integrity of ASME Class MC pressure retaining surfaces and Class CC metallic shell and penetration liners are maintained. The Condition Assessment of Class MC and CC components is achieved by performing examinations of the accessible surfaces. All examinations were performed so as to comply with Article IWE of the ASME Boiler and Pressure Vessel Code, Section XI, 2001 Edition through the 2003 Addenda.

The results of previous examinations were reviewed to identify any areas or components that required an augmented or focused examination.

The examination results of the Class MC pressure retaining surfaces and CC shell and penetration liners (including pressure retaining bolting) and MB(s) were reviewed, compared to acceptance standards specified in IWE-3500 of ASME Section XI, 2001 Edition through the 2003 Addenda, and evaluated by the appropriate personnel.

VT-3 examinations of pressure retaining bolted connections in Item E1.11 of Table IWE-2500-1 were performed for the 3rd ISI/2nd CISI Interval, 3rd Period, Outage A2R20. A General Visual (GV) Examination of Unit 2 liner pressurization pipe caps inside containment was performed during A2R19. Therefore, inspection of these caps was not required in A2R20. Minor surface rust was found on electrical penetrations 35 and 42 bolting, but there was no metal loss. These were information only (IO) indications. The identified concerns were reviewed by the Responsible Individual and determined to have no impact on containment structural integrity.

The results of the visual examinations of IWE surfaces are detailed in Table 3.7.8-1 below. Note that the contents of Table 3.7.8-1 do not include the results of inspections where there were No Reportable Indications (NRI).

Table 3.7.8-1: Unit 2 ISI Containment Inspection Listing, Outage A2R20								
Component ID	**Description**	**ASME Class**	**ASME Category**	**ASME Item No.**	**Required Exam**	**Actual Exam**	**Results (1)**	**Comments**
2E-035-HDBOLTING	ELECTRICAL PENETRATION	MC	E-A	E1.11	VT-3	VT-3	IO	Minor surface rust found with no loss of material during VT-3 examination on 10/9/2018. Identified condition was reviewed by Responsible Individual and determined to have no impact on containment structural integrity. Acceptable as is.
2E-042-HDBOLTING	ELECTRICAL PENETRATION	MC	E-A	E1.11	VT-3	VT-3	IO	Minor surface rust found with no loss of material during VT-3 examination on 10/9/2018. Identified condition was reviewed by Responsible Individual and determined to have no impact on containment structural integrity. Acceptable as is.

Note 1: RI – Recordable Indication; NRI – No Recordable Indication; IO – Information Only

3.7.9 Units 1 and 2 IWL Examinations, 2011

BRW completed the 25th Year ASME Class CC examinations and tests for the Units 1 and 2 containment surfaces during 2011. The examinations were performed in accordance with ASME Section XI, 2001 Edition through 2003 Addenda and additional criterion as specified in 10 CFR 50.55a(b)(2)(viii)(E) through (b)(2)(viii)(G). The BRW, Units 1 and 2, Containment structures are post-tensioned concrete designs. The scope of this Evaluation Report includes Examination of Concrete Surfaces as specified in ASME Section XI, IWL-2310 and IWL-2510.

Personnel that examined the containment concrete (CC) surfaces met the qualification provisions specified in ASME Section XI, IWA-2300.

Examination Results and Evaluation – Concrete Surfaces (ASME IWL-2310 and IWL-2510)

Acceptance Standard IWL-3211

The condition of the concrete surface and tendon end anchorage areas is acceptable if the Responsible Engineer determines there is no evidence of damage or degradation, corrosion protection medium leakage, or end cap deformation sufficient to warrant further evaluation or performance of repair/replacement activities.

Discussion: Tables 3.7.9-1 and 3.7.9-2 provide discussion and evaluation of the conditions/indications identified during the General and Detailed examinations performed in accordance with IWL-2310 and IWL-2510.

Conclusions

The results of the examinations revealed no degradation that adversely affects the structural integrity of the containment structures. The conditions/indications are primarily cosmetic in nature. However, conditions/indications were identified that warrant repair in order to mitigate conditions that could result in more significant degradation in the future. Additionally, conditions/indications were identified that warrant monitoring to ensure any worsening conditions are identified prior to the development of more significant degradation in the future.

Recoating of localized areas of Units 1 and 2 containment domes was performed in 2016.
Refer to Tables 3.7.9-1 and 3.7.9-2 for detailed discussion of identified conditions/indications for BRW, Units 1 and 2, respectively.

ATTACHMENT 1a
Description and Assessment

Table 3.7.9-1: Unit 1 Concrete Indications, 2011				
Description of the Condition/Indication	**Cause of Condition that Did Not Meet the Acceptance Standard**	**Applicability to Any Other Plants at the Same Site**	**Whether or Not Repair/Replacement Activity is Required; Extent, Method, and Completion Date for the Repair/Replacement Activity**	**Extent, Nature, and Frequency of Additional Examinations**
NEW INDICATION SINCE 2006 EXAM: Unit 1 Location: Tendon Tunnel/Gallery Ceiling in the vicinity of Tendon Anchorages V-121 and V-122. Evidence of moisture, efflorescence, cracking, and stalactites were observed during General Visual Exams.	Ground water intrusion through the structure resulting in the identified conditions.	Yes, this condition is applicable to and has been discovered in the Unit 2 Tendon Tunnel/Gallery Ceiling.	Areas were cleaned/prepared and Detailed Visual Exams re-performed. DETAILED EXAM RESULTS: 2 cracks approx. 18" long exist. Crack widths do not exceed 0.010"; the presence of moisture was minimal, and no evidence of exposed reinforcing steel or structural distress was observed. As determined by the Registered Professional Engineer (RPE), repair is not warranted at this time. However, annual exams are scheduled to monitor the condition.	The condition will be monitored through annual examinations for evidence of significant changes or degradation. Annual inspections were performed from 2012 to 2015 and showed no changes in conditions from previous exams.
NEW INDICATION SINCE 2006 EXAM: Location: Outdoors, Containment Dome. The coating on the Containment Dome is approaching end of life. Coating is fully intact, but wear spots and light areas with minor indentations/cracks at localized areas in the coatings exist.	Normal wear. The dome coating was last replaced approx. 10 years ago.	Yes, the same condition was identified on the Unit 2 Dome.	Although the coating is fully intact, wear spots evidenced by light areas and minor indentations/cracks at localized areas in the coating; replacement is scheduled to be completed during 2013.	No additional examinations prior to coating replacement are deemed as required.
NEW INDICATION SINCE 2006 EXAM: Grease Leakage (Containment Surface): Location: Outdoor, Northeast Face, first horizontal joint down, approx. 30' to the left of buttress C/AC. Leakage is at a previously placed form tie patch; minor shrinkage crack extends down. Surface area of grease is approx. 8" high x 6" wide. Grease accumulation is conservatively estimated at 1 pint. No evidence of exposed reinforcing steel or structural distress was observed.	Grease seepage/ leakage through minor cracks in the structure between the surface and the tendon sheathing.	Yes, the same condition was identified on the Unit 2 Containment Surface.	Based on RPE review/evaluation, the condition does not warrant repair as it has negligible impact on the structure. With regard to the post-tensioning system, the quantity of grease leakage is small when compared to the volume (> 100 gallons) in each tendon duct. The condition will not result in post-tensioning components becoming uncovered or susceptible to corrosion.	The condition will be monitored through annual examinations for evidence of significant changes or degradation. Annual inspections were performed from 2012 to 2015 and showed no changes in conditions from previous exams.

ATTACHMENT 1a
Description and Assessment

Table 3.7.9-1: Unit 1 Concrete Indications, 2011				
Description of the Condition/Indication	**Cause of Condition that Did Not Meet the Acceptance Standard**	**Applicability to Any Other Plants at the Same Site**	**Whether or Not Repair/Replacement Activity is Required; Extent, Method, and Completion Date for the Repair/Replacement Activity**	**Extent, Nature, and Frequency of Additional Examinations**
NEW INDICATION SINCE 2006 EXAM: Grease Leakage (Containment Surface): Location: Outdoors, East Face or Containment, upper left hand corner of the patch that was placed in support of closure of the steam generator replacement (SGR) project opening. Degradation in the form of pattern cracking (surface area approx. 3'-0" x 3'-0"), a single crack exists (approx. 5'-0" long with minimal width) from a form tie patch down to the edge of the SGR opening patch. Efflorescence exists in localized areas in the pattern cracking, and evidence of grease leakage/staining (no significant accumulation) exists in the vicinity of the crack adjacent to the form tie patch. There is no evidence of structural degradation such as deflection of concrete, significant cracking, settlement, shifting, or exposed reinforcing steel.	Grease seepage/ leakage through minor cracks in the structure between the surface and the tendon sheathing.	Yes, the same condition was identified on the Unit 2 Containment Surface.	Based on RPE review/evaluation, the condition does not warrant repair as it has negligible impact on the structure. With regard to the post-tensioning system, the quantity of grease leakage is small when compared to the volume (> 100 gallons) in each tendon duct. The condition will not result in post-tensioning components becoming uncovered or susceptible to corrosion.	The condition will be monitored through annual examinations for evidence of significant changes or degradation. Annual inspections were performed from 2012 to 2015 and showed no changes in conditions from previous exams.

ATTACHMENT 1a
Description and Assessment

Table 3.7.9-1: Unit 1 Concrete Indications, 2011				
Description of the Condition/Indication	**Cause of Condition that Did Not Meet the Acceptance Standard**	**Applicability to Any Other Plants at the Same Site**	**Whether or Not Repair/Replacement Activity is Required; Extent, Method, and Completion Date for the Repair/Replacement Activity**	**Extent, Nature, and Frequency of Additional Examinations**
CHANGE IN INDICATION SINCE 2006 EXAM: Grease Leakage (Containment Surface): Location: Outdoors, East Face or Containment, upper right hand corner of the patch that was placed in support of closure of the steam generator replacement project opening. The characteristics of the indication have not changed significantly but additional cracking further up, extending from previously identified cracking (tight widths and approx. 2'-0" in length) and additional minor grease staining/leakage within the new cracked area was observed. There are additional localized areas of pattern cracking in the panel adjacent to the indication. No evidence of structural distress or exposed reinforcing steel was identified.	Grease seepage/ leakage through minor cracks in the structure between the surface and the tendon sheathing.	Yes, the same condition was identified on the Unit 2 Containment Surface.	Based on RPE review/evaluation, the condition does not warrant repair as it has negligible impact on the structure. With regard to the post-tensioning system, the quantity of grease leakage is small when compared to the volume (> 100 gallons) in each tendon duct. The change in conditions will not result in post-tensioning components becoming uncovered or susceptible to corrosion.	The condition will continue to be monitored through annual examinations for evidence of significant changes or degradation. Annual inspections were performed from 2012 to 2015 and showed no changes in conditions from previous exams.
MINOR CHANGE IN INDICATION SINCE 2006 EXAM: Grease Leakage (Containment Surface): Location: Outdoors, Horizontal construction joint approx. 30' to the left (south) of the 1B/1C Main Steam Isolation Valve Rooms and up approx. 35' above ground level. The only change from the previous inspection is as expected: the quantity of grease accumulation has slightly increased. It still remains within the quantity (max. 1 quart). There are no significant changes in the characteristics of the previously identified small void/crack. No evidence of structural distress or exposed reinforcing steel was identified.	Grease seepage/ leakage through minor cracks in the structure between the surface and the tendon sheathing.	Yes, the same condition was identified on the Unit 2 Containment Surface.	Based on RPE review/evaluation, the condition does not warrant repair as it has negligible impact on the structure. With regard to the post-tensioning system, the quantity of grease leakage is small when compared to the volume (> 100 gallons) in each tendon duct. The change in conditions will not result in post-tensioning components becoming uncovered or susceptible to corrosion.	The condition will continue to be monitored through annual examinations. Annual inspections were performed from 2012 to 2015 and showed no changes in conditions from previous exams.

ATTACHMENT 1a
Description and Assessment

Table 3.7.9-1: Unit 1 Concrete Indications, 2011				
Description of the Condition/Indication	**Cause of Condition that Did Not Meet the Acceptance Standard**	**Applicability to Any Other Plants at the Same Site**	**Whether or Not Repair/Replacement Activity is Required; Extent, Method, and Completion Date for the Repair/Replacement Activity**	**Extent, Nature, and Frequency of Additional Examinations**
NEW INDICATION SINCE 2006 EXAM: Grease Leakage (Containment Surface): Location: Outdoors, Northwest Face of Containment, just above (approx. 1') the second horizontal joint down from the dome access grating approx. 20' to the left of the permanent/vertical ground cable that runs from the top to the bottom of the containment exterior. The leakage starts approx. 1' up from the joint and extends down to the horizontal joint. The source of the leakage is through a minor shrinkage crack/void. The leakage does not appear to be significant or active. The quantity of the grease accumulation is estimated to be a maximum of 1 pint. There is no evidence of structural distress or exposed reinforcing steel.	Grease seepage/ leakage through minor cracks in the structure between the surface and the tendon sheathing.	Yes, the same condition was identified on the Unit 2 Containment Surface.	Based on RPE review/evaluation, the condition does not warrant repair as it has negligible impact on the structure. With regard to the post-tensioning system, the quantity of grease leakage is small when compared to the volume (> 100 gallons) in each tendon duct. The change in conditions will not result in post-tensioning components becoming uncovered or susceptible to corrosion.	The condition will be monitored through annual examinations for evidence of significant changes or degradation. Annual inspections were performed from 2012 to 2015 and showed no changes in conditions from previous exams.

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Table 3.7.9-1: Unit 1 Concrete Indications, 2011				
Description of the Condition/Indication	**Cause of Condition that Did Not Meet the Acceptance Standard**	**Applicability to Any Other Plants at the Same Site**	**Whether or Not Repair/Replacement Activity is Required; Extent, Method, and Completion Date for the Repair/Replacement Activity**	**Extent, Nature, and Frequency of Additional Examinations**
NEW INDICATIONS SINCE 2006 EXAM: 1st INDICATION: Indication is adjacent to the pocket/opening for the Field End of Dome Tendon D-1-40. A patch (18.5' x 25') the corner of the opening where the anchorage is installed. A cosmetic patch is degraded. The patch is hollow when tapped on, extensive pattern cracking exists, and a small area of the patch has fallen out. Evidence of mineral buildup/efflorescence exists in the cracks within the patch and in the area where the patch has partially fallen out. No evidence of active moisture was identified. 2nd INDICATION: A small void/pop out (1.5" wide x 1" long x 0.25" deep) exists. The void/popout exists as a result of a small patch that was previously placed during construction has fallen out. Within the void/popout is a small area of exposed reinforcing steel (approx. 3" long x 0.5" wide). Surface rust exists on the exposed reinforcing steel but there is no evidence of wastage or reduction of the cross section. Small cracks (approx. 4" long x 0.010" in width) exist.	Degradation of the patched areas over the service time of the plant. Both patches were initially placed during construction. The patches are cosmetic and have negligible impact on the structure.	Yes, degraded patches have been discovered at other locations in the Units 1 and 2 Containments.	The area is degraded and repairs will be monitored to ensure degradation does not become worse in the future. Repairs were scheduled to be performed during Refuel Outage A1R17 (Fall 2013) but were not completed until 2015.	Visual examination of indications was performed annually from 2012 to 2015 and showed no change in conditions. The degraded concrete area was repaired in 2015. A post repair visual exam identified minor cracks which were acceptable "as is" by the Responsible Engineer. Therefore, continued monitoring is not needed.

Table 3.7.9-1: Unit 1 Concrete Indications, 2011				
Description of the Condition/Indication	**Cause of Condition that Did Not Meet the Acceptance Standard**	**Applicability to Any Other Plants at the Same Site**	**Whether or Not Repair/Replacement Activity is Required; Extent, Method, and Completion Date for the Repair/Replacement Activity**	**Extent, Nature, and Frequency of Additional Examinations**
NEW INDICATIONS SINCE 2006 EXAM: Location: Outdoors on the Containment Dome and on the face of the containment where the dome anchorages exist. The dome drain system piping is embedded in the concrete containment structure. All (6) dome drain grating assemblies are degraded. The epoxy/sealants are significantly degraded or missing. The 6 piping assemblies (embedded in the concrete) exit through the concrete structure and connect to the ring header. Accumulations of calcium deposits (efflorescence) were identified on the containment concrete surface at all points where the 6 drain lines exited the wall. Additionally, efflorescence was identified at seal and piping for all 6 drain lines. Cracks extend down from all 6 penetrations.	Suspected to be degradation of the drain grating assemblies and surrounding sealants resulting in water intrusion into the concrete structure. This is a likely source of free water intrusion into the tendons. Expansion from freeze thaw cycles has resulted in cracking at the penetrations where the drain piping exits the structure.	Yes, the same conditions were identified on the Unit 2 Containment Structure.	Areas were cleaned/prepared and Detailed Visual Exams were performed. DETAILED EXAM RESULTS: DOME AREA: Sealants and drain covers were degraded or missing. With exception of minor, localized spalls, no concrete damage was discovered. DOME RING FACE: Cracks in the concrete extend down from all 6 penetrations. The worse-case condition was identified at the drain penetration in the vicinity of the anchorage for dome tendon D2-23 (not within 24" of anchorage). Two cracks in > 6" exist. Shorter, localized cracking exists in the vicinity of the penetrations. With regard to crack width and depth, the maximum width is in excess of 0.080" at the surface. However, the crack width is greatly reduced to approx. 0.015" at a depth of no more than 0.125". The reason the crack is wider at the surface is minor spalls exist in localized areas adjacent to the cracks. Corrosion staining also exists. When sealants were removed at one penetration, water exited from the area between the sealant and drain piping. Expedited repair of the areas where water intrusion has occurred was completed during November/December 2011.	Although repairs of the dome drainage system have been completed, additional monitoring is warranted. Annual inspections were performed from 2012 to 2015 and showed no changes in conditions from previous exams.

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Table 3.7.9-2: Unit 2 Concrete Indications, 2011

Description of the Condition/Indication	Cause of Condition that Did Not Meet the Acceptance Standard	Applicability to Any Other Plants at the Same Site	Whether or Not Repair/Replacement Activity is Required; Extent, Method, and Completion Date for the Repair/Replacement Activity	Extent, Nature, and Frequency of Additional Examinations
NEW INDICATION SINCE 2006 EXAM: Location: Unit 2 Tendon Tunnel Ceiling: Near vertical tendon anchorage locations V-220 and V-221. A crack (approx. 17" long) exists with a buildup of minerals/efflorescence in it. No evidence of moisture identified.	Ground water intrusion through the structure resulting in the identified conditions.	Yes, similar conditions have been discovered in the Unit 1 Tendon Tunnel/Gallery Ceiling.	Surfaces were cleaned and prepared and Detailed Examinations were performed. DETAILED EXAM RESULTS: The identified crack was measured and characterized. The length is 17.5" long. The crack width exceeds 0.040" at the surface due to minor spalls at the edges but in less than 0.0625" depth the crack width reduces to a "tight" configuration (< 0.010" in width). No evidence of moisture, exposed reinforcing steel, or structural distress was identified. Although there is negligible impact on structural integrity and repair is not required, monitoring through annual examination is warranted.	The condition will be monitored through annual examinations. Annual inspections were performed from 2012 to 2015 and showed no changes in conditions from previous exams.
NEW INDICATION SINCE 2006 EXAM: The coating on the Unit 2 Containment Dome is approaching end of life. Although the coating is fully intact, wear spots evidenced by light areas and minor indentations/cracks at localized areas in the coating exist.	Normal wear. The dome coating was last replaced approx. 10 years ago.	Yes, the same condition was identified on the Unit 1 Dome.	Although the coating is fully intact, wear spots evidenced by light areas and minor indentations/cracks are localized in the coating; replacement is scheduled to be completed during 2013.	No additional examinations prior to coating replacement are deemed required.

Table 3.7.9-2: Unit 2 Concrete Indications, 2011				
Description of the Condition/Indication	**Cause of Condition that Did Not Meet the Acceptance Standard**	**Applicability to Any Other Plants at the Same Site**	**Whether or Not Repair/Replacement Activity is Required; Extent, Method, and Completion Date for the Repair/Replacement Activity**	**Extent, Nature, and Frequency of Additional Examinations**
NEW INDICATIONS SINCE 2006 EXAM: Location: Unit 2 Tendon Tunnel Ceiling: Near vertical tendon anchorage locations V-240 and V-241. A crack (approx. 18" long with mineral buildup) was identified. Another suspect area was identified. This area is a heavy buildup of minerals/efflorescence with the existence of wet stalactites. Stalactites and minerals are also adjacent to an embedded plate.	Ground water intrusion through the structure resulting in the identified conditions.	Yes, similar conditions have been discovered in the Unit 1 Tendon Tunnel/Gallery Ceiling.	Surfaces were cleaned and prepared and Detailed Examinations were performed. DETAILED EXAM RESULTS: The 18" long crack length is 19.5" long. The crack width exceeds 0.040" at the surface due to minor spalls at the edges but in less than 1/18" depth the crack width reduces to a "tight" configuration (< 0.010" in width). In the area where a single stalactite was removed, a small void (approx. 0.125" round with a max. depth of 0.5") was identified. This is an air hole from construction. Wetness/moisture were observed at the small void. In the area where other stalactites were removed (adjacent to the embedded plate), 2 small voids (approx. 0.25" round with a max. depth of 0.75") were identified. These are air holes that occurred during construction. Wetness/moisture were observed at the small voids from which the stalactite extended. No evidence of exposed reinforcing steel or structural distress was identified.	Visual examination of indications was performed annually from 2012 to 2015 and showed no change in conditions. Efflorescence (mineral deposit) was removed from the indications and surface areas were visually examined in 2014. No ASME Section XI code concrete repairs were required. No recordable indications were found, therefore continued monitoring is not needed.

Table 3.7.9-2: Unit 2 Concrete Indications, 2011				
Description of the Condition/Indication	**Cause of Condition that Did Not Meet the Acceptance Standard**	**Applicability to Any Other Plants at the Same Site**	**Whether or Not Repair/Replacement Activity is Required; Extent, Method, and Completion Date for the Repair/Replacement Activity**	**Extent, Nature, and Frequency of Additional Examinations**
REPEAT INDICATION FROM 2006 EXAM: Location: Unit 2 Tendon Tunnel Ceiling: Near vertical tendon anchorage location V-242. The area is adjacent to an embedded plate. A wet, rust colored stalactite approx. 3" long exists. A buildup of rust colored minerals/efflorescence exists.	Ground water intrusion through the structure resulting in the identified conditions.	Yes, similar conditions have been discovered in the Unit 1 Tendon Tunnel/Gallery Ceiling.	Surfaces were cleaned and prepared and Detailed Examinations were performed. DETAILED EXAM RESULTS: In the area where the stalactite was removed, a small void (approx. 0.125" round with a max. depth of 0.5") was identified. This could be characterized as an air hole that occurred during construction. Wetness/moisture were observed at the small void from which the stalactite extended. After cleaning, no evidence of significant degradation (e.g., loss of material or wastage) was observed on the conduit or embedded plate. No evidence of exposed reinforcing steel or structural distress was identified.	Visual examination of indications was performed annually from 2012 to 2015 and showed no change in conditions. Efflorescence (mineral deposit) was removed from the indications and surface areas were visually examined in 2014. No ASME Section XI code concrete repairs were required. No recordable indications were found, therefore continued monitoring is not needed.

Table 3.7.9-2: Unit 2 Concrete Indications, 2011				
Description of the Condition/Indication	**Cause of Condition that Did Not Meet the Acceptance Standard**	**Applicability to Any Other Plants at the Same Site**	**Whether or Not Repair/Replacement Activity is Required; Extent, Method, and Completion Date for the Repair/Replacement Activity**	**Extent, Nature, and Frequency of Additional Examinations**
REPEAT INDICATION FROM 2006 EXAM: Location: Unit 2 Tendon Tunnel Ceiling: Near Anchorage V-273. A crack filled with minerals/efflorescence extends from the outer wall to the corner of the bearing plate for tendon anchorage V-273. The crack is approx. 30" long. As evidenced by the localized areas of heavy mineral buildup, there is evidence of past moisture.	Ground water intrusion through the structure resulting in the identified conditions.	Yes, similar conditions have been discovered in the Unit 1 Tendon Tunnel/Gallery Ceiling.	Surfaces were cleaned and prepared and Detailed Examinations were performed. DETAILED EXAM RESULTS: The identified crack was measures and characterized. The length is 31.25" long. There was evidence of moisture in the form of dampness at localized areas within the crack where the accumulation was heaviest. The crack width exceeds 0.040" at the surface due to minor spalls at the edges but in less than 0.0625" depth the crack width reduces to a "tight" configuration (< 0.010" in width). After cleaning, no evidence of significant degradation (e.g., no loss of material or wastage) was observed on the conduit or embedded plate. No evidence of exposed reinforcing steel or structural distress was identified.	Visual examination of indications was performed annually from 2012 to 2015 and showed no change in conditions. Efflorescence (mineral deposit) was removed from the indications and surface areas were visually examined in 2014. No ASME Section XI code concrete repairs were required. No recordable indications were found, therefore continued monitoring is not needed.

Table 3.7.9-2: Unit 2 Concrete Indications, 2011				
Description of the Condition/Indication	**Cause of Condition that Did Not Meet the Acceptance Standard**	**Applicability to Any Other Plants at the Same Site**	**Whether or Not Repair/Replacement Activity is Required; Extent, Method, and Completion Date for the Repair/Replacement Activity**	**Extent, Nature, and Frequency of Additional Examinations**
REPEAT INDICATION FROM 2006 EXAM: Location: Unit 2 Tendon Tunnel Ceiling: Between anchorage locations V-273 and V-274. Degradation was identified in a previously placed patch. The degradation is in the form of pattern cracking filled with minerals/efflorescence. The overall area of the patch is approx. 3" wide x 8" long. Additionally, a conduit in the vicinity has been affected.	Ground water intrusion through the structure resulting in the identified conditions.	Yes, similar conditions have been discovered in the Unit 1 Tendon Tunnel/Gallery Ceiling.	Surfaces were cleaned and prepared and Detailed Examinations were performed. DETAILED EXAM RESULTS: The identified pattern cracking was measured and characterized. The crack widths do not exceed 0.010". The patch was "tapped on" using a small hammer. Although the pattern cracking was identified, the patch is solid (no hollow sounds when tapping on it) and is structurally sound. After cleaning, no evidence of significant degradation (e.g., loss of material or wastage) was observed on the conduit or embedded plate. No evidence of moisture, exposed reinforcing steel, or structural distress was identified.	This condition will be monitored through annual examinations. Annual inspections were performed from 2012 to 2015 and showed no changes in conditions from previous exams.

Table 3.7.9-2: Unit 2 Concrete Indications, 2011				
Description of the Condition/Indication	**Cause of Condition that Did Not Meet the Acceptance Standard**	**Applicability to Any Other Plants at the Same Site**	**Whether or Not Repair/Replacement Activity is Required; Extent, Method, and Completion Date for the Repair/Replacement Activity**	**Extent, Nature, and Frequency of Additional Examinations**
REPEAT INDICATION FROM 2006 EXAM: Location: Unit 2 Tendon Tunnel Ceiling: Between anchorage locations V-285 and V-286. An isolated area (approx. 3" in diameter) exists where a buildup of minerals/efflorescence is present with a single wet stalactite. Another area of a heavy accumulation of minerals/efflorescence exists with multiple wet stalactites. The longest stalactite is approx. 6" long. The area is approx. 3" wide x 8" long.	Ground water intrusion through the structure resulting in the identified conditions and aging of the patch.	Yes, similar conditions have been discovered in the Unit 1 Tendon Tunnel/Gallery Ceiling.	Surfaces were cleaned and prepared and Detailed Examinations were performed. DETAILED EXAM RESULTS: In the area where the stalactites were removed, small voids (approx. 0.125" round with a max. depth of 0.5") were identified in the areas where the stalactites existed. These voids are characterized as honeycomb/airholes that developed during construction. Wetness/Moisture was observed at the small voids from which the stalactite extended. After cleaning, no evidence of exposed reinforcing steel or structural distress was identified.	Visual examination of indications was performed annually from 2012 to 2015 and showed no change in conditions. Efflorescence (mineral deposit) was removed from the indications and surface areas were visually examined in 2014. No ASME Section XI code concrete repairs were required. No recordable indications were found, therefore continued monitoring is not needed.

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Table 3.7.9-2: Unit 2 Concrete Indications, 2011				
Description of the Condition/Indication	**Cause of Condition that Did Not Meet the Acceptance Standard**	**Applicability to Any Other Plants at the Same Site**	**Whether or Not Repair/Replacement Activity is Required; Extent, Method, and Completion Date for the Repair/Replacement Activity**	**Extent, Nature, and Frequency of Additional Examinations**
NEW INDICATIONS SINCE 2006 EXAM: Location: Unit 2 Tendon Tunnel Ceiling: Near anchorage location V-289. An isolated area (approx. 3" diameter) exists in the ceiling near the outer wall. A buildup of minerals/efflorescence is present with a single stalactite. The stalactite is wet with a length of approx. 12".	Ground water intrusion through the structure resulting in the identified conditions.	Yes, similar conditions have been discovered in the Unit 1 Tendon Tunnel/Gallery Ceiling.	Surfaces were cleaned and prepared and Detailed Examinations were performed. DETAILED EXAM RESULTS: In the area where the stalactite was removed, a small void (approx. 0.125" round with a max. depth of 0.5") was identified. This could be characterized as an airhole that occurred during construction. Wetness/Moisture were observed at the small void from which the stalactite extended. After cleaning, no evidence of exposed reinforcing steel or structural distress was identified.	Visual examination of indications was performed annually from 2012 to 2015 and showed no change in conditions. Efflorescence (mineral deposit) was removed from the indications and surface areas were visually examined in 2014. No ASME Section XI code concrete repairs were required. No recordable indications were found, therefore continued monitoring is not needed.

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Table 3.7.9-2: Unit 2 Concrete Indications, 2011				
Description of the Condition/Indication	**Cause of Condition that Did Not Meet the Acceptance Standard**	**Applicability to Any Other Plants at the Same Site**	**Whether or Not Repair/Replacement Activity is Required; Extent, Method, and Completion Date for the Repair/Replacement Activity**	**Extent, Nature, and Frequency of Additional Examinations**
REPEAT INDICATION FROM 2006 EXAM: Location: Unit 2 Tendon Tunnel Ceiling: Between anchorage locations V-345 and V-346. Degradation was identified in a previously placed patch. The degradation is in the form of pattern cracking filled with minerals/efflorescence. The overall area of the patch is approx. 3" wide x 5" long. Additionally, a vertical conduit extending through the ceiling in the vicinity has been affected.	Ground water intrusion through the structure resulting in the identified conditions and aging of the patch.	Yes, similar conditions have been discovered in the Unit 1 Tendon Tunnel/Gallery Ceiling.	Surfaces were cleaned and prepared and Detailed Examinations were performed. DETAILED EXAM RESULTS: The identified pattern cracking was measured and characterized. The crack widths do not exceed 0.040". The patch was "tapped on" using a small hammer. Although the pattern cracking was identified, the patch is solid (no hollow sounds when tapping on it) and is structurally sound. After cleaning, no evidence of significant degradation (e.g., loss of material or wastage) was observed on the conduit. No evidence of moisture, exposed reinforcing steel, or structural distress was identified.	The condition will be monitored through annual examinations. Annual inspections were performed from 2012 to 2015 and showed no changes in conditions from previous exams.
INDICATION IDENTIFIED DURING 2006 EXAM (NO SIGNIFICANT CHANGES): Grease Leakage through the Containment Surface: Identified During Previous Examination (2006). Location: South Face of the containment above and to the left of the A/D Main Steam Isolation Valve Room approx. 40" above ground elevation. Film of grease (approx. 10" x 15") exists on the surface. Source is seepage through a minor/tight crack. (NOTE: No change in conditions identified during the 2011 examination.)	Grease seepage/leakage through minor cracks in the structure between the surface and the tendon sheathing.	Yes, the same condition was identified on the Unit 1 Containment Surface.	Based on RPE review/evaluation, the condition does not warrant repair as it has negligible impact on the structure. With regard to the post tensioning system, the quantity of grease leakage is small when compared to the volume (> 100 gallons) in each tendon duct. The condition will not result in post-tensioning components becoming uncovered or susceptible to corrosion.	The condition will continue to be monitored through annual examinations for evidence of significant changes or degradation. Annual inspections were performed from 2012 to 2015 and showed no changes in conditions from previous exams.

Table 3.7.9-2: Unit 2 Concrete Indications, 2011				
Description of the Condition/Indication	**Cause of Condition that Did Not Meet the Acceptance Standard**	**Applicability to Any Other Plants at the Same Site**	**Whether or Not Repair/Replacement Activity is Required; Extent, Method, and Completion Date for the Repair/Replacement Activity**	**Extent, Nature, and Frequency of Additional Examinations**
NEW INDICATIONS SINCE 2006 EXAM: Location: Outdoors on the Containment Dome and on the face of the containment where the dome anchorages exist. 2 of the 6 Removable Grating Assemblies on the containment dome are damaged and are no longer performing the design function of a debris screen. The epoxy caulk and other sealants are degraded and/or missing. The concrete surrounding 3 of the grating/drain assemblies is degraded and loose materials are present (no evidence of structural degradation or exposed reinforcing steel exists). The drain piping assembly is embedded in the containment concrete structure. Due to the degraded and missing sealants, gaps now exist resulting in leakage paths where moisture/water can potentially migrate into small cracks/voids in the concrete and eventually into the post-tensioning systems (tendons). At the point where the piping protrudes from the dome ring at all 6 locations, there is evidence of a buildup of minerals. The drain piping is corroded at the penetrations. Corrosion staining also exists on the concrete. This condition is indicative of moisture in contact with the concrete. The conditions identified at some locations during this inspection (2011) are worse than that identified during the previous surveillance (2006). An important fact is the same accumulation of efflorescence has reoccurred within the last 5 years. Therefore, this is an active condition and is not construction related.	Degradation of the drain grating assemblies and surrounding sealants resulting in water intrusion into the concrete structure. This is a likely source of free water intrusion into the tendons. Expansion from freeze thaw cycles has resulted in cracking at the penetrations where the drain piping exits the structure.	Yes, the same conditions were identified on the Unit 1 Containment Structure.	Areas were cleaned/prepared and Detailed Visual Exams were performed. DETAILED EXAM RESULTS: DOME AREA: DRAIN SYSTEM DOME AREA: Sealant is degraded and/or missing at all 6 drains. Loose concrete (minor spalls) exist in areas adjacent to the drains. Depth is minimal (< 0. 125") and there is no evidence of exposed reinforcing steel or structural distress. CONTAINMENT DOME RING FACE: Cracks extend down from all 6 penetrations. The worse-case condition is in the vicinity of the anchorage for dome tendons D4-23 and D4-24. One crack in length in excess of 10' exists. One of the cracks extends from the corner of the pocket for anchorage D-4-24 (not adjacent to the bearing plate). With regard to crack width and depth, the maximum width is in excess of 0.080" at the surface. However, the crack width is greatly reduced to approx. 0.015" at a depth of no more than 0.125". Minor spalls exist in localized areas adjacent to the cracks. After sealants were removed, water ran out from the area between the structure and drain piping. Expedited repair of the areas where water intrusion has occurred was completed during November/December 2011.	Although repairs of the dome drainage system have been completed, additional monitoring is warranted. Annual inspections were performed from 2012 to 2015 and showed no changes in conditions from previous exams.

3.7.10 Units 1 and 2 IWL Examinations, 2016

BRW has completed the 30th year visual examinations for the Units 1 and 2 ASME Class CC containment concrete surfaces in accordance with ASME Section XI, 2001 Edition/2003 Addenda and additional criterion as specified in 10 CFR 50.55a, paragraphs (b)(2)(viii)(E) through (b)(2)(viii)(G).

The scope of the BRW Evaluation Report includes examination of concrete surfaces, as specified in ASME Section XI IWL-2310 and IWL-2510 and addresses indications identified during the 30th Year Post Tensioning activities. Tables 3.7.10-1 and 3.7.10-2 provide discussion and evaluation of the conditions/indications identified for BRW, Units 1 and 2, respectively, during the General and Detailed visual examinations performed in accordance with IWL-2310 and IWL-2510.

Personnel that examined the containment concrete surfaces met the qualification provisions specified in ASME Section XI IWA-2300.

Conclusion

Recoating of the entire surfaces of the BRW Units 1 and 2 containment domes was completed in 2018.

The results of the examinations revealed no degradation that adversely affects the structural integrity of the containment structures.

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Table 3.7.10-1: Unit 1 Concrete Indications, 2016				
Description of the Condition/Indication	**Cause of Condition that Did Not Meet the Acceptance Standard**	**Applicability to Any Other Plants at the Same Site**	**Whether or Not Repair/Replacement Activity is Required, the Extent, Method, and Completion Date for the Repair/Replacement Activity**	**Extent, Nature, and Frequency of Additional Examinations**
CHANGE IN INDICATION SINCE 2011 EXAM: The coating on the Unit 1 Containment Dome is significantly degraded and has reached the end of its effective life. Peeling has been identified, which leaves the concrete surface exposed in localized areas. The maximum surface area of each indication where the concrete surface is exposed is 1". Localized blistering has occurred to the point where the coating no longer is adhered to the concrete surface and is missing. Widespread areas where the coating is worn and thinning exists. Finish coat has worn off and primer is exposed. Sanding from the concrete is now evident on the surface in localized areas. Cracks and peeling in the coating exist in localized areas. The drains (6) are partially blocked with debris. Minor discoloration of the sealants around the dome was observed. Additionally, corrosion staining has been found at two places on the dome surface and requires further investigation and detailed examination.	The Containment Dome was last recoated in October 2001. The existing coating has been in service for approx. 15 years, is at end of life. The cause of the condition is normal wear. This is a likely source of free water intrusion into the tendons.	Yes, the same condition was identified on the Unit 2 Containment Structure.	Areas were cleaned/prepared and Detailed Visual Exams were performed. DETAILED EXAM RESULTS: The corrosion staining on those areas was caused due to fragments of tie wire/nails left on the surface concrete at the time of construction. The fragments of tie wire/nails were removed from the concrete surface and localized areas were recoated after a satisfactory detailed visual exam.	Although recoating of localized areas was performed in 2016, the entire dome surface needs to be recoated. No additional examinations prior to coating replacement are deemed as required.
NEW INDICATION SINCE 2011 EXAM: Moisture is seeping through the concrete surface in Containment Buttress 1 (A/BA) area at the 384' elevation and running down the wall to the floor. The floor elevation is 374'. There is evidence of corrosion based on the color of the seepage on the wall. There exists a heavy accumulation of efflorescence/minerals on the surface/in the joints adjacent to tendon anchorage locations H02BA/A and H03BA/A and on the containment wall surface. Additionally, there is a minor accumulation of water on the buttress floor.	Ground water intrusion through minor cracks and voids in the concrete structure due to high water table at BRW.	No, this condition was only identified on the Unit 1 Containment Structure.	The surface area with efflorescence was cleaned and prepared for Detailed Visual Exams. DETAILED EXAM RESULTS: A degraded patch with minor cracking (< 0.015") and a small void < 1.25" were observed. Concrete adjacent to crack was determined to be sound.	Based on the review of the examination results, no additional actions are needed.

Table 3.7.10-1: Unit 1 Concrete Indications, 2016				
Description of the Condition/Indication	**Cause of Condition that Did Not Meet the Acceptance Standard**	**Applicability to Any Other Plants at the Same Site**	**Whether or Not Repair/Replacement Activity is Required, the Extent, Method, and Completion Date for the Repair/Replacement Activity**	**Extent, Nature, and Frequency of Additional Examinations**
NEW INDICATION SINCE 2011 EXAM: A degraded concrete patch (14" x 4") and a small area of exposed reinforcing steel (2" x 2") were identified at the left corner of the anchorage bearing plate of Unit 1 tendon D2-19. The small area of exposed reinforcing steel does not show any loss of material and serves no structural purpose.	Age-related degradation of concrete patches placed during construction.	No, this condition was only identified on the Unit 1 Containment Structure.	Detailed Visual Exam was performed. DETAILED EXAM RESULTS: The patch degradation is on the surface of the concrete and does not affect the structural integrity or the load carrying capability of the containment structure. The exposed rebar is non-structural and could be form-tie or similar and does not show any loss of cross section.	Based on the review of the examination results, no impact on the containment structure, and no further evaluation is required. Any restoration work recommendation will be included in the approved inspection report.

Table 3.7.10-2: Unit 2 Concrete Indications, 2016				
Description of the Condition/Indication	**Cause of Condition that Did Not Meet the Acceptance Standard**	**Applicability to Any Other Plants at the Same Site**	**Whether or Not Repair/Replacement Activity is Required, the Extent, Method, and Completion Date for the Repair/Replacement Activity**	**Extent, Nature, and Frequency of Additional Examinations**
CHANGE IN INDICATION SINCE 2011 EXAM: The coating on the Unit 2 Containment Dome is now thinned down to the primer. Peeling has been identified in the localized areas. The maximum surface area of each indication where the coating is missing is 1". This condition is evidenced by changes in color (coating is gray in color and thinning areas are now showing the concrete color). The sand added to the epoxy coating is starting to lose its adhesion. Drain covers/gratings are partially blocked with debris. The sealant around the drains is deteriorated. Additionally, corrosion staining exists at two locations and requires Detailed Exam for further investigation.	The Containment Dome was last recoated in October 2001. The existing coating has been in service for approx. 15 years, is at end of life. The cause of the condition is normal wear. This is a likely source of free water intrusion into the tendons.	Yes, the same condition was identified on the Unit 1 Containment Structure.	Areas were cleaned/prepared and Detailed Visual Exams were performed. DETAILED EXAM RESULTS: The corrosion staining on those areas was caused due to fragments of tie wire/nails left on the surface concrete at the time of construction. The fragments of tie wire/nails were removed from the concrete surface and localized areas were recoated after a satisfactory detailed visual exam.	Although recoating of localized areas was performed in 2016, the entire dome surface needs to be recoated. No additional examinations prior to coating replacement are deemed as required.

3.7.11 Tendon Surveillance Assessment, 2011

This report details the 2011 Exelon BRW, Units 1 and 2, 25th Year (7th Period), containment structures post tensioning system tendon surveillance. The surveillance program is a systematic means of assessing the quality and structural performance of the post tensioning system.

The tendon surveillance program consists of a periodic inspection of the condition of a selected group of tendons. This program provides confidence in the condition and functional capability of the system, and an opportunity for timely corrective measures if adverse conditions are detected. The 2011 tendon surveillance at BRW began on June 6, 2011 and ended on August 12, 2011. This surveillance period consisted of a physical inspection of the post tensioning system. Physical tendon surveillance consists of: sheathing filler inspection and testing, inspection for water, thread measurement, anchorage inspection, concrete inspection around inspected tendons, force monitoring, inspection and tensile testing of removed wire samples (for detensioned tendons), retensioning of detensioned tendons, and replacement of sheathing filler after completion of all inspections.

The Braidwood 25th Year Surveillance was performed in accordance with the requirements of the ASME, Boiler and Pressure Vessel Code, Section XI, Subsection IWL, 2001 Edition with 2003 Addenda and the applicable amendments as specified in 10 CFR 50.55a, Codes and Standards.

Summary

The results of this containment structures' post tensioning investigation are summarized as follows:

1. The sheathing filler (grease) samples were tested and found to have acceptable levels of water-soluble ions (Chlorides, Nitrates end Sulfides). The moisture contents were within the acceptable maximum limit of 10% water by weight. All neutralization numbers were acceptable.

2. Seven (7) tendon ends in Unit 1 and twenty-one (21) tendon ends in Unit 2 showed presence of water during the removal of the grease cap, during anchorage inspection or during detensioning and is documented. No additional water was observed during the cap removal or at any time during the inspections for any of the other grease caps removed.

3. Acceptable corrosion levels were found on all tendon ends and no cracks were found on any anchorage components.

4. The initial inspection of the SHOP (Buttress A) end of Unit 1 tendon H-31AC revealed one (1) protruding buttonhead not previously reported. A non-conformance report (NCR) was written to document this finding. The initial inspection of the FIELD (Buttress E) end of Unit 2 tendon H-62FE revealed one (1) protruding buttonhead not previously reported. An NCR was written to document this finding. The initial inspection of the SHOP (Buttress C) end of Unit 1 tendon H-4CB revealed one (1) protruding buttonhead not previously reported. An NCR was written to document this finding. No additional protruding/ missing buttonheads were detected on any of the other inspected tendon ends, which had not been previously reported.

5. No recordable indications were noted during a detailed visual inspection performed on the 24" of concrete surrounding the bearing plate of each tendon end inspected.

6. All measurements were within the acceptable ranges indicating that the external threads of inspected tendon anchorages meet the minimum strength requirement of 120% of the minimum Guaranteed Ultimate Tensile Strength (GUTS) of the tendon, when coupled with a specific stressing adaptor.

7. The hydraulic jacks used for liftoffs, detensioning, and retensioning of tendons were calibrated and found to be within an acceptable variation of +/- 1.5% between pre and post calibrations.

8. All of the tendons monitored for forces this inspection period were found to have forces greater than the Lower Limit Lift-off Force and Minimum Design Force as defined by EGC. The as-found group averages were above the required minimum design force levels.

9. All tendon test wire samples removed for testing had acceptable diameter, corrosion levels, yield stress, and ultimate stress results.

10. All detensioned tendons were retensioned with acceptable elongations and to acceptable force levels.

11. All inspected tendons were reseated and re-greased to acceptable levels.

12. A comparison of as-found force levels to the original force levels was made in an effort to detect any evidence of system degradation. The force losses since original installation for each tendon group are reported as: 7.63% for the dome tendons, 13.97% for the hoop tendons, and 3.94% for the vertical tendons. It should be noted that, in 1982, all of the tendons had their forces documented upon installation. These As-Left forces from 1982 have been used as the "original" force for calculating group losses.

13. A stressing trend (regression) analysis was performed on each group of tendons using the current and all previous liftoff data. The analysis results show all groups' forces staying above the required minimum design force beyond the next surveillance.

Based on the data gathered during the BRW 25th Year (7th Period) Inservice Inspection on the containment structure post tensioning system, the conclusion is reached that no abnormal degradation of the post tensioning system has occurred.

Conclusion

A review of this surveillance was conducted per IWL-3221, Unbonded Post-Tensioning Systems, and is outlined below:

IWL-3221 Acceptance by Examination

IWL-3221.1 Tendon Force and Elongation. Tendon forces and elongation are acceptable if the following conditions are met:

(a) The average of all measured tendon forces, including those measured in IWL-3221.1(b)(2), for each type of tendon is equal to or greater than the minimum required prestress specified at the anchorage for that type of tendon.

Results: Group averages for each group of tendons monitored were above the required average minimum effective design forces specified.

(b) The measured force in each individual tendon is not less than 95% of the predicted force unless the following conditions are satisfied:

(1) The measured force in not more than one tendon is between 90% and 95% of the predicted force.

(2) The measured forces in two tendons located adjacent to the tendon in IWL-3221.1(b)(1) are not less than 95% of the predicted forces.

(3) For tendons requiring augmented examination in accordance with Table IWL-2521- 2, Item L2-10, the measured forces in two like tendons located nearest to but on opposite sides of the tendon described in IWL-3221-1(b)(1) are not less than 95% of the predicted forces.

(4) The measured forces in all the remaining sample tendons are not less than 95% of the predicted force.

Results: All of the tendon liftoffs were above 95% of the Predicted Force and are acceptable.

(c) The prestressing forces for each type of tendon measured in IWL-3221.1(a) and (b), and the measurement from the previous examination, indicate a prestress loss such that predicted tendon forces meet the minimum design prestress forces at the next scheduled examination.

Results: Regression analysis shows force levels remaining above minimum design beyond the next surveillance interval for all tendon groups.

(d) The measured tendon elongation varies from the last measurement, adjusted for wires or strands, by less than 10%.

Results: All tendons, which were detensioned exhibited elongations within 10% of their original elongation values when restressed and are acceptable.

IWL-3221.2 Tendon Wire or Strand Samples. The condition of wire or strand samples is acceptable if:

(a) Samples are free of physical damage.

Results: All of the tendon wire test samples were free of physical damage.

(b) Sample ultimate tensile strength and elongation are not less than minimum specified values.

Results: All of the tendon wire test samples had acceptable results for ultimate tensile stress (≤ 240 ksi).

ATTACHMENT 1a
Description and Assessment

IWL-3221.3 Tendon Anchorage Areas. The condition of tendon anchorage areas is acceptable if:

(a) There is no evidence of cracking in anchor heads, shims, or bearing plates;

Results: Detailed inspections did not reveal any cracks in the anchorage components for any inspected tendon end.

(b) There is no evidence of active corrosion;

Results: Detailed inspections did not reveal any active corrosion on the anchorage components for any inspected tendon end. All corrosion conditions were level 1 and level 2 (on a scale of 5) and acceptable.

(c) Broken or unseated wires, broken strands, and detached buttonheads were documented and accepted during a preservice examination or during a previous in-service examination;

Results: The initial inspection of the SHOP (Buttress A) end of tendon H-31AC revealed one (1) protruding buttonhead not previously reported. An NCR was written to document this finding.

The initial inspection of the FIELD (Buttress E) end of tendon H-62FE revealed one (1) protruding buttonhead not previously reported. An NCR was written to document this finding.

The initial inspection of the SHOP (Buttress C) end of tendon H-4CB revealed one (1) protruding buttonhead not previously reported. An NCR was written to document this finding.

No additional protruding/missing buttonheads were detected on any of the other inspected tendon ends, which had not been previously reported and accepted.

(d) Cracks in the concrete adjacent to the bearing plates do not exceed 0.01 in. (0.3 mm) in width;

Results: No cracks exceeding 0.010" were detected in the 24" of concrete adjacent to the bearing plates.

(e) Water was observed during the cap removal and/or at any time during the inspection and was documented;

Results: Chemical tests were performed on seven (7) tendon ends in Unit 1 and twenty-one (21) tendon ends in Unit 2.

Two (2) tendon ends in Unit 1 were categorized as having "Significant Moisture," which is defined as the tendon end having 8 ounces of water or more found. Five (5) tendon ends in Unit 1 were categorized as having "Observable Moisture," which is defined as the tendon end having less than 8 ounces of water.

Nine (9) tendon ends in Unit 2 were categorized as having "Significant Moisture." Twelve (12) tendon ends in Unit 2 were categorized as having "Observable Moisture."

No additional water was observed during the cap removal or at any time during the inspections for any of the other grease caps removed.

IWL-3221.4 Corrosion Protection Medium. Corrosion protection medium is acceptable when the reserve alkalinity, water content and soluble ion concentrations of all samples are within the limits specified in Table IWL-2525-1. The absolute difference between the amount removed and the amount replaced shall not exceed 10% of the tendon net duct volume.

Results: All sheathing filler (grease) samples were tested and found to have acceptable levels of water-soluble ions (chlorides, nitrates, and sulfides). Water content values were below 10% by weight and acceptable for all samples tested. All neutralization numbers were above the requirement of 17.5 Potassium Hydroxide/gram (KOH/g) and were found acceptable.

No tendon accepted more than 10% of its net duct volume more than was removed [per IWL-3221.4] and all refills were acceptable.

Based upon the evaluation of the Inservice Inspection results for BRW, Units 1 and 2, 25th Year (7th Period), Containment Building Tendon Surveillance reported herein, it was concluded that the containment structure has experienced no abnormal degradation of the post-tensioning system.

3.7.12 Tendon Surveillance Assessment, 2017

This report details the BRW, Unit 1 (Physical) and Unit 2 (Visual), 30th Year containment structure post-tensioning systems' IWL Tendon Surveillance. The surveillance program is a systematic means of assessing the quality and structural performance of the post-tensioning system.

The tendon surveillance program consists of a periodic inspection of the physical condition of a selected group of tendons. This program provides confidence in the condition and functional capability of the system, and an opportunity for timely corrective measures if adverse conditions are detected. The 30th year Tendon Surveillance at BRW began on November 7, 2016, and the on-site inspection was completed on January 13, 2017. More specifically, the Unit 1 physical surveillance was completed on December 20, 2016, and the Unit 2 visual surveillance was completed on January 6, 2017.

This surveillance period consisted of a visual inspection at Unit 2 and a physical inspection at Unit 1 of the containment buildings' post-tensioning system. A visual tendon surveillance consists of sheathing filler inspection and testing, inspection for free water, anchorage inspection, concrete inspection around tendon bearing plates, and replacement of grease after completion of all inspections. A physical tendon surveillance consists of a visual inspection, plus force monitoring and inspection, tensile testing, of removed wire samples for detensioned tendons.

The BRW 30th Year Tendon Surveillance was performed in accordance with the requirements of the ASME, BPV Code, Section XI, Division 1, Subsection IWL, 2001 Edition with 2003 Addenda and the applicable amendments as specified in 10 CFR 50.55a.

Fourteen (14) tendons were selected for the original scope of the Unit 1 surveillance. Among the group of selected tendons, four (4) tendons (2 hoops and 2 verticals) have been affected by Steam Generator Replacement activities and were inspected in accordance with Table IWL-2521-2. The remaining ten (10) tendons were selected in accordance with Section IWL-2521 and Table IWL-2521-1. Eight (8) tendons, additional to the Unit 1 original scope, were selected for water inspections and a shim adjustment as an augmented scope for Unit 1. The Unit 2 original scope selection consists of twelve (12) tendons for a visual inspection. Thirty (30) additional tendons were selected for Unit 2 augmented scope as water inspections.

Summary of Findings

The results of the containment structures' post-tensioning investigation are summarized as follows:

1. Water-soluble ion concentrations and Reserve Alkalinity (Base Numbers) of the tested sheathing filler samples were within acceptance limits for all inspected tendons, per IWL-3221.4.

   Two (2) Unit 2 tendons had a moisture content (measured in percent of dry weight) greater than the acceptance limit. The field (303 deg.) end of D5-12 and the field (bottom) end of V-249 both had a moisture content of 12%, which exceeds the acceptance limit of 10%. The results were highlighted and submitted to BRW Engineering via a Water Content Notification Letter dated March 24, 2017. All other tendon grease samples' moisture contents were within the acceptance limit.

2. Acceptable grease coatings were found on all tendon ends inspected, and no unusual conditions were reported at any tendon end.

3. The presence of free water was observed at Unit 1 tendon V-112 (6 oz.) and Unit 2 tendons D4-08 (128 oz.), D4-27 (12 oz.), D4-36 (64 oz.), D4-38 (128 oz.), D4-39 (4 oz.), D6-13 (14 oz.), H04-ED (16 oz.), H05-FE (192 oz.), HO6-FE (4 oz.), V-217 (3.5 oz.), V-241 (4 oz.), and V-249 (15 oz.). Water Content Notification Letters were submitted to BRW Engineering in response to each occurrence.

   All other inspected tendon ends were found with no evidence of free water and are acceptable per IWL-3221.3(e).

4. All measurements were within the acceptable ranges indicating that the external threads of inspected tendon anchorages meet the minimum strength requirement of 120% of the minimum GUTS of the tendon, when coupled with a specific stressing adaptor. The minimum GUTS of 0.250" (6.35 mm) diameter wire is 240,000 pounds per square inch (psi) or 11,781 pounds per wire.

5. The buttress A of Unit 1 hoop tendon H21-BA was found with three (3) protruding buttonheads, protruding 0.2", 0.2", and 0.5", respectively. Quality Control (QC) personnel wrote an NCR, and BRW Engineering was notified.

   All other buttonheads at all inspected tendon ends were found in acceptable condition, per IWL-3221.3(c).

6. No anchorage component cracks were observed on any inspected tendon end, and all inspected tendon anchorage components were found with acceptable corrosion levels of 1 or 2.

7. All cracks observed within the 24" perimeter of the concrete surrounding each inspected bearing plate were less than 0.01" in width and are acceptable per IWL-3221.3(d).

8. The hydraulic jacks used for tendon lift-offs were calibrated before and after the surveillance period and were found to be within the acceptable variation of +/- 1.5% of specified minimum ultimate strength of tendon per IWL-2522(b).

9. The average value of all tendon lift-off forces for a given tendon group exceeded the minimum required pre-stress value for their respective tendon group, per IWL-3221.1(a).

10. In examining the average group percentage loss from the original installation lock-off force values to the as-found lift-off force values during the 30th year surveillance, no abnormal losses were observed.

11. All tendon wires removed and tested were found to have diameter values within the acceptable range and acceptably high yield stress.

    All wire samples, selected for testing per IWL-2523.1, had acceptable corrosion level of 1 and were free of physical damage.

12. All detensioned tendons had acceptable elongation variation percentages with respect to the previous measurement, per IWL-3221.1(d).

    All detensioned tendons were retensioned to acceptable lock-off forces, per IWL-2523.3.

13. The buttress C of Unit 1 hoop tendon H42-CB was found with one (1) protruding buttonhead, protruding 0.5". The protrusion was recorded during post re-tensioning of the tendon and was not found during the initial as-found inspection. An NCR was written by QC personnel, and BRW Engineering was notified.

    The top end of Unit 1 vertical tendon V-112 was found with one (1) protruding buttonhead, protruding 0.5". The protrusion was recorded during post re-tensioning of the tendon and was not found during the initial as-found inspection. An NCR was written by QC personnel, and BRW Engineering was notified.

14. All tendon grease caps were properly installed to their respective tendon ends, and all tendon caps were refilled to acceptable levels, per IWL-3221.4.

Based on the available data, the final report for the 30th Year Tendon Surveillance at BRW concluded that the functional integrity of the selected post-tensioning system met all the applicable code requirements, unless noted otherwise with non-conformance items, as required.

Conclusion

A review of this surveillance was conducted per IWL-3221, Unbonded Post-Tensioning Systems, and is outlined below:

IWL-3221 Acceptance by Examination

IWL-3221.1 Tendon Force and Elongation. Tendon forces and elongation are acceptable if the following conditions are met:

(a) The average of all measured tendon forces, including those measured in IWL-3221.1(b)(2), for each type of tendon is equal to or greater than the minimum required prestress specified at the anchorage for that type of tendon.

Results: At BRW, a minimum design force is generated for each tendon. All tendons had lift-off forces greater than their respective minimum design force. Therefore, the average measured force for each type of tendon was greater than the average calculated minimum design force for that type of tendon.

(b) The measured force in each individual tendon is not less than 95% of the predicted force unless the following conditions are satisfied:

(1) The measured force in not more than one tendon is between 90% and 95% of the predicted force.

(2) The measured forces in two tendons located adjacent to the tendon in IWL-3221.1(b)(1) are not less than 95% of the predicted forces.

(3) For tendons requiring augmented examination in accordance with Table IWL-2521-2, Item L2-10, the measured forces in two like tendons located nearest to but on opposite sides of the tendon described in IWL-3221-1(b)(1) are not less than 95% of the predicted forces.

(4) The measured forces in all the remaining sample tendons are not less than 95% of the predicted force.

Results: All of the tendon lift-off forces were found within the acceptable limits.

IWL-3221.2 Tendon Wire or Strand Samples. The condition of wire or strand samples is acceptable if:

(a) Samples are free of physical damage.

Results: All test wire samples collected for this inspection were found to have acceptable corrosion levels and free of physical damage.

(b) Sample ultimate tensile strength and elongation are not less than minimum specified values.

Results: All test wire samples had acceptable results for ultimate tensile stress ($\geq$ 240 ksi) and elongation ($\geq$ 4.0%).

IWL-3221.3 Tendon Anchorage Areas. The condition of tendon anchorage areas is acceptable if:

(a) There is no evidence of cracking in anchor heads, shims, or bearing plates;

Results: Detailed inspections did not reveal any cracks in the anchorage components for any inspected tendon end.

(b) There is no evidence of active corrosion;

Results: No tendon end inspected revealed active corrosion on the anchorage components.

(c) Broken or unseated wires, broken strands, and detached buttonheads were documented and accepted during a preservice examination or during a previous in-service examination;

Results: The buttress A of Unit 1 hoop tendon H21-BA was found with three (3) protruding buttonheads, protruding 0.2", 0.2", and 0.5", respectively – conditions that had not been previously reported. An NCR was written by QC personnel, and BRW Engineering was notified.

All other buttonheads at all inspected tendon ends were found in acceptable condition, per IWL-3221.3(c).

(d) Cracks in the concrete adjacent to the bearing plates do not exceed 0.01 in. (0.3 mm) in width;

Results: No cracks exceeding 0.010" were detected in the 24" of concrete adjacent to the bearing plates of the tendon ends inspected.

(e) There is no evidence of free water.

Results: The presence of free water was observed at Unit 1 tendon V-112 (6 oz.) and Unit 2 tendons D4-08 (128 oz.), D4-27 (12oz.), D4-36 (64 oz.), D4-38 (128 oz.), D4-39 (4oz.), D6-13 (14 oz.), H04-ED (16 oz.), H05-FE (192 oz.), H06-FE (4 oz.), V-217 (3.5 oz.), V-241 (4 oz.), and V-249 (15 oz.). Water Content Notification Letters were submitted to BRW Engineering in response to each occurrence.

All other inspected tendon ends were found with no evidence of free water and are acceptable per IWL-3221.3(e).

IWL-3221.4 Corrosion Protection Medium. Corrosion protection medium is acceptable when the reserve alkalinity, water content, and soluble ion concentrations of all samples are within the limits specified in Table IWL-2525-1. The absolute difference between the amount removed and the amount replaced shall not exceed 10% of the tendon net ductvolume.

Results: Water-soluble ion concentrations and Reverse Alkalinity (Base Numbers) of the tested sheathing filler samples were within acceptable limits for all inspected tendons.

Two (2) Unit 2 tendons had a moisture content (measured in percent of dry weight) greater than the specified limit. The field (303 deg.) end of D5-12 and the field (bottom) end of V-249 both had a moisture content of 12%, which exceeds the allowable limit of 10%. The results were highlighted and submitted to BRW Engineering via a Water Content Notification Letter

dated March 24, 2017. All other tendon grease samples' moisture contents were within the acceptable limit.

No tendon accepted more than 10% of its net duct volume more than was removed, and all refills were acceptable.

Based upon the evaluation of the Inservice Inspection results for the BRW, Units 1 and 2, 30th Year Containment Building Tendon Surveillance reported herein, it was concluded that the containment structure had experienced no abnormal degradation of the post-tensioning system and all nonconformance items were identified, documented, and reported as required.

3.7.13 Containment Modifications

No major containment modifications have been performed since the last ILRT in 2013 (Unit 1) and 2014 (Unit 2). Steam generator replacement on BRW Unit 1 was completed in 1998 (A1R07). An ILRT was performed after completion of the Unit 1 steam generator replacement during A1R07 to verify containment integrity (Reference Section 3.1.5 of this submittal). The BRW Unit 2 steam generators have not been replaced and there are no plans to replace them. There are no plans to replace the reactor heads on Unit 1 or Unit 2 and there are no other major containment modifications planned that would require the performance of an ILRT or Structural Integrity Test (SIT).

3.8 License Renewal Aging Management

By letter dated May 29, 2013, EGC requested renewal of Operating Licenses NPF-72 and NPF-77 for BRW, Units 1 and 2, respectively, for a period of 20 years beyond the current expiration dates of midnight October 17, 2026, for Unit 1 and December 18, 2027, for Unit 2.

An SE was issued by the NRC on July 6, 2015 (Reference 32), and the Renewed Facility Operating License was issued for BRW, Units 1 and 2 (Operating License Nos. NPF-72 and NPF-77, respectively). The BRW Period of Extended Operation (PEO) is effective from October 17, 2026, through October 16, 2046, for Unit 1, and from December 18, 2027, through December 17, 2047, for Unit 2.

As part of the license renewal effort, demonstration was required that the aging effects applicable for the components and structures within the scope of license renewal would be adequately managed during the PEO.

In many cases, existing activities were found to be adequate for managing aging effects during the PEO. In some cases, aging management reviews revealed that existing activities required enhancement to adequately manage applicable aging effects. In a few cases, new activities were developed to provide added assurance that aging affects are adequately managed.

License renewal commitments are currently tracked in a supplement to the BRW and BYR UFSAR, Appendix F, as required per 10 CFR 54.21(d). The following programs, which are part of the supporting basis of this LAR, are also Aging Management Programs (AMPs) at BRW.

3.8.1 Aging Management Programs (AMPs)

Appendix J Program

The 10 CFR Part 50, Appendix J AMP is an existing performance monitoring program that monitors leakage rates through the containment pressure boundary, including the containment liner, associated welds, penetrations, fittings, and other access openings, in order to detect degradation of the containment pressure boundary. Corrective actions are taken if leakage rates exceed acceptance criteria. The Primary Containment Leakage Rate Testing (CLRT) Program provides for aging management of pressure boundary degradation for electrical penetration assemblies, mechanical penetrations, penetration bellows and sleeves, the containment liner, bolting, personnel airlock, equipment hatch, and seals, gaskets, and MBs, due to aging effects from the loss of material, loss of sealing, loss of leak tightness, loss of preload, or cracking in systems penetrating containment. Consistent with the current licensing basis, the CLRTs are performed in accordance with the regulations and guidance provided in 10 CFR 50, Appendix J, Option B; RG 1.163, "Performance-Based Containment Leak-Test Program;" NEI 94-01, "Industry Guideline for Implementing Performance-Based Option of 10 CFR Part 50, Appendix J;" and ANSI/ANS 56.8, "Containment System Leakage Testing Requirements."

Containment leak rate tests are performed to assure that leakage through the containment, and systems and components penetrating primary containment, does not exceed allowable leakage limits specified in the TS. An ILRT is performed during a period of reactor shutdown at a frequency based on the historical performance of the overall containment system. LLRTs are performed on containment isolation valves and containment access penetrations at frequencies that comply with the requirements of 10 CFR 50, Appendix J, Option B.

The 10 CFR 50, Appendix J AMP is consistent with the corresponding program described in NUREG-1801, Revision 2 (Reference 33).

ASME Section XI, Subsection IWE Program

The ASME Section XI, Subsection IWE aging management program is an existing program based on ASME Section XI, Subsection IWE requirements and complies with the provisions of 10 CFR 50.55a. This program is in accordance with ASME Section XI, Subsection IWE, 2013 Edition.

The program consists of periodic visual and volumetric examination of pressure retaining components of steel and concrete containments for signs of degradation, assessment of damage, and corrective actions. The program includes aging management of surfaces and components such as bolting for containment closure, containment liner, containment penetrations (electrical, instrumentation, and control assemblies), mechanical penetrations, penetration bellows at the containment boundary, penetration sleeves at the containment boundary, and the personnel airlock and equipment hatch. The MB, which is a sealant between the bottom of the containment liner and the base mat, is included within the scope of the program.

Examination methods include visual and volumetric testing as required by ASME Section XI, Subsection IWE. Observed conditions that have the potential for impacting an intended function are evaluated for acceptability in accordance with ASME requirements and corrected in accordance with corrective action program.

The ASME Section XI, Subsection IWE AMP will be enhanced to:

1. Provide guidance for specification of bolting material, lubricant and sealants, and installation torque or tension to prevent or mitigate degradation and failure of structural bolting.

2. Use the condition of the embedded reinforcing steel at the inner surface of the tendon tunnel as a representative indicator for the potential for corrosion at the exterior surface of the containment liner plate. Use the results of Structures Monitoring (B.2.1.34) AMP, Enhancement 16 activities and results from ongoing examinations of the tendon tunnel performed as part of the ASME Section XI, Subsection IWL (B.2.1.30) and Structures Monitoring (B.2.1.34) AMPs to identify changing conditions. Changing conditions consisting of the identification of significant corrosion of embedded steel in the tendon tunnel structure require an evaluation to determine if augmented examinations in accordance with requirements of IWE-1240, "Surface Areas Requiring Augmented Examination," are required due to the potential for accelerated corrosion at the exterior surface of the containment liner plate.

These enhancements will be implemented prior to the PEO.

<u>ASME Section XI, Subsection IWL Program</u>

The ASME Section XI, Subsection IWL AMP is an existing program that consists of (a) periodic visual inspection of concrete surfaces for reinforced and unbonded, prestressed concrete containments, and (b) periodic visual inspection and sample tendon testing of unbonded post-tensioning systems for prestressed concrete containments for signs of degradation, assessment of damage, and corrective actions, and testing of the tendon corrosion protection medium and free water. Measured tendon lift-off forces are compared to predicted tendon forces calculated in accordance with RG 1.35.1, "Determining Prestressing Forces for Inspection of Prestressed Concrete Containments," (Reference 31).

Reinforced concrete surfaces are inspected for material degradation, including loss of material, cracking, increase in porosity and permeability, and loss of bond. A sample of each tendon wire type (vertical, hoop, dome) for the post-tensioning system is tested for loss of prestress. One tendon wire of each type is also examined for loss of material and subject to physical testing to determine yield strength, ultimate tensile strength, and elongation. The end anchorage for the unbonded post-tensioning system is inspected for loss of material.

This program is in accordance with ASME Section XI, Subsection IWL, 2013 Edition, and complies with the provisions of 10 CFR 50.55a.

The ASME Section XI, Subsection IWL AMP will be enhanced to:

1. Include additional augmented examination requirements after post-tensioning system repair/replacement activities in accordance with Table IWL-2521-2.

2. A one-time inspection of one (1) vertical and one (1) horizontal tendon on each unit will be performed prior to the period of extended operation. The inspection will consist of visually examining one (1) wire from each of the two (2) types of tendons at a worst-case location based on evidence of free water, grease discoloration, and grease chemistry results. This location will serve as a leading indicator for potential degradation or tendon surface corrosion. The visual inspection of these wires will be performed in accordance with existing

station procedures used for inspections consistent with IWL-2523.2. The acceptance criteria will consist of each wire being free of any active corrosion, including general and pitting corrosion. In the event that the acceptance criteria are not met, and corrosion is identified, the condition will be entered into the corrective action program. The condition will be evaluated to characterize the corrosion, determine the cause of the corrosion, the location, depth, extent of the condition, and applicability of the condition to other wires that comprise that tendon. Corrective actions may include activities such as grease analysis, replacement of grease within the tendon duct, additional wire inspections from the same tendon, evaluation of the tendon capacity, potential replacement of the tendon, and augmented inspections and grease sampling of other leading indicator tendons, based, in part, on previous evidence of free water, observed grease leakage, grease discoloration, and grease chemistry results. Specific corrective actions will depend upon the cause, extent of condition, and grease properties. These corrective actions will be consistent with those actions, which would be evaluated during periodic required IWL examinations.

3. In order to monitor for tendon exposure to free water and moisture and manage any potential adverse effects, a periodic tendon water monitoring and grease sampling program will be implemented. The program will consist of:

   a. A baseline inspection of tendon grease caps at the bottom of all vertical and dome tendons, as well as all below-grade horizontal tendons, prior to the period of extended operation. The baseline inspection will check for evidence of free water and grease discoloration, with further actions taken based on the condition of the grease.

   b. A follow-up tendon grease cap inspection of all vertical and dome tendons, as well as all below grade horizontal tendons, will be performed within 10 years of the initial inspection, using the same approach as the baseline inspection.

   c. For those tendons where free water, moisture, and grease did not meet acceptance criteria during the two (2) previous inspections, periodic monitoring of grease chemistry and moisture, free water, and grease discoloration will be performed on a frequency not to exceed 10 years. Tendons, which exhibit significant quantities of free water (e.g., more than eight ounces) during periodic monitoring, will be inspected more often, with the timing of follow-up inspections increased until a frequency is achieved that no longer results in significant amounts of free water observed during successive inspections. Tendon water inspection and draining frequencies may vary from annual to every ten (10) years, depending upon grease chemistry and moisture parameters meeting IWL acceptance criteria. The maximum ten (10) year periodic frequency is meant to address any tendons, which exhibit evidence of free water but the quantity is observed to be insignificant, with no observable grease discoloration, and given that the tendon wasn't inspected for at least ten (10) years prior. More frequent follow-up inspections will be performed for tendons, which exhibit insignificant quantities of free water, but were inspected within the ten (10) years prior. In all cases, the frequency of inspections for water in individual tendons will be adjusted to be commensurate with the severity of the conditions found during each examination.

d. BRW has performed augmented inspections on additional tendons beyond those selected for the ASME Section XI, Subsection IWL program. The BRW augmented inspections are performed on a 5-year frequency, in conjunction with the ASME Section XI, Subsection IWL AMP. The current augmented examinations of additional tendons will continue until the periodic tendon water monitoring and grease sampling program described above is implemented.

   Corrective actions will be taken as necessary to ensure that the tendon grease meets ASME Section XI, Subsection IWL requirements.

4. Explicitly require that areas of concrete deterioration and distress be recorded in accordance with the guidance provided in ACI 349.3R. The visual resolution capability of direct and remote examination techniques will be sufficient to detect concrete degradation at the levels described in Chapter 5 of ACI 349.3R. The resolution capability of the optical aids used for remote examinations will be demonstrated as equivalent to direct visual examination.

5. Include quantitative acceptance criteria, based on the "Evaluation Criteria" provided in Chapter 5 of ACI 349.3R, that will be used to augment the qualitative assessment of the Responsible Engineer. In addition, the Responsible Engineer will confirm that the visual resolution capability used for the concrete Containment Structure examinations was sufficient to evaluate the examination results against the quantitative acceptance criteria described in Chapter 5 of ACI 349.3R.

These enhancements will be implemented prior to the PEO.

Protective Coating Monitoring and Maintenance Program

The Protective Coating Monitoring and Maintenance Program is an existing condition monitoring program that provides for aging management of Service Level I coatings inside BRW containments including selection, application, inspection, and maintenance. The program is comparable to RG 1.54, Revision 2. The failure of the Service Level I coatings could adversely affect the operation of the ECCS by clogging the ECCS suction strainers. Proper maintenance of the Service Level I coating ensures that coating degradation will not impact the operability of the ECCS systems. The program includes a visual examination of all reasonably accessible Service Level I coatings inside containment during every refueling outage and includes assessment and repair for any condition that adversely affects the intended function of Service Level I coatings.

Service Level I coatings will prevent or minimize the loss of material due to corrosion, but these coatings are not credited for managing the effects of corrosion for the carbon steel containment liners and components at BRW. This program ensures that the Service Level I coatings maintain adhesion so as to not affect the intended function of the ECCS suction strainers.

The program also provides controls over the amount of unqualified coating which is defined as coating inside the containment that has not passed the required laboratory testing, including irradiation and simulated DBA conditions. Unqualified coating may fail in a way to affect the intended function of the ECCS suction strainers. Therefore, the quantity of unqualified coating is controlled to ensure that the amount of unqualified coating in the containment is kept within acceptable design limits.

The Protective Coating Monitoring and Maintenance Program is an existing program that is consistent with NUREG-1801, Revision 2, AMP XI.S8 (Reference 33), with enhancements as described below:

1. Add recurring work orders requiring Service Level I coating inspections every refuel outage.
2. Require qualification of coating inspectors to ASTM D 5498.
3. Require qualification of personnel in accordance with ASTM D 7108.
4. Incorporate guidance for inspection and maintenance of Service Level I coatings per RG 1.54 and impose ASTM D5163-08 requirements for Service Level I coatings condition assessment, reporting, evaluation, and documentation.
5. Require thorough visual inspections of all coatings near sumps or screens associated with the ECCS by the coatings inspector(s).
6. Specify instruments and equipment that may be needed for Service Level I coatings inspections.

These enhancements will be implemented prior to the PEO.

3.9 NRC SE Limitations and Conditions

3.9.1 Limitations and Conditions Applicable to NEI 94-01, Revision 2-A

The NRC staff found that the use of NEI TR 94-01, Revision 2, was acceptable for referencing by licensees proposing to amend their TS to permanently extend the ILRT surveillance interval to 15 years, provided the following conditions as listed in Table 3.9.1-1 are satisfied:

Table 3.9.1-1: NEI 94-01, Revision 2-A, Limitations and Conditions

Limitation/Condition (from Section 4.0 of SE)	BRW Response
For calculating the Type A leakage rate, the licensee should use the definition in the NEI TR 94-01, Revision 2, in lieu of that in ANSI/ANS-56.8-2002. (Refer to SE Section 3.1.1.1)	BRW will utilize the definition in NEI 94-01, Revision 3-A, Section 5.0. This definition has remained unchanged from Revision 2-A to Revision 3-A of NEI 94-01.
The licensee submits a schedule of containment inspections to be performed prior to and between Type A tests. (Refer to SE Section 3.1.1.3)	Reference Sections 3.5.3 and 3.5.4 of this submittal.
The licensee addresses the areas of the containment structure potentially subjected to degradation. (Refer to SE Section 3.1.3)	Reference Section 3.6.3 of this submittal.

Table 3.9.1-1: NEI 94-01, Revision 2-A, Limitations and Conditions	
Limitation/Condition (from Section 4.0 of SE)	**BRW Response**
The licensee addresses any tests and inspections performed following major modifications to the containment structure, as applicable. (Refer to SE Section 3.1.4)	No major containment modifications have been performed since the last ILRT in 2013 (Unit 1) and 2014 (Unit 2). Steam generator replacement on Braidwood Unit 1 was completed in 1998 (A1R07). An ILRT was performed after completion of the Unit 1 steam generator replacement during A1R07 to verify containment integrity (Reference Section 3.1.5 of this submittal). There are no major modifications planned that would require the performance of a Type A or Structural Integrity Test (SIT). Reference Section 3.7.13 of this submittal.
The normal Type A test interval should be less than 15 years. If a licensee has to utilize the provision of Section 9.1 of NEI TR 94-01, Revision 2, related to extending the ILRT interval beyond 15 years, the licensee must demonstrate to the NRC staff that it is an unforeseen emergent condition. (Refer to SE Section 3.1.1.2)	BRW will follow the requirements of NEI 94-01, Revision 3-A, Section 9.1. This requirement has remained unchanged from Revision 2-A to Revision 3-A of NEI 94-01. In accordance with the requirements of NEI 94-01 Revision 2-A, SE Section 3.1.1.2, BRW will also demonstrate to the NRC staff that an unforeseen emergent condition exists in the event an extension beyond the 15-year interval is required.
For plants licensed under 10 CFR 52, applications requesting a permanent extension of the ILRT surveillance interval to 15 years should be deferred until after the construction and testing of containments for that design have been completed and applicants have confirmed the applicability of NEI 94-01, Revision 2, and EPRI Report No. 1009325, Revision 2, including the use of past containment ILRT data.	Not applicable. BRW, Units 1 and 2 were not licensed under 10 CFR 52.

3.9.2 Limitations and Conditions Applicable to NEI 94-01, Revision 3-A

The NRC staff found that the guidance in NEI TR 94-01, Revision 3, was acceptable for referencing by licensees in the implementation for the optional performance-based requirements of Option B to 10 CFR 50, Appendix J. However, the NRC staff identified two conditions on the use of NEI TR 94-01, Revision 3 (Reference NEI 94-01, Revision 3-A, NRC SE 4.0, Limitations and Conditions).

Topical Report Condition 1

NEI TR 94-01, Revision 3, is requesting that the allowable extended interval for Type C LLRTs be increased to 75 months, with a permissible extension (for non-routine emergent conditions) of nine months (84 months total). The staff is allowing the extended interval for Type C LLRTs be increased to 75 months with the requirement that a licensee's post-outage report include the margin between the Type B and Type C leakage rate summation and its regulatory limit. In addition, a corrective action plan shall be developed to restore the margin to an acceptable level. The staff is also allowing the non-routine emergent extension out to 84-months as applied to Type C valves at a site, with some exceptions that must be detailed in NEI 94-01, Revision 3. At no time shall an extension be

allowed for Type C valves that are restricted categorically (e.g., BWR MSIVs), and those valves with a history of leakage, or any valves held to either a less than maximum interval or to the base refueling cycle interval. Only non-routine emergent conditions allow an extension to 84 months.

Response to Condition 1:

Condition 1 presents the following three (3) separate issues that are required to be addressed:

- ISSUE 1 – The allowance of an extended interval for Type C LLRTs of 75 months carries the requirement that a licensee's post-outage report include the margin between the Type B and Type C leakage rate summation and its regulatory limit.
- ISSUE 2 – In addition, a corrective action plan shall be developed to restore the margin to an acceptable level.
- ISSUE 3 – Use of the allowed 9-month extension for eligible Type C valves is only authorized for non-routine emergent conditions with exceptions as detailed in NEI 94-01, Revision 3-A, Section 10.1.

Response to Condition 1, ISSUE 1:

The post-outage report shall include the margin between the Type B and Type C Minimum Pathway Leak Rate (MNPLR) summation value, as adjusted to include the estimate of applicable Type C leakage understatement, and its regulatory limit of 0.60 L_a.

Response to Condition 1, ISSUE 2:

When the potential leakage understatement adjusted Types B and C MNPLR total is greater than the BRW administrative leakage summation limit of 0.50 L_a, but less than the regulatory limit of 0.6 L_a, then an analysis and determination of a corrective action plan shall be prepared to restore the leakage summation margin to less than the BRW leakage limit. The corrective action plan shall focus on those components which have contributed the most to the increase in the leakage summation value and the manner of timely corrective action, as deemed appropriate, that best focuses on the prevention of future component leakage performance issues so as to maintain an acceptable level of margin.

Response to Condition 1, ISSUE 3:

BRW will apply the 9-month allowable interval extension period only to eligible Type C components for non-routine emergent conditions. Such occurrences will be documented in the record of tests.

Topical Report Condition 2

The basis for acceptability of extending the ILRT interval out to once per 15 years was the enhanced and robust primary containment inspection program and the local leakage rate testing of penetrations. Most of the primary containment leakage experienced has been attributed to penetration leakage and penetrations are thought to be the most likely location of most containment leakage at any time. The containment leakage condition monitoring regime involves a portion of the penetrations being tested each refueling outage, nearly all LLRTs being performed during plant outages. For the purposes of assessing and monitoring or trending

overall containment leakage potential, the as-found minimum pathway leakage rates for the just tested penetrations are summed with the as-left minimum pathway leakage rates for penetrations tested during the previous 1 or 2 or even 3 refueling outages. Type C tests involve valves, which in the aggregate, will show increasing leakage potential due to normal wear and tear, some predictable and some not so predictable. Routine and appropriate maintenance may extend this increasing leakage potential. Allowing for longer intervals between LLRTs means that more leakage rate test results from farther back in time are summed with fewer just tested penetrations and that total is used to assess the current containment leakage potential. This leads to the possibility that the LLRT totals calculated understate the actual leakage potential of the penetrations. Given the required margin included with the performance criterion and the considerable extra margin most plants consistently show with their testing, any understatement of the LLRT total using a 5-year test frequency is thought to be conservatively accounted for. Extending the LLRT intervals beyond 5 years to a 75-month interval should be similarly conservative provided an estimate is made of the potential understatement and its acceptability determined as part of the trending specified in NEI TR 94-01, Revision 3, Section 12.1.

When routinely scheduling any LLRT valve interval beyond 60-months and up to 75-months, the primary containment leakage rate testing program trending or monitoring must include an estimate of the amount of understatement in the Types B and C total leakage and must be included in a licensee's post-outage report. The report must include the reasoning and determination of the acceptability of the extension, demonstrating that the LLRT totals calculated represent the actual leakage potential of the penetrations.

Response to Condition 2:

Condition 2 presents the following two (2) separate issues that are required to be addressed:

- ISSUE 1 – Extending the LLRT intervals beyond 5 years to a 75-month interval should be similarly conservative provided an estimate is made of the potential understatement and its acceptability determined as part of the trending specified in NEI TR 94-01, Revision 3, Section 12.1.

- ISSUE 2 – When routinely scheduling any LLRT valve interval beyond 60 months and up to 75 months, the primary containment leakage rate testing program trending or monitoring must include an estimate of the amount of understatement in the Type B and C total and must be included in a licensee's post-outage report. The report must include the reasoning and determination of the acceptability of the extension, demonstrating that the LLRT totals calculated represent the actual leakage potential of the penetrations.

Response to Condition 2, ISSUE 1:

The change in going from a 60-month extended test interval for Type C tested components to a 75-month interval, as authorized under NEI 94-01, Revision 3-A, represents an increase of 25% in the LLRT periodicity. As such, BRW will conservatively apply a potential leakage understatement adjustment factor of 1.25 to the actual As-Left leak rate, which will increase the As-Left leakage total for each Type C component currently on greater than a 60-month test interval up to the 75-month extended test interval. This will result in a combined conservative Type C total for all 75-month LLRTs being "carried forward" and will be included whenever the total leakage summation is required to be updated (either while online or following an outage).

When the potential leakage understatement adjusted leak rate total for those Type C components being tested on greater than a 60-month test interval up to the 75-month extended test interval is summed with the non-adjusted total of those Type C components being tested at less than or equal to a 60-month test interval, and the total of the Type B tested components, results in the MNPLR being greater than the BRW administrative leakage summation limit of 0.50 L_a, but less than the regulatory limit of 0.6 L_a, then an analysis and corrective action plan shall be prepared to restore the leakage summation value to less than the BRW leakage limit. The corrective action plan shall focus on those components which have contributed the most to the increase in the leakage summation value and the manner of timely corrective action, as deemed appropriate, that best focuses on the prevention of future component leakage performance issues.

Response to Condition 2, ISSUE 2:

If the potential leakage understatement adjusted leak rate MNPLR is less than the BRW administrative leakage summation limit of 0.50 L_a, then the acceptability of the greater than a 60-month test interval up to the 75-month LLRT extension for all affected Type C components has been adequately demonstrated and the calculated local leak rate total represents the actual leakage potential of the penetrations.

In addition to Condition 1, ISSUES 1 and 2, which deal with the MNPLR Types B and C summation margin, NEI 94-01, Revision 3-A, also has a margin-related requirement as contained in Section 12.1, "Report Requirements."

A post-outage report shall be prepared presenting results of the previous cycle's Type B and Type C tests, and Type A, Type B and Type C tests, if performed during that outage. The technical contents of the report are generally described in ANSI/ANS-56.8-2002 and shall be available on-site for NRC review. The report shall show that the applicable performance criteria are met and serve as a record that continuing performance is acceptable. The report shall also include the combined Type B and Type C leakage summation, and the margin between the Type B and Type C leakage rate summation and its regulatory limit. Adverse trends in the Type B and Type C leakage rate summation shall be identified in the report and a corrective action plan developed to restore the margin to an acceptable level.

At BRW, in the event an adverse trend in the aforementioned potential leakage understatement adjusted Types B and C summation is identified, then an analysis and determination of a corrective action plan shall be prepared to restore the trend and associated margin to an acceptable level. The corrective action plan shall focus on those components, which have contributed the most to the adverse trend in the leakage summation value and the manner of timely corrective action, as deemed appropriate, that best focuses on the prevention of future component leakage performance issues.

At BRW, an adverse trend is defined as three (3) consecutive increases in the final pre-mode change Types B and C MNPLR leakage summation values, as adjusted to include the estimate of applicable Type C leakage understatement, as expressed in terms of L_a.

3.10.1 Conclusion

Adoption of NEI 94-01, Revision 3-A

NEI 94-01, Revision 3-A, dated July 2012, and the conditions and limitations specified in NEI 94-01, Revision 2-A, dated October 2008, describe an NRC-accepted approach for implementing the performance-based requirements of 10 CFR 50, Appendix J, Option B. It incorporates the regulatory positions stated in RG 1.163 and includes provisions for extending Type A intervals to 15 years and Type C test intervals to 75 months. NEI 94-01, Revision 3-A, delineates a performance-based approach for determining Type A, Type B, and Type C containment leakage rate surveillance test frequencies. BRW is adopting the guidance of NEI 94-01, Revision 3-A, and the conditions and limitations specified in NEI 94-01, Revision 2-A, for the BRW 10 CFR 50, Appendix J testing program plan.

Based on the previous ILRTs conducted at BRW, EGC concludes that the permanent extension of the containment ILRT interval from 10 to 15 years represents minimal risk to increased leakage. The risk is minimized by continued Type B and Type C testing performed in accordance with Option B of 10 CFR 50, Appendix J and the overlapping inspection activities performed as part of the following BRW inspection programs:

- ASME Section XI, IWE Examinations
- ASME Section XI, IWL Examinations
- Tendon Surveillance Program (TS 5.5.6)
- Maintenance Rule Structures Monitoring Program
- Protective Coatings Monitoring and Maintenance Program

This experience is supplemented by risk analysis studies, including the BRW risk analysis provided in Attachment 3a of this submittal. The risk assessment concludes that increasing the ILRT interval on a permanent basis to a one-in-fifteen-year frequency is not considered to be significant since it represents only a small change in the BRW risk profile.

4.0 REGULATORY EVALUATION

4.1 Applicable Regulatory Requirements/Criteria

The proposed change has been evaluated to determine whether applicable regulations and requirements continue to be met.

10 CFR 50.54(o) requires primary reactor containments for water-cooled power reactors to be subject to the requirements of Appendix J to 10 CFR 50, "Primary Reactor Containment Leakage Rate Testing for Water-Cooled Power Reactors" (Reference 7). Appendix J specifies containment leakage testing requirements, including the types required to ensure the leak-tight integrity of the primary reactor containment and systems and components which penetrate the containment. In addition, Appendix J discusses leakage rate acceptance criteria, test methodology, frequency of testing and reporting requirements for each type of test.

The adoption of the Option B performance-based containment leakage rate testing for Type A, Type B and Type C testing did not alter the basic method by which Appendix J leakage rate testing is performed; however, it did alter the frequency at which Type A, Type B, and Type C containment leakage tests must be performed. Under the performance-based option of 10 CFR 50, Appendix J,

the test frequency is based upon an evaluation that reviewed "as-found" leakage history to determine the frequency for leakage testing which provides assurance that leakage limits will be maintained. The change to the Type A test frequency did not directly result in an increase in containment leakage. Similarly, the proposed change to the Type C test frequencies will not directly result in an increase in containment leakage.

EPRI TR-1009325, Revision 2-A (Reference 13), provided a risk impact assessment for optimized ILRT intervals up to 15 years, utilizing current industry performance data and risk informed guidance. NEI 94-01, Revision 3-A, Section 9.2.3.1 states that Type A ILRT intervals of up to 15 years are allowed by this guideline. The Risk Impact Assessment of Extended Integrated Leak Rate Testing Intervals, EPRI Report 1018243 (formerly TR-1009325, Revision 2-A) indicates that, in general, the risk impact associated with ILRT interval extensions for intervals up to 15 years is small. However, plant-specific confirmatory analyses are required.

The NRC staff reviewed NEI TR 94-01, Revision 2 (Reference 2), and EPRI Report No. 1009325, Revision 2-A. For NEI TR 94-01, Revision 2, the NRC staff determined that it described an acceptable approach for implementing the optional performance-based requirements of Option B to 10 CFR 50, Appendix J. This guidance includes provisions for extending Type A ILRT intervals up to 15 years and incorporates the regulatory positions stated in RG 1.163 (Reference 4). The NRC staff finds that the Type A testing methodology as described in ANSI/ANS-56.8-2002 (Reference 3), and the modified testing frequencies recommended by NEI TR 94-01, Revision 2, serve to ensure continued leakage integrity of the containment structure. Type B and Type C testing ensures that individual penetrations are essentially leak tight. In addition, aggregate Type B and Type C leakage rates support the leakage tightness of primary containment by minimizing potential leakage paths.

For EPRI Report No. 1009325, Revision 2-A, a risk-informed methodology using plant-specific risk insights and industry ILRT performance data to revise ILRT surveillance frequencies, the NRC staff finds that the proposed methodology satisfies the key principles of risk-informed decision-making applied to changes to TS as delineated in RG 1.177, "An Approach to Plant-Specific, Risk-Informed Decision Making: Technical Specifications" (Reference 34) and RG 1.174 (Reference 5). The NRC staff, therefore, found that this guidance was acceptable for referencing by licensees proposing to amend their TS in regards to containment leakage rate testing, subject to the limitations and conditions noted in Section 4.2 of the SE (Reference 11).

The NRC staff reviewed NEI TR 94-01, Revision 3 (Reference 1), and determined that it described an acceptable approach for implementing the optional performance-based requirements of Option B to 10 CFR 50, Appendix J, as modified by the conditions and limitations summarized in Section 4.0 of the associated SE. This guidance included provisions for extending Type C LLRT intervals up to 75 months. Type C testing ensures that individual CIVs are essentially leak tight. In addition, aggregate Type C leakage rates support the leakage tightness of primary containment by minimizing potential leakage paths. The NRC staff, therefore, found that this guidance, as modified to include two limitations and conditions, was acceptable for referencing by licensees proposing to amend their TS regarding containment leakage rate testing. Any applicant may reference NEI TR 94-01, Revision 3, as modified by the associated SE and approved by the NRC, and the conditions and limitations specified in NEI 94-01, Revision 2-A, dated October 2008, in a licensing action to satisfy the requirements of Option B to 10 CFR 50, Appendix J.

4.2 Precedent

This LAR is similar in nature to the following license amendments for extending the Type A test frequency to 15 years and the Type C test frequency to 75 months as previously authorized by the NRC in the associated referenced SEs:

- Beaver Valley Power Station, Unit Nos. 1 and 2, issued April 8, 2015 (Reference 35 - ML15078A058)
- Comanche Peak Nuclear Power Plant, Units 1 and 2, issued December 30, 2015 (Reference 36 - ML15309A073)
- Vogtle Electric Generating Plant, Units 1 and 2, issued October 29, 2018 (Reference 37 - ML18263A039)

4.3 No Significant Hazards Consideration

Exelon Generation Company, LLC (EGC) proposes to amend the Technical Specifications (TS) for Braidwood Station (BRW), Units 1 and 2, to allow extension of the Type A and Type C test intervals. The extension is based on the adoption of the Nuclear Energy Institute (NEI) 94-01, Industry Guideline for Implementing Performance-Based Option of 10 CFR Part 50, Appendix J, Revision 3-A, and conditions and limitations set forth in Revision 2-A.

Specifically, the proposed change revises BRW TS 5.5.16, "Containment Leakage Rate Testing Program," by replacing the reference to Regulatory Guide (RG) 1.163, "Performance-Based Containment Leak-Test Program," with a reference to NEI 94-01, "Industry Guideline for Implementing Performance-Based Option of 10 CFR 50, Appendix J," Revision 3-A, and the conditions and limitations specified in NEI 94-01, Revision 2-A.

EGC has evaluated whether or not a significant hazards consideration is involved with the proposed amendment by focusing on the three standards set forth in 10 CFR 50.92, "Issuance of amendment," as discussed below:

1. Does the proposed amendment involve a significant increase in the probability or consequences of an accident previously evaluated?

Response: No.

The proposed activity involves the revision of the Braidwood Station (BRW) Units 1 and 2 Technical Specifications (TS) 5.5.16, "Containment Leakage Rate Testing Program," to allow the extension of the Type A integrated leakage rate test (ILRT) containment test interval to 15 years, and the extension of the Type C local leakage rate test (LLRT) interval to 75 months. Per the guidance provided in Nuclear Energy Institute (NEI) 94-01, Industry Guideline for Implementing Performance-Based Option of 10 CFR 50, Appendix J, Revision 3-A, the current Type A test interval of 120 months (10 years) would be extended on a permanent basis to no longer than 15 years from the last Type A test. The current Type C test interval of 60 months for selected components would be extended on a performance basis to no longer than 75 months. Extensions of up to nine months for Types A, B, and C tests are permissible only for non-routine emergent conditions.

The proposed interval extensions do not involve either a physical change to the plant or a change in the manner in which the plant is operated or controlled. The containment is designed to provide an essentially leak tight barrier against the uncontrolled release of radioactivity to the environment for postulated accidents. As such, the containment and the testing requirements invoked to periodically demonstrate the integrity of the containment exist to ensure the plant's ability to mitigate the consequences of an accident, and do not involve the prevention or identification of any precursors of an accident.

The change in Type A test frequency to once-per-fifteen-years, measured as an increase to the total integrated plant risk, for those accident sequences influenced by Type A testing based on the probabilistic risk assessment (PRA), is 0.135 person-rem/year for Unit 1 and 0.133 person-rem/year for Unit 2. Electric Power Research Institute (EPRI) Report No. 1009325, Revision 2-A states that a very small population dose is defined as an increase of less than 1.0 person-rem per year or less than 1 percent of the total population dose, whichever is less restrictive for the risk impact assessment of the extended ILRT intervals. Moreover, the risk impact when compared to other severe accident risks is negligible.

In addition, as documented in NUREG-1493, "Performance-Based Containment Leak-Test Program," dated September 1995, Types B and C tests have identified a very large percentage of containment leakage paths, and the percentage of containment leakage paths that are detected only by Type A testing is very small. The BRW Units 1 and 2 Type A test history supports this conclusion.

The integrity of the containment is subject to two types of failure mechanisms that can be categorized as: (1) activity based, and (2) time based. Activity based failure mechanisms are defined as degradation due to system and/or component modifications or maintenance. Local leak rate test requirements and administrative controls such as configuration management and procedural requirements for system restoration ensure that containment integrity is not degraded by plant modifications or maintenance activities. The design and construction requirements of the containment combined with the containment inspections, performed in accordance with American Society of Mechanical Engineers (ASME) Boiler and Pressure Vessel (B&PV) Code, Section XI, Rules for Inservice Inspection of Nuclear Power Plant Components; Containment Maintenance Rule Inspections; Containment Coatings Program; and TS requirements, serve to provide a high degree of assurance that the containment would not degrade in a manner that is detectable only by a Type A test (ILRT). Based on the above, the proposed test interval extensions do not significantly increase the consequences of an accident previously evaluated.

Therefore, the proposed changes do not involve a significant increase in the probability or consequences of an accident previously evaluated.

2. **Does the proposed change create the possibility of a new or different kind of accident from any accident previously evaluated?**

Response: No.

The proposed amendment to the BRW Units 1 and 2 TS 5.5.16, "Containment Leakage Rate Testing Program," involves the extension of the BRW, Units 1 and 2 Type A containment test interval to 15 years and the extension of the Type C test interval to 75 months. The containment and the testing requirements to periodically demonstrate the integrity of the containment exist to ensure the plant's ability to mitigate the consequences of an accident.

The proposed change does not involve a physical modification to the plant (i.e., no new or different type of equipment will be installed) nor does it alter the design, configuration, or change the manner in which the plant is operated or controlled beyond the standard functional capabilities of the equipment.

Therefore, the proposed change does not create the possibility of a new or different kind of accident from any previously evaluated.

3. **Does the proposed change involve a significant reduction in a margin of safety?**

Response: No.

The proposed amendment to the Units 1 and 2 TS 5.5.16 involves the extension of the BRW Type A containment test interval to 15 years and the extension of the Type C test interval to 75 months for selected components. This amendment does not alter the manner in which safety limits, limiting safety system set points, or limiting conditions for operation are determined. The specific requirements and conditions of the TS Leak Rate Testing Program exist to ensure that the degree of containment structural integrity and leak-tightness that is considered in the plant safety analysis is maintained. The overall containment leak rate limit specified by TS is maintained.

The proposed change involves the extension of the interval between Type A containment leak rate tests and Type C tests for BRW, Units 1 and 2. The proposed surveillance interval extension is bounded by the 15-year ILRT interval and the 75-month Type C test interval currently authorized within NEI 94-01, Revision 3-A. Industry experience supports the conclusion that Types B and C testing detects a large percentage of containment leakage paths and that the percentage of containment leakage paths that are detected only by Type A testing is small. The containment inspections performed in accordance with 10 CFR 50, Appendix J, Option B, and the overlapping inspection activities performed as part of ASME Section XI and the TS, serve to provide a high degree of assurance that the containment would not degrade in a manner that is detectable only by Type A testing. The combination of these factors ensures that the margin of safety in the plant safety analysis is maintained. The design, operation, testing methods, and acceptance criteria for Types A, B, and C containment leakage tests specified in applicable codes and standards would continue to be met, with the acceptance of this proposed change, since these are not affected by changes to the Type A and Type C test intervals.

Therefore, the proposed changes do not involve a significant reduction in a margin of safety.

Based on the above, EGC concludes that the proposed amendment does not involve a significant hazards consideration under the standards set forth in 10 CFR 50.92(c), and, accordingly, a finding of no significant hazards consideration is justified.

4.4 Conclusion

In conclusion, based on the considerations discussed above, (1) there is reasonable assurance that the health and safety of the public will not be endangered by operation in the proposed manner, (2) such activities will be conducted in compliance with the Commission's regulations, and (3) the issuance of the amendment will not be inimical to the common defense and security or to the health and safety of the public.

5.0 ENVIRONMENTAL CONSIDERATION

A review has determined that the proposed amendment would change a requirement with respect to installation or use of a facility component located within the restricted area, as defined in 10 CFR 20, or would change an inspection or surveillance requirement. However, the proposed amendment does not involve: (i) a significant hazards consideration, (ii) a significant change in the types or significant increase in the amounts of any effluent that may be released offsite, or (iii) a significant increase in individual or cumulative occupational radiation exposure. Accordingly, the proposed amendment meets the eligibility criterion for categorical exclusion set forth in 10 CFR 51.22(c)(9). Therefore, pursuant to 10 CFR 51.22(b), no environmental impact statement or environmental assessment need be prepared in connection with the proposed amendment.

6.0 REFERENCES

1. NEI 94-01, Revision 3-A, "Industry Guideline for Implementing Performance-Based Option of 10 CFR Part 50, Appendix J," dated July 2012

2. NEI 94-01, Revision 2-A, "Industry Guideline for Implementing Performance-Based Option of 10 CFR Part 50, Appendix J," dated October 2008

3. ANSI/ANS-56.8-2002, "Containment System Leakage Testing Requirements," dated November 27, 2002

4. Regulatory Guide 1.163, Revision 0, "Performance-Based Containment Leak-Test Program," dated September 1995

5. Regulatory Guide 1.174, Revision 3, "An Approach for Using Probabilistic Risk Assessment in Risk-Informed Decisions on Plant-Specific Changes to the Licensing Basis," dated January 2018

6. Regulatory Guide 1.200, Revision 2, "An Approach for Determining the Technical Adequacy of Probabilistic Risk Assessment Results for Risk-Informed Activities," dated March 2009

7. 10 CFR 50, Appendix J, "Primary Reactor Containment Leakage Testing for Water-Cooled Power Reactors"

8. NEI 94-01, Revision 0, "Industry Guideline for Implementing Performance-Based Option of 10 CFR Part 50, Appendix J," dated July 26, 1995

9. NUREG-1493, "Performance-Based Containment Leak-Test Program," dated September 1995

10. EPRI TR-104285, "Risk Impact Assessment of Revised Containment Leak Rate Test Intervals," dated August 1994

11. Letter from M. J. Maxin (NRC) to J. C. Butler (NEI), "Final Safety Evaluation for Nuclear Energy Institute (NEI) Topical Report (TR) 94-01, Revision 2, "Industry Guideline for Implementing Performance-Based Option of 10 CFR Part 50, Appendix J" and Electric Power Research Institute (EPRI) Report No. 1009325, Revision 2, August 2007, "Risk-Impact Assessment of Extended Integrated Leak Rate Testing Intervals" (TAC No. MC9663)," dated June 25, 2008 (ML081140105)

12. Letter from S. Bahadur (NRC) to B. Bradley (NEI), "Final Safety Evaluation of Nuclear Energy Institute (NEI) Report, 94-01, Revision 3, "Industry Guideline for Implementing Performance-Based Option of 10 CFR Part 50, Appendix J" (TAC No. ME2164)," dated June 8, 2012 (ML121030286)

13. EPRI 1009325, Revision 2-A, "Risk Impact Assessment of Extended Integrated Leak Rate Testing Intervals," 1018243, dated October 2008

14. Letter from R. R. Assa (NRC) to D. L. Farrar (Commonwealth Edison), "Issuance of Amendments (TAC Nos. M94212, M94213, M94214, and M94215)," dated April 4, 1996 (ML020870051)

15. ANSI/ANS-56.8-1994, "Containment System Leakage Testing Requirements," dated August 4, 1994

16. Letter from G. F. Dick, Jr. (NRC) to O. D. Kingsley (Exelon), "Issuance of Amendments; Increase in Reactor Power, Byron Station, Units 1 and 2, and Braidwood Station, Units 1 and 2 (TAC Nos. MA9428, MA9429, MA9426, and MA9427)," dated May 4, 2001 (ML011420274)

17. Letter from R. F. Kuntz (NRC) to C. M. Crane (Exelon), "Byron Station, Unit Nos. 1 and 2, and Braidwood Station, Unit Nos. 1 and 2 – Issuance of Amendments Re: Alternative Source Term (TAC Nos. MC6221, MC6222, MC6223, and MC6224)," dated September 8, 2006 (ML062340420)

18. Letter from M. J. David (NRC) to C. G. Pardee (Exelon), "Braidwood Station, Units 1 and 2 – Issuance of Amendments Re: Request for Amendment to Technical Specification 5.5.16, "Containment Leakage Rate Testing Program" (TAC Nos. MD5149 and MD5150)," dated April 2, 2008 (ML080640290)

19. Letter from J. S. Wiebe (NRC) to M. J. Pacilio (Exelon), "Braidwood Station, Units 1 and 2 – Issuance of Amendments to Revise Technical Specification 5.5.16, "Containment Leakage Rate Testing Program" (TAC Nos. MF2964 and MF2965)," dated March 13, 2014 (ML13326A107)

20. Letter from NRC (J. S. Wiebe) to Exelon Generation Company (B. C. Hanson), "Braidwood Station, Units 1 and 2, and Byron Station, Unit Nos. 1 and 2 – Issuance of Amendments Regarding Request to Delete Obsolete License Conditions and Make Administrative Changes to Technical Specifications (CAC Nos. MF9338, MF9339, MF9340, and MF9341)," dated July 5, 2017 (ML17088A703)

21. NEI Document, "Interim Guidance for Performing Risk Impact Assessments in Support of One-Time Extensions for Containment Integrated Leakage Rate Test Surveillance Intervals," dated October 2001 (developed by EPRI and Data Systems & Solutions)

22. Letter from C. H. Cruse (Calvert Cliffs Nuclear Power Plant) to Document Control Desk (NRC), "Response to Request for Additional Information Concerning the License Amendment Request for a One-Time Integrated Leakage Rate Test Extension," dated March 27, 2002 (ML020920100)

23. Letter from NEI to NRC, "Final Revision of Appendix X to NEI 05-04/07-12/12-16, Close-Out of Facts and Observations (F&Os)," dated February 21, 2017 (ML17086A431)

24. Letter from J. Giitter and M. J. Ross-Lee (NRC) to G. Krueger (NEI), "U.S. Nuclear Regulatory Commission Acceptance on Nuclear Energy Institute Appendix X to Guidance 05-04, 07-12, and 12-13, Close-out of Facts and Observations (F&Os)," dated May 3, 2017 (ML17079A427)

25. Report 032299-RPT-05, Revision 2, "Byron Braidwood Nuclear Power Plants; PRA Finding Level Fact and Observation Technical Review," dated May 2018

26. NUREG-2122, "Glossary of Risk-Related Terms in Support of Risk-Informed Decision Making," dated November 2013 (ML13311A353)

27. Safety Evaluation (SE) for Generic Safety Issue (GSI-191), Containment Sump Blockage, Response to Generic Letter 2004-02, "Pressurized Water Reactor Sump Performance Evaluation Methodology," Revision 0, dated December 6, 2004 (ML043280007)

28. NRC Revised Review Guidance for Licensee Responses to Generic Letter 2004-02, Enclosure 2, "Coatings Review Guidance," dated March 28, 2008 (ML080230462)

29. 10 CFR 50.55a, Codes and Standards

30. Regulatory Guide 1.147, Revision 18, "Inservice Inspection Code Case Acceptability, ASME Section XI, Division 1," dated March 2017

31. Regulatory Guide 1.35.1, "Determining Prestressing Forces for Inspection of Prestressed Concrete Containments," dated 07/1990 (ML003740040).

32. Letter from C. G. Miller (NRC) to M. P. Gallagher (Exelon), "Safety Evaluation Report Related to the License Renewal of Byron Nuclear Station, Units 1 and 2, and Braidwood Nuclear Station, Units 1 and 2 (TAC Nos. MF1879, MF1880, MF1881, MF1882)," dated July 6, 2015 (ML15166A326)

33. NUREG-1801, Revision 2, "Generic Aging Lessons Learned (GALL) Report," dated December 2010

34. Regulatory Guide 1.177, Revision 1, "An Approach for Plant-Specific, Risk-Informed Decision Making: Technical Specifications," dated May 2011

35. Letter from T. A. Lamb (NRC) to E. A. Larson (FirstEnergy), "Beaver Valley Power Station, Unit Nos. 1 and 2 – Issuance of Amendment Re: License Amendment Request to Extend Containment Leakage Rate Test Frequency (TAC Nos. MF3985 and MF3986)," dated April 8, 2015 (ML15078A058)

36. Letter from B. Singal (NRC) to R. Flores (Luminant), "Comanche Peak Nuclear Power Plant, Units 1 and 2 – Issuance of Amendments Re: Technical Specification Change for Extension of the Integrated Leak Rate Test Frequency from 10 to 15 Years (CAC Nos. MF5621 and MF5622)," dated December 30, 2015 (ML15309A073)

37. Letter from M. Orenak (NRC) to C. A. Gayheart (Southern Nuclear),"Vogtle Electric Generating Plant, Units 1 and 2, Issuance of Amendments to Extend the Containment Type A Leak Rate Test Frequency to 15 Years and Type C Leak Rate Test Frequency to 75 Months (CAC Nos. MG0240 and MG0241; EPID L-2017-LLA-0295)," dated October 29, 2018 (ML18263A039)

ATTACHMENT 2a
Proposed Technical Specifications Changes for Braidwood Station, Units 1 and 2

Braidwood Station, Units 1 and 2

Renewed Facility Operating License Nos. NPF-72 and NPF-77

Mark-up of Technical Specifications Page

Page 5.5-21

5.5 Programs and Manuals

5.5.15 Safety Function Determination Program (SFDP) (continued)

The SFDP identifies where a loss of safety function exists. If a loss of safety function is determined to exist by this program, the appropriate Conditions and Required Actions of the LCO in which the loss of safety function exists are required to be entered.

Nuclear Energy Institute (NEI) Topical Report (TR)

5.5.16 Containment Leakage Rate Testing Program

A program shall be established to implement the leakage rate testing of the containment as required by 10 CFR 50.54(o) and 10 CFR 50, Appendix J, Option B, as modified by approved exemptions. This program shall be in accordance with the guidelines contained in ~~Regulatory Guide 1.163, September 1995 and~~ NEI 94-01, ~~Revision 0.~~

The ~~peak~~ calculated containment internal pressure for the design basis loss of coolant accident, P_a, is 42.8 psig for Unit 1 and 38.4 psig for Unit 2

The maximum allowable containment leakage rate, L_a, at P_a, shall be 0.20% of containment air weight per day.

Leakage Rate acceptance criteria are:

a. Containment leakage rate acceptance criterion is $\leq 1.0\ L_a$. During the first unit startup following testing in accordance with this program, the leakage rate acceptance criteria are $< 0.60\ L_a$ for the Type B and C tests and $< 0.75\ L_a$ for Type A tests; and

"Industry Guideline for Implementing Performance-Based Option of 10 CFR 50, Appendix J," Revision 3-A, dated July 2012, and the conditions and limitations specified in NEI 94-01, Revision 2-A, dated October 2008.

ENCLOSURE 2

Byron Station, Units 1 and 2

Renewed Facility Operating License Nos. NPF-37 and NPF-66

License Amendment Request to Revise Byron Station, Units 1 and 2, Technical Specifications 5.5.16, "Containment Leakage Rate Testing Program," for Permanent Extension of Type A and Type C Leak Rate Test Frequencies

ATTACHMENT 1b
Description and Assessment

EVALUATION OF THE PROPOSED CHANGE

SUBJECT: License Amendment Request to Revise Byron Units 1 and 2 Technical Specifications 5.5.16, "Containment Leakage Rate Testing Program," for Permanent Extension of Type A and Type C Leak Rate Test Frequencies

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ATTACHMENTS:

2b. Proposed Technical Specifications Changes for Byron Station, Units 1 and 2
3b. Byron Station: Evaluation of Risk Significance of Permanent ILRT Extension

ATTACHMENT 1b
Description and Assessment

1.0 SUMMARY DESCRIPTION

In accordance with 10 CFR 50.90, "Application for amendment of license, construction permit, or early site permit," Exelon Generation Company, LLC (EGC) requests an amendment to Renewed Facility Operating License Nos. NPF-37 and NPF-66 for Byron Station (BYR), Unit 1 and Unit 2, respectively.

The proposed change revises Units 1 and 2 Technical Specifications (TS) 5.5.16, "Containment Leakage Rate Testing Program," to reflect the following:

- Increases the existing Type A integrated leakage rate test (ILRT) program test interval from 10 years to 15 years in accordance with Nuclear Energy Institute (NEI) Topical Report (TR) NEI 94-01, "Industry Guideline for Implementing Performance-Based Option of 10 CFR 50, Appendix J," Revision 3-A (Reference 1) and the conditions and limitations specified in NEI 94-01, Revision 2-A (Reference 2).

- Adopts an extension of the containment isolation valve (CIV) leakage rate testing (Type C) frequency from the 60 months currently permitted by 10 CFR 50, Appendix J, "Primary Reactor Containment Leakage Testing for Water-Cooled Power Reactors," Option B, to a 75-month frequency for Type C leakage rate testing of selected components, in accordance with NEI 94-01, Revision 3-A.

- Adopts the use of American National Standards Institute/American Nuclear Society (ANSI/ANS) 56.8-2002, "Containment System Leakage Testing Requirements," (Reference 3).

- Adopts a more conservative allowable test interval extension of nine months, for Type A, Type B and Type C leakage rate tests in accordance with NEI 94-01, Revision 3-A.

Specifically, the proposed change contained herein revises each of the BYR Units 1 and 2 TS 5.5.16, by replacing the reference to Regulatory Guide (RG) 1.163, "Performance-Based Containment Leak-Test Program," (Reference 4) and NEI 94-01, Revision 0, with a reference to NEI 94-01, Revision 3-A (Reference 1), and the conditions and limitations specified in NEI 94-01, Revision 2-A (Reference 2), as the documents used by BYR to implement the performance-based leakage testing program in accordance with Option B of 10 CFR 50, Appendix J.

2.0 DETAILED DESCRIPTION

BYR Units 1 and 2 TS 5.5.16, "Containment Leakage Rate Testing Program," currently states, in part:

> A program shall be established to implement the leakage rate testing of the containment as required by 10 CFR 50.54(o) and 10 CFR 50, Appendix J, Option B, as modified by approved exemptions. This program shall be in accordance with the guidelines contained in Regulatory Guide 1.163, September 1995 and NEI 94-01, Revision 0.

The proposed changes to BYR Units 1 and 2 TS 5.5.16 will replace the reference to RG 1.163 with reference to NEI Topical Report NEI 94-01 Revisions 2-A and 3-A.

The proposed change revises the BYR Units 1 and 2 TS 5.5.16 to read as follows (with recommended changes using strike-out and **bold-type** for clarification purposes):

> A program shall be established to implement the leakage rate testing of the containment as required by 10 CFR 50.54(o) and 10 CFR 50, Appendix J, Option B, as modified by approved exemptions. This program shall be in accordance with the guidelines contained in ~~Regulatory Guide 1.163, September 1995 and~~ **Nuclear Energy Institute (NEI) Topical Report (TR)** NEI 94-01, ~~Revision 0.~~ **"Industry Guideline for Implementing Performance-Based Option of 10 CFR 50, Appendix J," Revision 3-A, dated July 2012, and the conditions and limitations specified in NEI 94-01, Revision 2-A, dated October 2008.**

Therefore, the retyped ("clean") version of TS 5.5.16 will appear as follows:

> A program shall be established to implement the leakage rate testing of the containment as required by 10 CFR 50.54(o) and 10 CFR 50, Appendix J, Option B, as modified by approved exemptions. This program shall be in accordance with the guidelines contained in Nuclear Energy Institute (NEI) Topical Report (TR) NEI 94-01, "Industry Guideline for Implementing Performance-Based Option of 10 CFR 50, Appendix J," Revision 3-A, dated July 2012, and the conditions and limitations specified in NEI 94-01, Revision 2-A, dated October 2008.

The marked-up TS page for BYR Units 1 and 2 TS 5.5.16 are provided in Attachment 2b.

Attachment 3b contains the plant specific risk assessment conducted to support this proposed change. This risk assessment follows the guidelines of NRC RG 1.174, Revision 3 (Reference 5) and RG 1.200, Revision 2 (Reference 6). The risk assessment concludes that increasing the ILRT frequency on a permanent basis to a one-in-fifteen-year test frequency is considered to represent a small change in the BYR risk profile.

3.0 TECHNICAL EVALUATION

3.1 Description of Containment System

The BYR containments are post-tensioned reinforced concrete structures with a carbon steel liner on the inside surface. Each containment consists of a cylindrical wall, a flat foundation mat, a shallow dome roof, and penetrations through the structure. The post-tensioning system consists of vertical and horizontal tendons in the cylinder wall and three-way tendons in the dome. The steel liner and its penetrations establish the leakage-limiting boundary of the containment. The post-tensioned reinforced concrete structures provide containment structural integrity.

3.1.1 Containment Structure

The containment structure is a prestressed concrete shell structure made up of a cylinder with a shallow dome roof and flat foundation slab. The cylindrical portion is prestressed by a post-tensioning system consisting of horizontal and vertical tendons. There are three buttresses equally spaced around the containment and each horizontal tendon is anchored at buttresses 240° apart, bypassing the intermediate buttress. The dome post-tensioning system is made up of three groups of tendons oriented 120° to each other and anchored at the vertical face of the dome ring. The entire structure is lined on the inside with steel plate, which acts as a leak tight membrane.

The containment completely encloses the entire pressurized water reactor, steam generators, reactor coolant loops, and portions of the auxiliary and engineered safety features systems. It ensures that leakage of radioactive material to the environment does not cause the dose limits of 10 CFR 50.67, "Accident Source Term," to be exceeded.

The containment has the following dimensions:

a) thickness of base slab: 12'
b) diameter of base slab: 157'
c) inside diameter of containment: 140'
d) inside height of containment: 222'
e) thickness of containment wall: 3'-6"
f) dome thickness: 3'

The base foundation slab is conventionally reinforced with high strength reinforcing steel. A continuous access gallery is provided beneath the base slab for access to the vertical tendons. The top of the base slab, within the containment, is lined with a steel liner plate to provide a leak tight membrane.

The containment cylindrical wall has a constant thickness of 3.5' starting from the base slab elevation (Elev.) of 374' to the dome spring line at Elev. 555' 3-3/8". The wall has been thickened locally around the main steam penetrations, personnel lock, and equipment hatch. Containment reinforcing consists primarily of hoop and meridional steel. Prestressing tendons are arranged in hoop and meridian directions.

3.1.2 Prestressing Tendons

Three groups of tendons oriented 120° to each other have been provided in the dome. In each group there are 40 tendons spaced equally on a horizontal projection. Bearing plates for anchorage of the tendons are placed on wedge shaped pockets located on the vertical face of the dome ring.

The containment wall is prestressed using 201 hoop and 162 vertical unbonded tendons. Each hoop tendon is anchored at buttresses 240° apart, bypassing the intermediate buttress. The hoop tendons are arranged in the wall between Elev. 374'-0" and Elev. 562'-0".

Vertical tendons are anchored at the underside of the base slab at Elev. 362' and at the top of the dome ring at Elev. 579'-0". The anchorage zones for all the tendons have been provided with additional reinforcing to account for transverse tensile stresses resulting from anchorage forces reacting on the concrete.

3.1.3 Equipment Hatch

An equipment hatch is provided for access to the containment during shutdown. The transfer of equipment and components through the containment wall is accomplished through this opening. The equipment hatch is a round barrel frame with dished head access hatch. The equipment access hatch has been furnished with a double-gasketed flange. Provisions are made to pressurize the space between the double gaskets of the door flanges and the weld seam channels at the liner joint, hatch flange, and dished door. The wall around the equipment hatch has been thickened to 7'. The tendons are deflected around the equipment hatch.

3.1.4 Personnel Access Hatch

There are two personnel locks. One penetrates the dished door of the equipment hatch, used for access to the containment building. The second, which penetrates the containment on the side opposite the equipment hatch at grade level, is used as an emergency escape route, an alternate containment access at power, and as routine access for personnel and equipment into and out of the containment building during cold shutdown, refueling mode, and when the reactor is defueled. Both personnel locks are double-door, mechanically latched, welded steel assemblies. The space between the doors can be pressurized to peak containment pressure, P_a, through test connections. The shell wall around the emergency personnel lock has been thickened to 4'-6". Additional reinforcing has been provided to account for stress concentrations due to the openings and pipe support reactions. The tendons are deflected around the penetrations.

3.1.5 Steam Generator Replacement, Unit 1

During Refueling Outage B1R08 in February 1998, the steam generator replacement was completed on BYR Unit 1. This involved cutting an opening in the containment structure to facilitate removal of the original steam generators from containment and movement of the replacement steam generators into containment. During this effort, concrete was removed to provide adequate clearance for a steam generator to pass through the opening. Specific detail regarding the concrete work performed during the restoration of the containment opening following steam generator replacement is contained in Appendix B of the UFSAR. Reinforcing steel of the containment was damaged during the concrete removal process. The steel was repaired by splicing new reinforcing steel bars (rebars) to the remaining rebar in the containment structure. Reinforcing steel repair for the steam generator replacement containment opening is discussed in Section B.2.4 of Appendix B in the UFSAR.

The Unit 1 containment structure was also analyzed using Bechtel computer program BSAP to assess the effects of a temporary construction opening created in the containment wall to accommodate the steam generator replacement activities. A three-dimensional, finite-element model of the containment structure was used in the analysis. Special attention to the area of the opening was given to assess the state of stress in the containment wall during construction and after restoration of the temporary opening.

Subsequent to restoration of the containment opening following steam generator replacement, a containment pressure test as required by American Society of Mechanical Engineers (ASME) Section XI, 1992 Edition with 1992 Addenda, Subsection IWL-5000 was performed to a pressure equal to the accident pressure. This Type A test also met the requirements of 10 CFR 50 Appendix J, Option B and served to demonstrate the operability of the primary containment structure and containment liner following restoration of the temporary construction opening used during the Unit 1 steam generator replacement project. In addition to this pneumatic pressure test, qualified inspectors performed a visual examination of the containment wall concrete surface in the area of the opening to ensure there was no evidence of conditions indicative of damage or degradation.

3.2 Emergency Core Cooling System (ECCS) Net Positive Suction Head (NPSH) Analysis

Design Analyses for the ECCS pumps show that the NPSH Available is greater than the NPSH Required from the specific vendor performance curves. The analyses cover the ECCS Injection and the ECCS Recirculation Phases.

Upon a safety injection (SI) signal, the ECCS pumps take suction from the reactor water storage tank (RWST) and inject into the reactor coolant system (RCS) cold legs. When the RWST level lowers to 46.7% (LO-2), the suction source for the residual heat removal (RHR) pumps is switched to the containment recirculation sumps. As part of this sequence, the discharge from the RHR pumps is lined-up to supply the suction of the chemical and volume control (CV) and SI pumps. The NPSH requirements during ECCS Recirculation for the CV and SI pumps is satisfied by the RHR pumps discharge pressure. The suction source to the containment spray (CS) pumps is also switched to the containment recirculation sumps after the RWST level lowers to 13%.

Therefore, conditions inside the Containment Building have the potential to influence NPSH parameters only for the RHR and CS pumps. The NPSH analysis for temperatures above 200°F assumes that the vapor pressure of the recirculation sump liquid is equal to the containment pressure. This ensures that credit is not taken for increase in the containment pressure due to the accident. The NPSH analysis for temperatures below 200°F credits the minimum containment air pressure that was present inside containment before the accident. No credit is taken for the increase in containment pressure due to the accident (containment overpressurization).

3.3 Justification for the TS Change

3.3.1 Chronology of Testing Requirements of 10 CFR 50, Appendix J

The testing requirements of 10 CFR 50, Appendix J, "Primary Reactor Containment Leakage Testing for Water-Cooled Power Reactors," (Reference 7) provide assurance that leakage from the containment, including systems and components that penetrate the containment, does not exceed the allowable leakage values specified in the TS. 10 CFR 50, Appendix J also ensures that periodic surveillance of reactor containment penetrations and isolation valves are performed so that proper maintenance and repairs are made during the service life of the containment and those systems and components penetrating primary containment. The limitation on containment leakage provides assurance that the containment would perform its design function following an accident up to and including the plant design basis accident (DBA). Appendix J identifies three types of required tests:

1) Type A tests, intended to measure the primary containment overall integrated leakage rate;

2) Type B tests, intended to detect local leaks and to measure leakage across pressure-containing or leakage limiting boundaries (other than valves) for primary containment penetrations; and,

3) Type C tests, intended to measure containment isolation valve (CIV) leakage rates.

Types B and C tests identify the vast majority of potential containment leakage paths. Type A tests identify the overall (integrated) containment leakage rate and serve to ensure continued leakage integrity of the containment structure by evaluating those structural parts of the containment not covered by Types B and C testing.

In 1995, 10 CFR 50, Appendix J (Reference 7), was amended to provide a performance-based Option B for the containment leakage testing requirements. Option B requires that test intervals for Type A, Type B, and Type C testing be determined by using a performance-based approach. Performance-based test intervals are based on consideration of the operating history of the component and resulting risk from its failure. The use of the term "performance-based" in 10 CFR 50, Appendix J, refers to both the performance history necessary to extend test intervals as well as to the criteria necessary to meet the requirements of Option B.

Also, in 1995, RG 1.163, "Performance-Based Containment Leak-Test Program," (Reference 4) was issued. The RG endorsed NEI 94-01, Revision 0, (Reference 8) with certain modifications and additions. Option B, in concert with RG 1.163 and NEI 94-01, Revision 0, allows licensees with a satisfactory ILRT performance history (i.e., two consecutive, successful Type A tests) to reduce the test frequency for the containment Type A (ILRT) test from three tests in 10 years to one test in 10 years. This relaxation was based on an NRC risk assessment contained in NUREG-1493, (Reference 9) and Electric Power Research Institute (EPRI) TR-104285 (Reference 10), both of which showed that the risk increase associated with extending the ILRT surveillance interval was very small. In addition to the 10-year ILRT interval, provisions for extending the test interval an additional 15 months were considered in the establishment of the intervals allowed by RG 1.163 and NEI 94-01, but that this extension of interval "should be used only in cases where refueling schedules have been changed to accommodate other factors."

In 2008, NEI 94-01, Revision 2-A (Reference 2), was issued. This document describes an acceptable approach for implementing the optional performance-based requirements of Option B to 10 CFR 50, Appendix J, subject to the limitations and conditions noted in Section 4.0 of the NRC Safety Evaluation (SE) on NEI 94-01 (Reference 11). NEI 94-01, Revision 2-A, includes provisions for extending Type A ILRT intervals to up to 15 years and incorporates the regulatory positions stated in RG 1.163 (Reference 4). It delineates a performance-based approach for determining Type A, Type B, and Type C containment leakage rate surveillance testing frequencies. Justification for extending test intervals is based on the performance history and risk insights.

In 2012, NEI 94-01, Revision 3-A (Reference 1), was issued. This document describes an acceptable approach for implementing the optional performance-based requirements of Option B to 10 CFR 50, Appendix J and includes provisions for extending Type A ILRT intervals to up to 15 years. NEI 94-01 has been endorsed as an acceptable methodology for complying with the provisions of 10 CFR Part 50, Appendix J, Option B, by RG 1.163 and NRC SEs dated June 25, 2008 and June 8, 2012 (References 4, 11, and 12, respectively). The regulatory positions stated in RG 1.163, as modified by References 11 and 12, are incorporated in NEI 94-01 Revision 3-A. It delineates a performance-based approach for determining Type A, Type B, and Type C containment leakage rate surveillance testing frequencies. Justification for extending test intervals is based on the performance history and risk insights.

Extensions of Type B and Type C test intervals are allowed based upon completion of two consecutive periodic as-found tests where the results of each test are within a licensee's allowable administrative limits. Intervals may be increased from 30 months up to a maximum of 120 months for Type B tests (except for containment airlocks) and up to a maximum of 75 months for Type C tests. If a licensee considers extended test intervals of greater than 60 months for Type B or Type C tested components, the review should include the additional considerations of as-found tests, schedule and review as described in NEI 94-01, Revision 3-A, Section 11.3.2.

The NRC has provided guidance concerning the use of test interval extensions in the deferral of ILRTs beyond the 15-year interval in NEI 94-01, Revision 2-A, NRC SE Section 3.1.1.2, which states, in part:

> As noted above, Section 9.2.3, NEI TR 94-01, Revision 2, states, "Type A testing shall be performed during a period of reactor shutdown at a frequency of at least once per 15 years based on acceptable performance history." However, Section 9.1 states that the "required surveillance intervals for recommended Type A testing given in this section may be extended by up to 9 months to accommodate unforeseen emergent conditions but should not be used for routine scheduling and planning purposes." The NRC staff believes that extensions of the performance-based Type A test interval beyond the required 15 years

> should be infrequent and used only for compelling reasons. Therefore, if a licensee wants to use the provisions of Section 9.1 in TR NEI 94-01, Revision 2, the licensee will have to demonstrate to the NRC staff that an unforeseen emergent condition exists.

NEI 94-01, Revision 3-A, Section 10.1, Introduction, concerning the use of test interval extensions in the deferral of Type B and Type C LLRTs, based on performance, states in part, that:

> Consistent with standard scheduling practices for TS Required Surveillances, intervals of up to 120 months for the recommended surveillance frequency for Type B testing and up to 75 months for Type C testing given in this section may be extended by up to 25% of the test interval, not to exceed nine months.
>
> Notes: For routine scheduling of tests at intervals over 60 months, refer to the additional requirements of Section 11.3.2.
>
> Extensions of up to nine months (total maximum interval of 84 months for Type C tests) are permissible only for non-routine emergent conditions. This provision (nine-month extension) does not apply to valves that are restricted and/or limited to 30-month intervals in Section 10.2 (such as BWR MSIVs) or to valves held to the base interval (30 months) due to unsatisfactory LLRT performance.

The NRC also provided the following concerning the extension of ILRT intervals to 15 years in NEI 94-01, Revision 3-A, NRC SE Section 4.0, Condition 2, which states, in part:

> The basis for acceptability of extending the ILRT interval out to once per 15 years was the enhanced and robust primary containment inspection program and the local leakage rate testing of penetrations. Most of the primary containment leakage experienced has been attributed to penetration leakage and penetrations are thought to be the most likely location of most containment leakage at any time.

3.3.2 <u>Current BYR Primary Containment Leakage Rate Testing Program Requirements</u>

10 CFR 50, Appendix J was revised, effective October 26, 1995, to allow licensees to choose containment leakage testing under either Option A, "Prescriptive Requirements," or Option B, "Performance-Based Requirements." On April 4, 1996, the NRC issued Amendment No. 81 to Facility Operating License No. NPF-37 and Amendment No. 81 to Facility Operating License No. NPF-66 for the BYR, Unit Nos. 1 and 2, respectively (Reference 14), authorizing the implementation of 10 CFR 50, Appendix J, Option B for Types A, B, and C tests. The amendment modifies the TS to replace the existing scheduling requirements for overall integrated and local containment leakage rate testing with a requirement to perform the testing in accordance with 10 CFR Part 50, Appendix J, Option B, "Performance-Based Containment Leakage Rate Testing."

Current BYR Units 1 and 2 TS 5.5.16 requires that a program be established to comply with the containment leakage rate testing requirements of 10 CFR 50.54(o) and 10 CFR 50, Appendix J, Option B. The program is required to be in accordance with the guidelines contained in RG 1.163 (Reference 4). RG 1.163 endorses, with certain exceptions, NEI 94-01, Revision 0 (Reference 8), as an acceptable method for complying with the provisions of Appendix J, Option B.

RG 1.163, Section C.1 states that licensees intending to comply with 10 CFR 50, Appendix J, Option B, should establish test intervals based upon the criteria in Section 11.0 of NEI 94-01, Revision 0, rather than using test intervals specified in ANSI/ANS 56.8-1994 (Reference 15). NEI 94-01, Section 11.0 refers to Section 9, which states that Type A testing shall be performed during a period of reactor shutdown at a frequency of at least once per ten years based on acceptable performance history. Acceptable performance history is defined as completion of two consecutive periodic Type A tests where the calculated performance leakage was less than 1.0 L_a (where L_a is the maximum allowable leakage rate at peak post-accident pressure). Elapsed time between the first and last tests in a series of consecutive satisfactory tests used to determine performance shall be at least 24 months.

Adoption of the Option B performance-based containment leakage rate testing program altered the frequency of measuring primary containment leakage in Types A, B, and C tests but did not alter the basic method by which Appendix J leakage testing is performed. The test frequency is based on an evaluation of the "as-found" leakage history to determine a frequency for leakage testing which provides assurance that leakage limits will not be exceeded. The allowed frequency for Type A testing as documented in NEI 94-01 is based, in part, upon a generic evaluation documented in NUREG-1493 (Reference 8). The evaluation documented in NUREG-1493 included a study of the dependence of reactor accident risks on containment leak tightness. NUREG-1493 concluded in Section 10.1.2 that reducing the frequency of Type A tests (ILRT) from the original three (3) tests per 10 years to one (1) test per 20 years was found to lead to an imperceptible increase in risk. The estimated increase in risk is very small because ILRTs identify only a few potential containment leakage paths that cannot be identified by Types B and C testing, and the leaks that have been found by Type A tests have been only marginally above existing requirements. Given the insensitivity of risk to containment leakage rate and the small fraction of leakage paths detected solely by Type A testing, NUREG-1493 concluded that increasing the interval between ILRTs is possible with minimal impact on public risk.

3.3.3 BYR 10 CFR 50, Appendix J, Option B Licensing History

April 4, 1996 – License Amendment 81

The NRC issued Amendment No. 81 to Facility Operating License No. NPF-37 and Amendment No. 81 to Facility Operating License No. NPF-66 for the BYR, Unit Nos. 1 and 2, respectively. The amendments modified the TS to replace the existing scheduling requirements for overall integrated and local containment leakage rate testing with a requirement to perform the testing in accordance with 10 CFR Part 50, Appendix J, Option B, "Performance-Based Containment Leakage Rate Testing." Option B allows test scheduling to be adjusted based on past performance (Reference 14).

May 8, 1998 – License Amendment 102

The NRC issued Amendment No. 102 to Facility License No. NPF-37 and Amendment No. 102 to Facility Operating License No. NPF-66 for BYR, Unit Nos. 1 and 2, respectively. The amendments deferred the Type A containment ILRT for BYR, Unit 2, from December 1998, until the next refueling outage in 1999 (Reference 16).

May 4, 2001 – License Amendment 119

The NRC issued Amendment No. 119 to Facility Operating License No. NPF-37 and Amendment No. 119 to Facility Operating License No. NPF-66 for BYR, Unit Nos. 1 and 2, respectively. The amendments revised the licenses and TS to reflect approval of an increase in maximum thermal power from 3411 megawatts thermal (MWt) to 3586.6 MWt. This resulted in an approximate increase of 70 megawatts electric (MWe) for BYR Unit 1 and an approximate 40 MWe increase for BYR Unit 2. Included as part of the amendments was a revision to TS 5.5.16, "Containment Leakage Rate Testing Program," which changed the peak calculated containment internal pressure for the design basis LOCA (P_a) to 42.8 pounds per square inch gauge (psig) for Unit 1 and 38.4 psig for Unit 2 (Reference 17).

September 8, 2006 – License Amendment 147

The NRC issued Amendment No. 147 to Facility Operating License No. NPF-37 and Amendment No. 147 to Facility Operating License No. NPF-66 for BYR, Unit Nos. 1 and 2, respectively. The amendments fully implemented an alternative source term pursuant to 10 CFR 50.67. The amendment revised TS 5.5.16, "Containment Leakage Rate Testing Program," to reflect a change in the maximum allowable containment leakage rate leakage limit (L_a), at design accident pressure (P_a), from 0.10% to 0.20% of containment air weight per day (Reference 18).

February 12, 2008 – License Amendment 154

The NRC issued Amendment No.154 to Facility Operating License No. NPF-37 and Amendment No. 154 to Facility Operating License No. NPF-66 for the BYR, Unit Nos. 1 and 2, respectively. The amendments revised TS 5.5.16, "Containment Leakage Rate Testing Program," to reflect a one-time, 5-year extension of the containment Type A test (containment integrated leakage rate test (ILRT)) interval requirement, under 10 CFR 50, Appendix J, Option B, from 10 years to 15 years. The amendment allowed the next Type A ILRT to be performed within 15 years of the most recent Type A test at BYR, but no later than February 19, 2013, for Unit 1 and no later than November 2, 2014, for Unit 2 (Reference 19).

July 5, 2017 – License Amendment 198

The NRC Issued Amendment No. 198 to Renewed Facility Operating License Nos. NPF-37 and NPF-66 for the BYR Unit Nos. 1 and 2, respectively. This amendment made administrative changes to the BYR TS including a revision to TS 5.5.16. Specifically, the first paragraph in TS 5.5.16 was changed to remove "as modified by the following exceptions:" and delete exceptions 1 and 2 in their entirety, since the Type A tests were performed on September 27, 2012, and September 26, 2014, for BYR Unit Nos. 1 and 2, respectively. Therefore, with the completion of these tests, these exceptions were no longer applicable and were removed from TS 5.5.16. (Reference 35)

3.3.4 Integrated Leakage Rate Testing (ILRT) History

As noted previously, BYR TS 5.5.16 currently requires Types A, B, and C testing in accordance with RG 1.163, which endorses the methodology for complying with Option B. Since the adoption of Option B, the performance leakage rates are calculated in accordance with NEI 94-01, Section 9.1.1 for Type A testing. Tables 3.3.4-1 and 3.3.4-2 list the past Periodic Type A ILRT results for BYR, Units 1 and 2, respectively.

Table 3.3.4-1: BYR Unit 1 Type A Testing History [1]				
Test Date	**95% Upper Confidence Limit (wt.%/day)**	**As-Left Leakage (wt.%/day)**	**Acceptance Criteria (wt.%/day)**	**Test Method**
9/2/1983 [2]	0.0058	0.0310	0.075	Total Time
9/9/1988	0.0458 [3]	0.0554	0.075	Total Time
9/12/1991	0.01843	0.01777	0.075	Mass Point
2/14/1998 [4]	0.05959	0.07042	0.075	Mass Point
9/29/2012 [7]	0.07672	0.08133	0.150 [6]	Mass Point

Table 3.3.4-2: BYR Unit 2 Type A Testing History [1]				
Test Date	**95% Upper Confidence Limit (wt.%/day)**	**As-Left Leakage (wt.%/day)**	**Acceptance Criteria (wt.%/day)**	**Test Method**
7/2/1986 [2]	0.0253	0.0257	0.075	Total Time
9/7/1990	0.0706 [5]	0.07105	0.075	Total Time
9/9/1993	0.06666	0.06669	0.075	Total Time
11/9/1999	0.05832	0.07253	0.075	Mass Point
10/19/2014 [7]	0.06562	0.07977	0.150 [6]	Mass Point

Notes for Tables 3.3.4-1 and 3.3.4-2:

(1) All Unit 1 and Unit 2 Type A tests were performed at a test pressure greater than P_a. Therefore, a partial pressure calculation to adjust the wt.%/day for reduced test pressure was not required. During the Pre-Operational test, data was collected, and a leakage rate calculated at reduced pressure. However, only the leakage rate results calculated from data taken at full pressure are displayed above.

(2) This ILRT was a Pre-Operational Test.

(3) This test was performed using the Total Time test method, based on ANSI/ANS N45.4-1972. Using this test method, the "As-Found" total primary containment leakage rate was calculated to be in excess of the maximum allowable leakage rate of 0.075 wt.%/day (0.75 L_a). Leaks, which could not be quantified, were repaired or isolated without depressurizing containment. The "As-Found" leak rate exceeded the acceptance criteria. This was caused by the failure of both the inside and outside containment isolation valves on Pen P-52. At penetration P-52, check valve 1PR032 (inside CIV) leaked by its seat. In series with this valve, air-operated valve 1PR066 (outside CIV) experienced a significant packing leak.

The packing leak was repaired prior to starting the ILRT, and the check valve was replaced during the refueling outage. After the initial problems, the ILRT was completed without any significant events. The final "As-Left" total containment leakage rate was calculated to be 0.0405 wt.%/day.

(4) This ILRT was conducted following the steam generator replacement completed during the B1R08 refueling outage. This test demonstrated containment integrity before transitioning to a mode where containment operability was required.

(5) The first BYR Unit 2 Type A test following the successful pre-operational test was conducted in September 1990. During this test, a steam generator manway leaked. The leakage was isolated by closing the Main Steam Isolation Valve and pressurizing the secondary side of the steam generator to approximately one psig below the containment test pressure. Initially, the test was considered successful, since the steam generator pressure was greater than containment pressure expected during post-accident conditions. The manway leak was not considered a post-accident leakage path. However, after further review and consultation with Nuclear Reactor Regulation, Region III, Commonwealth Edison (ComEd) decided that the manway leakage should be treated as valve leakage, and the as-found test was then considered a failure. The next Type A test, conducted in September 1993, was completed successfully on both an as-found and a performance basis.

(6) On September 8, 2006, the NRC issued Amendment No. 147 to the Facility Operating Licenses for both BYR Unit 1 and BYR Unit 2. The amendments implemented an alternative accident source term pursuant to 10 CFR 50.67. The amendments revise TS 5.5.16, "Containment Leakage Rate Testing Program," to reflect a change in the maximum allowable containment leakage rate (L_a), at P_a, from 0.10% of containment air weight per day to 0.20% of containment air weight per day.

(7) A one-time, 5-year extension of Type A testing was approved by the NRC with Amendment No. 154 to Facility Operating License No. NPF-37 and Amendment No. 154 to Facility Operating License No. NPF-66 for the BYR, Unit Nos. 1 and 2, respectively (Reference 19).

3.3.5 Performance Leakage Rate Determination

The current ILRT test interval for BYR, Units 1 and 2, is ten years. Verification of this interval is presented in Tables 3.3.5-1 and 3.3.5-2. The acceptance criteria used for this verification is contained in NEI 94-01, R2-A and R3-A, Section 5.0, Definitions, and is as follows:

> The **performance leakage rate** is calculated as the sum of the Type A upper confidence limit (UCL) and as-left minimum pathway leakage rate (MNPLR) leakage rate for all Type B and Type C pathways that were in service, isolated, or not lined up in their test position (i.e., drained and vented to containment atmosphere) prior to performing the Type A test. In addition, leakage pathways that were isolated during performance of the test because of criterion for Type A tests is a performance leak rate of less than 1.0 La.

Table 3.3.5-1: Verification of Current Extended ILRT Interval for BYR Unit 1						
Test Date	**95% UCL Leakage Rate (%wt./day) (Test Pressure)**	**Volume Level Corrections (%wt./day)**	**Types B and C Penalties (%wt./day)**	**Components Isolated During ILRT (%wt./day)**	**Performance Leakage Rate (%wt./day)**	**Acceptance Criteria (%wt./day)**
2/14/1998	0.05959 (49.19 psig, P_a = 47.8 psig)	0.00063	0.01020	0	0.07042	0.075 (1)
9/29/2012 (3)	0.076724 (43.39 psig, P_a = 42.8 psig)	0.0001215	0.00448	0	0.08133	0.150 (2)

Table 3.3.5-2: Verification of Current Extended ILRT Interval for BYR Unit 2						
Test Date	**95% UCL Leakage Rate (%wt./day) (Test Pressure)**	**Volume Level Corrections (%wt./day)**	**Types B and C Penalties (%wt./day)**	**Components Isolated During ILRT (%wt./day)**	**Performance Leakage Rate (%wt./day)**	**Acceptance Criteria (%wt./day)**
11/9/1999	0.05832 (47.3 psig, P_a = 44.4 psig)	0.0011	0.01311	0	0.07253	0.075 (1)
10/19/2014 (3)	0.06562 (39.97 psig, P_a = 38.4 psig)	0.00599	0.00816	0	0.07977	0.150 (2)

Notes for Tables 3.3.5-1 and 3.3.5-2:

(1) For the 1998 (Unit 1) and 1999 (Unit 2) ILRT tests, the acceptance criterion was 1.0 L_a (0.1 wt.%/day).

(2) For the 2013 (Unit 1) and 2014 (Unit 2) ILRT tests, the acceptance criterion was 1.0 L_a (0.2 wt.%/day). Reference Tables 3.3.4-1 and 3.3.4-2 Note 6 above regarding this increase in acceptance criteria for the performance leakage rate.

(3) A one-time, 5-year extension of Type A testing was approved by the NRC with Amendment No. 154 to Facility Operating License No. NPF-37 and Amendment No. 154 to Facility Operating License No. NPF-66 for the BYR, Unit Nos. 1 and 2, respectively (Reference 19).

3.4 Plant Specific Confirmatory Analysis

3.4.1 Methodology

A plant specific confirmatory analysis was performed to provide a risk assessment of extending the currently allowed containment Type A ILRT to a permanent interval of fifteen years. The risk assessment follows the guidelines from:

- NEI 94-01, Revision 3-A (Reference 1).
- The NEI document "Interim Guidance for Performing Risk Impact Assessments in Support of One-Time Extensions for Containment Integrated Leakage Rate Test Surveillance Intervals" (Reference 20).
- The NRC regulatory guidance on the use of Probabilistic Risk Assessment (PRA) stated in RG 1.200 (Reference 6) as applied to ILRT interval extensions.
- Risk insights in support of a request for a change in a plant's licensing basis as outlined in RG 1.174, Revision 3 (Reference 5).
- The methodology used for Calvert Cliffs to estimate the likelihood and risk implications of corrosion-induced leakage of steel liners going undetected during extended test interval (Reference 21).
- The methodology used in EPRI 1018243, Revision 2-A of EPRI 1009325 (Reference 13).

Revisions to 10 CFR 50, Appendix J (Option B) allow individual plants to extend the Integrated Leak Rate Test (ILRT) Type A surveillance testing frequency requirement from three in ten years to at least once in ten years. The revised Type A frequency is based on an acceptable performance history defined as two consecutive periodic Type A tests at least 24 months apart in which the calculated performance leakage rate was less than the limiting containment leakage rate of 1.0 L_a.

The basis for the current 10-year test interval is provided in Section 11.0 of NEI 94-01, Revision 0 (Reference 8), and was established in 1995 during development of the performance-based Option B to Appendix J. Section 11.2 of NEI 94-01, Revision 0 (Reference 8) states that NUREG-1493, "Performance-Based Containment Leak Test Program," dated September 1995 (Reference 9), provides the technical basis to support rulemaking to revise leakage rate testing requirements contained in Option B to Appendix J. The basis consisted of qualitative and quantitative assessments of the risk impact (in terms of increased public dose) associated with a range of extended leakage rate test intervals. To supplement the NRC's rulemaking basis, NEI undertook a similar study. The results of that study are documented in Electric Power Research Institute (EPRI) Research Project Report TR-104285, "Risk Impact Assessment of Revised Containment Leak Rate Testing Intervals" (Reference 10).

The NRC report on performance-based leak testing, NUREG-1493, analyzed the effects of containment leakage on the health and safety of the public and the benefits realized from the containment leak rate testing. In that analysis, it was determined that for a representative PWR plant (i.e., Surry), containment isolation failures contribute less than 0.1% to the latent risks from reactor accidents. Consequently, it is desirable to show that extending the ILRT interval will not lead to a substantial increase in risk from containment isolation failures for BYR.

NEI 94-01 Revision 3-A supports using EPRI Report No. 1009325 Revision 2-A (EPRI 1018243), "Risk Impact Assessment of Extended Integrated Leak Rate Testing Intervals," for performing risk impact assessments in support of ILRT extensions (Reference 13). The Guidance provided in Appendix H of EPRI Report No. 1009325 Revision 2-A builds on the EPRI Risk Assessment

methodology, EPRI TR-104285. This methodology is followed to determine the appropriate risk information for use in evaluating the impact of the proposed ILRT changes.

It should be noted that containment leak-tight integrity is also verified through periodic in-service inspections conducted in accordance with the requirements of the American Society of Mechanical Engineers (ASME) Boiler and Pressure Vessel Code Section XI. More specifically, Subsection IWE provides the rules and requirements for in-service inspection of Class MC pressure-retaining components and their integral attachments, and of metallic shell and penetration liners of Class CC pressure-retaining components and their integral attachments in light-water cooled plants. Furthermore, NRC regulations 10 CFR 50.55a(b)(2)(ix)(E) require licensees to conduct visual inspections of the accessible areas of the interior of the containment. The associated change to NEI 94-01 will require that visual examinations be conducted during at least three other outages, and in the outage during which the ILRT is being conducted. These requirements will not be changed as a result of the extended ILRT interval. In addition, Appendix J, Type B local leak tests performed to verify the leak-tight integrity of containment penetration bellows, airlocks, seals, and gaskets are also not affected by the change to the Type A test frequency.

In the SE issued by the NRC letter dated June 25, 2008 (Reference 11), the NRC concluded that the methodology in EPRI TR-1009325, Revision 2, was acceptable for referencing by licensees proposing to amend their TS to extend the ILRT surveillance interval to 15 years, subject to the limitations and conditions noted in Section 4.0 of the Safety Evaluation (SE). Table 3.4.1-1 addresses each of the four limitations and conditions for the use of EPRI 1009325, Revision 2-A.

Table 3.4.1-1: EPRI Report No. 1009325 Revision 2 Limitations and Conditions

Limitation/Condition (from Section 4.2 of SE)	**BYR Response**
1. The licensee submits documentation indicating that the technical adequacy of their PRA is consistent with the requirements of RG 1.200 relevant to the ILRT extension.	BYR PRA technical adequacy is addressed in Section.3.4.2 of this LAR and Attachment 3b, "Byron Station: Evaluation of Risk Significance of Permanent ILRT Extension," Appendix A, "PRA Acceptability."
2.a. The licensee submits documentation indicating that the estimated risk increase associated with permanently extending the ILRT surveillance interval to 15 years is small, and consistent with the clarification provided in Section 3.2.4.5 of this SE.	Since the ILRT does not impact CDF, the relevant criterion is LERF. The increase in LERF resulting from a change in the Type A ILRT test interval from 3 in 10 years to 1 in 15 years is estimated as 5.48E-8/year for Unit 1 and 4.87E-8/year for Unit 2 using the EPRI guidance. This value increases negligibly if the risk impact of corrosion-induced leakage of the steel liners occurring and going undetected during the extended test interval is included. Therefore, the estimated change in LERF is determined to be "very small" using the acceptance guidelines of RG 1.174 (Reference 5). When external event risk is included, the increase in LERF resulting from a change in the Type A ILRT test interval from 3 in 10 years to 1 in 15 years is estimated as 6.15E-7/year for Unit 1 and 6.24E-7 for Unit 2 using the EPRI guidance, and total LERF is 7.33E-6/year for Unit 1 and 7.80E-6/year for Unit 2. As such, the estimated change in LERF is determined to be "small" using the acceptance

Table 3.4.1-1: EPRI Report No. 1009325 Revision 2 Limitations and Conditions	
Limitation/Condition (from Section 4.2 of SE)	**BYR Response**
	guidelines of RG 1.174. (See Attachment 3b, Section 7 of this submittal.)
2.b. Specifically, a small increase in population dose should be defined as an increase in population dose of less than or equal to either 1.0 person-rem per year or 1% of the total population dose, whichever is less restrictive.	The effect resulting from changing the Type A test frequency to 1-per-15 years, measured as an increase to the total integrated plant risk for those accident sequences influenced by Type A testing is 0.080 person-rem/year for Unit 1 and 0.071 for Unit 2. NEI 94-01 (Reference 1) states that a "small" population dose is defined as an increase of ≤ 1.0 person-rem per year, or ≤ 1% of the total population dose, whichever is less restrictive for the risk impact assessment of the extended ILRT intervals. The results of this calculation meet these criteria. Moreover, the risk impact for the ILRT extension when compared to other severe accident risks is negligible. (See Attachment 3b, Section 7 of this submittal.)
2.c. In addition, a small increase in CCFP should be defined as a value marginally greater than that accepted in a previous one-time 15-year ILRT extension requests. This would require that the increase in CCFP be less than or equal to 1.5 percentage point.	The increase in the conditional containment failure probability from a 3 in 10 years interval to a 1 in 15 years interval is 0.870% for Unit 1 and 0.869% for Unit 2. NEI 94-01 (Reference 1) states that increases in CCFP of ≤ 1.5 is "small." Therefore, this increase is judged to be "small." (See Attachment 3b, Section 7 of this submittal.)
3. The methodology in EPRI Report No. 1009325, Revision 2, is acceptable except for the calculation of the increase in expected population dose (per year of reactor operation). In order to make the methodology acceptable, the average leak rate accident case (accident case 3b) used by the licensees shall be 100 L_a instead of 35 L_a.	The representative containment leakage for Class 3b sequences is 100 L_a based on the guidance provided in EPRI Report No. 1009325, Revision 2-A. It should be noted that this is more conservative than the earlier previous industry Type A test interval extension requests, which utilized 35 L_a for the Class 3b sequences. (See Attachment 3b, Section 4 of this submittal.)
4. A license amendment request (LAR) is required in instances where containment over-pressure is relied upon for ECCS performance.	Containment overpressure is not required for ECCS Performance and is discussed in Section 3.2 of this submittal. Therefore, no additional request is needed.

3.4.2 PRA Acceptability

3.4.2.1 PRA Quality Statement for Permanent 15-Year ILRT Extension

The BB016a2 version of the BYR PRA model is the most recent evaluation of internal event risk. The BYR PRA modeling is highly detailed, including a wide variety of initiating events, modeled systems, operator actions, and common cause events. The PRA model quantification process used for the BYR PRA is based on the single top fault tree methodology, which is a well-known PRA methodology in the industry.

The Byron internal events and Fire PRA models have been peer reviewed to RG 1.200 Rev 2. The internal events model and Fire PRA have open Facts and Observations (F&Os); further details are provided Attachment 3b, Section A.2 of this submittal.

EGC employs a multi-faceted approach to establishing and maintaining the technical adequacy and plant fidelity of the PRA models for all operating EGC nuclear generation sites. This approach includes both a proceduralized PRA maintenance and update process and the use of self-assessments and independent peer reviews. The following information describes the EGC approach to PRA model maintenance, as it applies to the BYR PRA.

3.4.2.2 <u>PRA Maintenance and Update</u>

The EGC risk management process ensures that the applicable PRA model is an accurate reflection of the as-built and as-operated plants. This process is defined in the EGC Risk Management program, which consists of a governing procedure ("Risk Management") and subordinate implementation training and reference materials (T&RMs).

- EGC procedure "Full Power Internal Event (FPIE) PRA Model Update" delineates the responsibilities and guidelines for updating the full power internal events PRA models at all operating EGC nuclear generation sites.
- EGC procedure "Fire PRA Model Update and Control" delineates the responsibilities and guidelines for updating the station fire PRA.

The overall EGC Risk Management program defines the process for implementing regularly scheduled and interim PRA model updates, tracking issues identified as potentially affecting the PRA models (e.g., due to changes in the plant, industry operating experience, etc.) and controlling the model and associated computer files. To ensure the current PRA model remains an accurate reflection of the as-built, as-operated plants, the following activities are routinely performed:

- Documentation of the PRA model, PRA products, and bases documents.
- Controlling electronic storage of Risk Management (RM) products including PRA update information, PRA models, and PRA applications.
- Updating the full power, internal events PRA models for EGC nuclear generation sites.
- Use of quantitative and qualitative risk models in support of the On-Line Work Control Process Program for risk evaluations for maintenance tasks (corrective maintenance, preventive maintenance, minor maintenance, surveillance tests and modifications) on systems, structures, and components (SSCs) within the scope of the Maintenance Rule (10 CFR 50.65(a)(4)).

As previously indicated, RG 1.200 also requires that additional information be provided as part of the LAR submittal to demonstrate the technical adequacy of the PRA model used for the risk assessment. Each of these items (plant changes not yet incorporated into the PRA model, relevant peer review findings, and consistency with applicable PRA Standards) is discussed.

3.4.2.3 <u>Plant Changes Not Yet Incorporated in the PRA Model</u>

Each EGC station maintains an updating requirements evaluation (URE) database to track all enhancements, corrections, and unincorporated plant changes. During the normal screening conducted as part of the plant change process, if a potential model update is identified, a new URE database item is created. Depending on the potential impact of the identified change, the requirements for incorporation will vary.

As part of this PRA evaluation, a review of open items in the URE database for BYR is performed, and an assessment of the impact on the results of the application is made. A few open UREs may lead to insignificant changes in CDF and LERF. Therefore, the model is adequate to perform this ILRT extension analysis.

3.4.2.4 Applicability of Peer Review Facts and Observations (F&Os)

The technical acceptability of the BYR PRA models has been demonstrated by the peer review process. The purpose of the industry PRA peer review process is to provide a method for establishing the technical capability and adequacy of a PRA relative to expectations of knowledgeable practitioners, using a set of guidance that establishes a set of minimum requirements. PRA peer reviews continue to be performed as PRAs are updated (and upgraded) to ensure the ability to support risk-informed applications and has proven to be a valuable process for establishing technical adequacy of nuclear power plant PRAs.

The internal events PRA model was subject to a self-assessment and a full-scope peer review conducted in July 2013. The fire PRA model was subject to a self-assessment and a full-scope peer review conducted in June 2015. Findings were reviewed and closed using the process documented in Reference 22 as accepted by NRC (Reference 23). The closure review was conducted in February 2017 (Reference 24). The F&O Closure Review consisting of an assessment of existing finding-level F&Os for the full-power internal events probabilistic risk assessment (FPIE PRA), the internal flood PRA (IFPRA), and the internal fire PRA (FPRA) was performed for BYR Units 1 and 2. Table A-1 in Attachment 3b of this enclosure provides a summary of open findings and dispositions of the BYR F&O Closure Review. This information demonstrates the PRA is of sufficient quality and level of detail to support the ILRT extension analysis.

3.4.2.5 Conclusion

This information demonstrates the PRA is of sufficient quality and level of detail to support the ILRT extension analysis.

3.4.3 Summary of Plant-Specific Risk Assessment Results

The findings of the BYR, Units 1 and 2 Risk Assessment contained in Attachment 3b of this submittal confirm the general findings of previous studies that the risk impact associated with extending the ILRT interval from three in ten years to one in 15 years is small.

Based on the results from Attachment 3b, Section 5.2 of this submittal and the sensitivity calculations presented in Attachment 3b, Section 5.3 of this submittal, the following conclusions regarding the assessment of the plant risk are associated with extending the Type A ILRT test frequency to 15 years:

- RG 1.174 (Reference 5) provides guidance for determining the risk impact of plant-specific changes to the licensing basis. RG 1.174 defines "very small" changes in risk as resulting in increases of CDF less than 1.0E-06/year and increases in LERF less than 1.0E-07/year. Since the ILRT does not impact CDF, the relevant criterion is LERF. The increase in LERF resulting from a change in the Type A ILRT test interval from 3 in 10 years to 1 in 15 years is estimated as 5.48E-8/year for Unit 1 and 4.87E-8/year for Unit 2 using the EPRI guidance; this value increases negligibly if the risk impact of corrosion-induced leakage of the steel liners occurring and going undetected during the extended test interval is included. Therefore, the estimated change in LERF is determined to be "very small" using the acceptance guidelines of RG 1.174. The risk change resulting from a change in the

Type A ILRT test interval from 3 in 10 years to 1 in 15 years bounds the 1 in 10 years to 1 in 15 years risk change. Considering the increase in LERF resulting from a change in the Type A ILRT test interval from 1 in 10 years to 1 in 15 years is estimated as 2.28E-8/year for Unit 1 and 2.03E-8/year for Unit 2, the risk increase is "very small" using the acceptance guidelines of RG 1.174.

- When external event risk is included, the increase in LERF resulting from a change in the Type A ILRT test interval from 3 in 10 years to 1 in 15 years is estimated as 6.15E-7/year for Unit 1 and 6.24E-7 for Unit 2 using the EPRI guidance, and total LERF is 7.33E-6/year for Unit 1 and 7.80E-6/year for Unit 2. As such, the estimated change in LERF is determined to be "small" using the acceptance guidelines of RG 1.174 (Reference 5). The risk change resulting from a change in the Type A ILRT test interval from 3 in 10 years to 1 in 15 years bounds the 1 in 10 years to 1 in 15 years risk change. When external event risk is included, the increase in LERF resulting from a change in the Type A ILRT test interval from 1 in 10 years to 1 in 15 years is estimated as 2.56E-7/year for Unit 1 and 2.60E-7/year for Unit 2, and the total LERF is 6.98E-6 /year for Unit 1 and 7.44E-6/year for Unit 2. Therefore, the risk increase is "small" using the acceptance guidelines of RG 1.174. As discussed in Sections 5.1.3 and 5.2.7 of Attachment 3b of this submittal, the EPRI methodology used to estimate the increase in LERF and the models used to estimate total LERF are conservative. Therefore, even though the total LERF is near the RG 1.174 threshold, the conservative methodology adds margin.

- The effect resulting from changing the Type A test frequency to 1-per-15 years, measured as an increase to the total integrated plant risk for those accident sequences influenced by Type A testing is 0.080 person-rem/year for Unit 1 and 0.071 for Unit 2. NEI 94-01 (Reference 1) states that a "small" population dose is defined as an increase of ≤ 1.0 person-rem per year, or ≤ 1% of the total population dose, whichever is less restrictive for the risk impact assessment of the extended ILRT intervals. The results of this calculation meet these criteria. Moreover, the risk impact for the ILRT extension when compared to other severe accident risks is negligible.

- The increase in the conditional containment failure probability from the 3 in 10-year interval to 1 in 15-year interval is 0.870% for Unit 1 and 0.869% for Unit 2. NEI 94-01 (Reference 1) states that increases in CCFP of ≤ 1.5% is "small." Therefore, this increase is judged to be "small."

Therefore, increasing the ILRT interval to 15 years is considered to be "small" since it represents a small change to the BYR risk profile.

3.4.4 Previous Assessments

The NRC in NUREG-1493 (Reference 9) has previously concluded that:

- Reducing the frequency of Type A tests (ILRTs) from 3 per 10 years to 1 per 20 years was found to lead to an imperceptible increase in risk. The estimated increase in risk is very small because ILRTs identify only a few potential containment leakage paths that cannot be identified by Type B or Type C testing, and the leaks that have been found by Type A tests have been only marginally above existing requirements.

- Given the insensitivity of risk to containment leakage rate and the small fraction of leakage paths detected solely by Type A testing, increasing the interval between integrated leakage-rate tests is possible with minimal impact on public risk. The impact of relaxing the

ILRT frequency beyond 1 in 20 years has not been evaluated. Beyond testing the performance of containment penetrations, ILRTs also test integrity of the containment structure.

The conclusions for BYR confirm these general conclusions on a plant-specific basis considering the severe accidents evaluated for BYR, the BYR containment failure modes, and the local population surrounding BYR.

3.4.5 RG 1.174, Revision 3, Defense in Depth Evaluation

RG 1.174, Revision 3 (Reference 5) describes an approach that is acceptable for developing risk-informed applications for a licensing basis change that considers engineering issues and applies risk insights. One of the considerations included in RG 1.174 is Defense in Depth. Defense in Depth is a safety philosophy that employs successive compensatory measures to prevent accidents or mitigate damage if a malfunction, accident, or naturally caused event occurs at a nuclear facility. The following seven considerations, as presented in RG 1.174, Revision 3, Section C.2.1.1.2, will serve to evaluate the proposed licensing basis change for overall impact on Defense in Depth.

1. Preserve a reasonable balance among the layers of defense.

A reasonable balance of the layers of defense (i.e., minimizing challenges to the plant, preventing any events from progressing to core damage, containing the radioactive source term, and emergency preparedness) helps to ensure an apportionment of the plant's capabilities between limiting disturbances to the plant and mitigating their consequences. The term "reasonable balance" is not meant to imply an equal apportionment of capabilities. The NRC recognizes that aspects of a plant's design or operation might cause one or more of the layers of defense to be adversely affected. For these situations, the balance between the other layers of defense becomes especially important when evaluating the impact of the proposed licensing basis change and its effect on defense in depth.

Response:
Several layers of defense are in place to ensure the BYR containment structure(s) penetrations, isolation valves and mechanical seal systems continue(s) to perform their intended safety function. The purpose of the proposed change is to extend the testing frequencies of the Type A ILRT from 10 years to 15 years and Type C LLRTs for selected components from 60 months to 75 months.

As shown in NUREG-1493, "Performance-Based Containment Leak-Test Program" (Reference 9), increasing the test frequency of ILRTs up to a 20-year test interval was found to lead to an imperceptible increase in risk. The estimated increase in risk is very small because ILRTs identify only a few potential containment leakage paths that cannot be identified by Type B or Type C testing. The study also concluded that extending the frequency of Type B tests is possible with no adverse impact on risk as identified leakage through Type B mechanical penetrations are both infrequent and small. Finally, the study concluded that Types B and C tests could identify the vast majority (greater than 95 percent) of all potential leakage paths.

Several programmatic factors can also be cited as layers of defense ensuring the continued safety function of the BYR containment pressure boundary. NEI 94-01 Revisions 2-A and 3-A require sites adopting the 15-year extended ILRT interval perform visual examinations of the accessible interior and exterior surfaces of the containment

structure for structural degradation that may affect the containment leak-tight integrity at the frequency prescribed by the guidance or, if approved through a TS amendment, at the frequencies prescribed by ASME Section XI. Additionally, several measures are put in place to ensure integrity of the Type B and C tested components. NEI 94-01 limits large containment penetrations such as airlocks, purge and vent valves, BWR main steam and feedwater isolation valves, to a maximum 30-month testing interval. For those valves that meet the performance standards defined in NEI 94-01 Revision 3-A and are selected for test intervals greater than 60 months, a leakage understatement "penalty" is added to the MNPLR prior to the frequency being extended beyond 60-months. Finally, identification of adverse trends in the overall Types B and C leakage rate summations and available margin between the Types B and Type C leakage rate summation and its regulatory limit are required by NEI 94-01, Revision 3-A to be shown in the BYR post-outage report(s). Therefore, the proposed change does not challenge or limit the layers of defense available to assess the ability of the BYR containment structure to perform its safety function.

PRA Response:
The use of the risk metrics of LERF, population dose, and conditional containment failure probability collectively ensures the balance between prevention of core damage, prevention of containment failure, and consequence mitigation is preserved. The change in LERF is "very small" with respect to internal events and "small" when including external events per RG 1.174, and the change in population dose and CCFP are "small" as defined in this analysis and consistent with NEI 94-01, Revision 3-A.

2. ***Preserve adequate capability of design features without an overreliance on programmatic activities as compensatory measures.***

Nuclear power plant licensees implement a number of programmatic activities, including programs for quality assurance, testing and inspection, maintenance, control of transient combustible material, foreign material exclusion, containment cleanliness, and training. In some cases, activities that are part of these programs are used as compensatory measures; that is, they are measures taken to compensate for some reduced functionality, availability, reliability, redundancy, or other feature of the plant's design to ensure safety functions (e.g., reactor vessel inspections that provide assurance that reactor vessel failure is unlikely). NUREG-2122, "Glossary of Risk-Related Terms in Support of Risk-Informed Decision Making" (Reference 25), defines "safety function" as those functions needed to shut down the reactor, remove the residual heat, and contain any radioactive material release.

A proposed licensing basis change might involve or require compensatory measures. Examples include hardware (e.g., skid-mounted temporary power supplies); human actions (e.g., manual system actuation); or some combination of these measures. Such compensatory measures are often associated with temporary plant configurations. The preferred approach for accomplishing safety functions is through engineered systems. Therefore, when the proposed licensing basis change necessitates reliance on programmatic activities as compensatory measures, the licensee should justify that this reliance is not excessive (i.e., not overly reliant). The intent of this consideration is not to preclude the use of such programs as compensatory measures but to ensure that the use of such measures does not significantly reduce the capability of the design features (e.g., hardware).

Response:

The purpose of the proposed change is to extend the testing frequencies of the Type A ILRT from 10 years to 15 years and select Type C LLRTs from 60 months to 75 months. Several programmatic factors were defined in the response to Question 1 above, which are required when adopting NEI 94-01, Revisions 2-A and 3-A. These factors are conservative in nature and are designed to generate corrective actions if the required testing or inspections are deemed unsatisfactory well in advance to ensure the continued safety function of the containment is maintained. The programmatic factors are designed to provide differing ways to test and/or examine the containment pressure boundary in a manner that verifies the BYR containment pressure boundary will perform its intended safety function. Since the proposed change does not alter the configuration of the BYR containment pressure boundary, continued performance of the tests and inspections associated with NEI 94-01 will only serve to ensure the continued safety function of the containment without affecting any margin of safety.

PRA Response:
The adequacy of the design feature (the containment boundary subject to Type A testing) is preserved as evidenced by the overall "small" change in risk associated with the Type A test frequency change.

3. Preserve system redundancy, independence, and diversity commensurate with the expected frequency and consequences of challenges to the system, including consideration of uncertainty.

As stated in Section C.2.1.1.1, the defense-in-depth philosophy has traditionally been applied in plant design and operation to provide multiple means to accomplish safety functions.

System redundancy, independence, and diversity result in high availability and reliability of the function and also help ensure that system functions are not reliant on any single feature of the design. Redundancy provides for duplicate equipment that enables the failure or unavailability of at least one set of equipment to be tolerated without loss of function. Independence of equipment implies that the redundant equipment is separate such that it does not rely on the same supports to function.

This independence can sometimes be achieved by the use of physical separation or physical protection. Diversity is accomplished by having equipment that performs the same function rely on different attributes such as different principles of operation, different physical variables, different conditions of operation, or production by different manufacturers which helps reduce common-cause failure (CCF).

A proposed change might reduce the redundancy, independence, or diversity of systems. The intent of this consideration is to ensure that the ability to provide the system function is commensurate with the risk of scenarios that could be mitigated by that function. The consideration of uncertainty, including the uncertainty inherent in the PRA, implies that the use of redundancy, independence, or diversity provides high reliability and availability and also results in the ability to tolerate failures or unanticipated events.

Response:
The proposed change to extend the testing frequencies of the Type A ILRT from 10 years to 15 years and select Type C LLRTs from 60 months to 75 months does not reduce the redundancy, independence or diversity of systems. As shown in NUREG-1493, increasing the test frequency of ILRTs up to a 20-year test interval was found to lead to an

imperceptible increase in risk. The estimated increase in risk is very small because ILRTs identify only a few potential containment leakage paths that cannot be identified by Type B or Type C testing. The study also concluded that extending the frequency of Type B tests is possible with no adverse impact on risk as identified leakage through Type B mechanical penetrations are both infrequent and small. Additionally, the study concluded that Type B and C tests could identify the vast majority (greater than 95 percent) of all potential leakage paths.

Despite the change in test interval, containment isolation diversity remains unaffected and will continue to provide the inherent isolation, as designed. In addition, NEI 94-01, Revisions 2-A and 3-A, Section 11.3.2 requires a schedule of tests be developed, for components on a test interval greater than 60 months, such that unanticipated random failures and unexpected common-mode failures are avoided. This is typically accomplished by implementing test intervals at approximately evenly distributed intervals. Therefore, the proposed change preserves system redundancy, independence, and diversity and ensures a high reliability and availability of the containment structure to perform its safety function in the event of unanticipated events.

PRA Response:
The redundancy, independence, and diversity of the containment subject to the Type A test is preserved, commensurate with the expected frequency and consequences of challenges to the system, as evidenced by the overall "small" change in risk associated with the Type A test frequency change.

4. ***Preserve adequate defense against potential common-cause failures (CCFs).***

An important aspect of ensuring defense in depth is to guard against CCF. Multiple components may fail to function because of a single specific cause or event that could simultaneously affect several components important to risk. The cause or event may include an installation or construction deficiency, accidental human action, extreme external environment, or an unintended cascading effect from any other operation or failure within the plant. CCFs can also result from poor design, manufacturing, or maintenance practices. Defenses can prevent the occurrence of failures from the causes and events that could allow simultaneous multiple component failures. Another aspect of guarding against CCF is to ensure that an existing defense put in place to minimize the impact of CCF is not significantly reduced; however, a reduction in one defense can be compensated for by adding another.

Response:
As part of the proposed change, BYR will be required to adopt the performance-based testing standards outlined in NEI 94-01, Revisions 2-A and 3-A along with ANSI/ANS 56.8-2002. NEI 94-01, Revisions 2-A and 3-A, Section 11.3.2 requires a schedule of tests be developed, for components on test intervals greater than 60 months, such that unanticipated random failures and unexpected common-mode failures are avoided. This is typically accomplished by implementing test intervals at approximately evenly distributed intervals. In addition, components considered to be risk-significant from a PRA standpoint are required to be limited to a testing interval less than the maximum allowable limit of 75-months. For those components that have demonstrated satisfactory performance and have had their testing limits extended, administrative testing limits are assigned on a component-by-component basis and are used to identify potential valve or penetration degradation. Administrative limits are established at a value low enough to identify and should allow early correction in advance of total valve failure. Should a component exceed

its administrative limit during testing, NEI 94-01 Revisions 2-A and 3-A require cause determinations be performed designed to reinforce achieving acceptable performance. The cause determination is designed to identify and address common-mode failure mechanisms through appropriate corrective actions. The proposed change also imposes a requirement to address "margin management" (i.e., margin between the current containment leakage rate and its pre-established limit). As a result, adoption of the performance-based testing standards proposed by this change ensures adequate barriers exist to preclude failure of the containment pressure boundary due to common-mode failures and therefore continues to guard against CCF.

PRA Response:
Adequate defense against CCFs is preserved. The Type A test detects problems in the containment which may or may not be the result of a CCF; such a CCF may affect failure of another portion of containment (i.e., local penetrations) due to the same phenomena. Adequate defense against CCFs is preserved via the continued performance of the Types B and C tests and the performance of inspections. The change to the Type A test, which bounds the risk associated with containment failure modes including those involving CCFs, does not degrade adequate defense as evidenced by the overall "small" change in risk associated with the Type A test frequency change.

5. ***Maintain multiple fission product barriers.***

Fission product barriers include the physical barriers themselves (e.g., the fuel cladding, reactor coolant system pressure boundary, and containment) and any equipment relied on to protect the barriers (e.g., containment spray). In general, these barriers are designed to perform independently so that a complete failure of one barrier does not disable the next subsequent barrier. For example, one barrier, the containment, is designed to withstand a double-ended guillotine break of the largest pipe in the reactor coolant system, another barrier.

A plant's licensing basis might contain events that, by their very nature, challenge multiple barriers simultaneously. Examples include interfacing-system loss-of-coolant accidents, steam generator tube rupture, or crediting containment accident pressure. Therefore, complete independence of barriers, while a goal, might not be achievable for all possible scenarios.

Response:
The purpose of the proposed change is to extend the testing frequencies of the Type A ILRT from 10 years to 15 years and select Type C LLRTs from 60 months to 75 months. As part of the proposed change, BYR will be required to adopt the performance-based testing standards outlined in NEI 94-01, Revisions 2-A and 3-A along with ANSI/ANS 56.8-2002. The overall containment leakage rate calculations associated with the testing standards contain inherent conservatisms through the use of margin. Plant TS require the overall primary containment leakage rate to be less than or equal to 1.0 L_a. NEI 94-01 requires the as-found Type A test leakage rate must be less than the acceptance criterion of 1.0 L_a given in the plant TS. Prior to entering a mode where containment integrity is required, the as-left Type A leakage rate shall not exceed 0.75 L_a. The as-found and as-left values are as determined by the appropriate testing methodology specifically described in ANSI/ANS-56.8–2002. Additionally, the combined leakage rate for all Type B and Type C tested penetrations shall be less than or equal to 0.6 L_a, determined on a maximum pathway basis from the as-left LLRT results prior to entering a mode where containment integrity is required. This regulatory approach results in a 25% and 40% margin,

respectively, to the 1.0 L_a requirements. For those local leak rate tested components that have demonstrated satisfactory performance and have had their testing limits extended, administrative testing limits are assigned on a component by component basis and are used to identify potential valve or penetration degradation. Administrative limits are established at a value low enough to identify and allow early correction in advance of total valve failure. Should a component exceed its administrative limit during testing, NEI 94-01 Revisions 2-A and 3-A require cause determinations be performed designed to reinforce achieving acceptable performance. The cause determination is designed to identify and address common-mode failure mechanisms through appropriate corrective actions. Therefore, the proposed change adopts requirements with inherent conservatisms to ensure the margin to safety limit is maintained, thereby, preserving the containment fission product barrier.

PRA Response:
Multiple Fission Product barriers are maintained. The portion of the containment affected by the Type A test extension is still maintained as an independent fission product barrier, albeit with an overall "small" change in the reliability of the barrier.

6. ***Preserve sufficient defense against human errors.***

Human errors include the failure of operators to correctly and promptly perform the actions necessary to operate the plant or respond to off-normal conditions and accidents, errors committed during test and maintenance, and incorrect actions by other plant staff. Human errors can result in the degradation or failure of a system to perform its function, thereby significantly reducing the effectiveness of one of the layers of defense or one of the fission product barriers. The plant design and operation include defenses to prevent the occurrence of such errors and events. These defenses generally involve the use of procedures, training, and human engineering; however, other considerations (e.g., communication protocols) might also be important.

Response:
Sufficient defense against human errors is preserved. Errors committed during testing and maintenance may be reduced by the less frequent performance of the Type A, Type B, and Type C tests (less opportunity for errors to occur).

PRA Response:
Sufficient defense against human errors is preserved. The probability of a human error to operate the plant, or to respond to off-normal conditions and accidents is not significantly affected by the change to the Type A testing frequency. Errors committed during test and maintenance may be reduced by the less frequent performance of the Type A test (less opportunity for errors to occur).

7. ***Continue to meet the intent of the plant's design criteria.***

For plants licensed under 10 CFR Part 50 or 10 CFR Part 52, the plant's design criteria are set forth in the current licensing basis of the plant. The plant's design criteria define minimum requirements that achieve aspects of the defense-in-depth philosophy; as a consequence, even a compromise of the intent of those design criteria can directly result in a significant reduction in the effectiveness of one or more of the layers of defense. When evaluating the effect of the proposed licensing basis change, the licensee should demonstrate that it continues to meet the intent of the plant's design criteria.

Response:
The purpose of the proposed change is to extend the testing frequencies of the Type A ILRT from 10 years to 15 years and select Type C LLRTs from 60 months to 75 months. The proposed extensions do not involve either a physical change to the plant or a change in the manner in which the plant is operated or controlled. As part of the proposed change, BYR will be required to adopt the performance-based testing standards outlined in NEI 94-01, Revisions 2-A and 3-A along with ANSI/ANS 56.8-2002. The leakage limits imposed by plant TS remain unchanged when adopting the performance-based testing standards outlined in NEI 94-01 Revision 3-A and ANSI/ANS 56.8-2002. Plant design limits imposed by the Updated Final Safety Analysis Report (UFSAR) also remain unchanged as a result of the proposed change. Therefore, the proposed change continues to meet the intent of the plant's design criteria to ensure the integrity of the BYR containment pressure boundary.

PRA Response:
The intent of the plant's design criteria continues to be met. The extension of the Type A test does not change the configuration of the plant or the way the plant is operated.

Conclusion:

The responses to the seven Defense in Depth questions above conclude that the existing Defense in Depth has not been diminished, rather, in some instances has been increased. Therefore, the proposed change does not comprise a reduction in safety.

3.5 Non-Risk Based Assessment

3.5.1 Safety-Related (Service Level I) Protective Coatings Program

The Safety Related Protective Coatings Program provides a common approach in controlling application, maintaining, and periodically assessing Safety-Related (Service Level I) Protective Coatings.

The failure of the Service Level I coatings could adversely affect the operation of the ECCS by clogging the ECCS suction strainers. Proper maintenance of the Service Level I coatings ensures that coating degradation will not impact the operability of the ECCS systems. The program includes a visual examination of all reasonably accessible Service Level I coatings inside containment during every refueling outage and includes assessment and repair for any condition that adversely affects the intended function of Service Level I coatings.

Service Level I coatings will prevent or minimize the loss of material due to corrosion, but these coatings are not credited for managing the effects of corrosion for the carbon steel containment liners and components at BYR. This program ensures only that the Service Level I coatings maintain adhesion so as to not affect the intended function of the ECCS suction strainers

3.5.1.1 Unqualified/Degraded Coatings in Containment

The size of the ECCS Recirculation Sump Screens was determined based on the results of head loss testing that used design basis debris loading. Coatings (qualified and unqualified were used in the test mixed with the other design basis debris. The debris load used for head loss testing included the maximum and bounding qualified and unqualified coatings debris load for all breaks.

ATTACHMENT 1b
Description and Assessment

BYR has followed the guidance from the NRC Safety Evaluation (SE) for generic safety issue GSI-191 for determining the quantity of coating debris (Reference 36). Per section 3.4.2.1 of the SE, the following LOCA effects on coatings are assumed:

- All coating (qualified and unqualified) in the ZOI will fail,
- All "qualified" (DBA-qualified or acceptable) coating outside the ZOI will remain intact
- All "unqualified" coatings outside the ZOI will fail.

The BYR design basis debris term for qualified coating has been calculated based on a Zone of Influence (ZOI) radius of 10D (Reference 26). It is recognized that the 10D ZOI assumption does result in significant conservatism. In fact, WCAP-16568-P, "Jet Impingement Testing to Determine the Zone of Influence (ZOI) for DBA-Qualified/ Acceptable Coatings," provides results of industry testing that support using a ZOI of 4D or greater for qualified epoxy coatings and a ZOI of 5D or greater for qualified un-top coated inorganic zinc coatings. In order to quantify the available margins, one debris generation case has been performed with a 5D ZOI applied to epoxy coatings, and a 10D ZOI applied to inorganic zinc coatings. The results of these analyses show that the total coating debris generated with a reduced ZOI is about 1/3 of the coating debris generated with a ZOI of 10D.

Site Engineering is responsible for verifying that the amount of coatings inside the primary containment does not exceed limits defined in design basis calculations and the UFSAR. This calculation ensures that the amount of coatings transported to the ECCS Recirculation sump does not degrade the ECCS system performance.

The total amount of protective coating debris (including Qualified 10D epoxy/epoxy phenolic and inorganic zinc, and Unqualified Coatings) inside the containment building is limited to 45.9 cubic feet (ft^3) for each unit. This quantity was considered acceptable based on ECCS suction strainer head loss testing. The results of the testing have been incorporated in the design basis analysis.

The estimated volumes of Qualified (10D) coatings and Unqualified Coatings inside the Unit 1 and Unit 2 BYR primary containments are summarized in Tables 3.5.1.1-1 through 3.5.1.1-6 below. The total volume for each containment is below the design limit and is considered to be a conservative estimate.

Table 3.5.1.1-1: Unit 1 Primary Containment Unqualified Coatings following B1R22 Refueling Outage, September 2018	
Design Limit	12.8 ft^3
Total Volume following B1R22	12.177 ft^3
Margin at start up following B1R22	0.623 ft^3
Percent of Design Limit at start up	95.13%

Table 3.5.1.1-2: Unit 1 Primary Containment Qualified Coatings 10D (epoxy/epoxy phenolic) following B1R22 Refueling Outage, September 2018 (1)	
Design Limit	26.0 ft^3
Total Volume following B1R22	25.476 ft^3
Margin at start up following B1R22	0.524 ft^3
Percent of Design Limit at start up	97.98%

Table 3.5.1.1-3: Unit 1 Primary Containment Qualified Coatings 10D (inorganic zinc) following B1R22 Refueling Outage, September 2018 (1)	
Design Limit	7.1 ft^3
Total Volume following B1R22	6.819 ft^3
Margin at start up following B1R22	0.281 ft^3
Percent of Design Limit at start up	96.04%

Table 3.5.1.1-4: Unit 2 Primary Containment Unqualified Coatings following B2R21 Refueling Outage, April 2019	
Design Limit	12.8 ft^3
Total Volume following B2R21	9.779 ft^3
Margin at start up following B2R21	3.021 ft^3
Percent of Design Limit at start up	76.40%

Table 3.5.1.1-5: Unit 2 Primary Containment Qualified Coatings 10D (epoxy/epoxy phenolic) following B2R21 Refueling Outage, April 2019 (1)	
Design Limit	26.0 ft^3
Total Volume following B2R21	25.476 ft^3
Margin at start up following B2R21	0.524 ft^3
Percent of Design Limit at start up	97.98%

Table 3.5.1.1-6: Unit 2 Primary Containment Unqualified Coatings 10D (inorganic zinc) following B2R21 Refueling Outage, April 2019 (1)	
Design Limit	7.1 ft^3
Total Volume following B2R21	6.819 ft^3
Margin at start up following B2R21	0.281 ft^3
Percent of Design Limit at start up	96.04%

Note 1: Based on the similarities between the Byron and Braidwood Units, the original quantities of qualified coating within the ZOI have been calculated based on Byron Unit 1 documents and have been made applicable to all four Units. The original quantities are adjusted as necessary to reflect changes in coating quantities inside containment.

3.5.2 Maintenance Rule Structures Monitoring Program

The Maintenance Rule Structures Monitoring Program provides an approach to systematically evaluate the various plant structures such that the effectiveness of a maintenance program can be demonstrated. The implementation of this program to meet the requirements of 10 CFR 50.65, commonly referred to as the Maintenance Rule, using the guidance of NEI 96-03, "Guidelines for Monitoring the Condition of Structures at Nuclear Power Plants." The Maintenance Rule requires that licensees monitor the performance or condition of structures, systems, or components, against established criteria. Performance monitoring of structures is impracticable; thus, condition monitoring has been set forth as the method of determining compliance with these established requirements. This program may also be used to examine structures that are outside the scope of the Maintenance Rule such as commitments made to support plant license renewals.

Unlike active plant components such as pumps, valves, generators, etc., which have prescribed periodic maintenance activities based on TS requirements, manufacturers' recommendations, and industry experience; structures are primarily passive in nature and are not normally subjected to periodic maintenance activities. Therefore, the definition of a maintenance program with respect to structures consists of the condition monitoring and timely repair, replacement, or refurbishment of age-related or event related degradation which will prevent continued degradation resulting in the loss of serviceability or the design function of the structure.

The development of this program consists of defining those tasks and the frequency at which they will be performed which will ensure that timely identification, assessment, and repair, replacement, or refurbishment of component degradation is accomplished. EGC procedures provide the bases for identification of those structures which will be monitored under the program; the specific monitoring tasks and examination criteria for each component; evaluation of the results of the monitoring activities; and the acceptance criteria for each component. The resulting documentation will be used for trending of potential continued degradation and the need for corrective action.

3.5.3 Containment Inservice Inspection Plan

The BYR Third Interval Containment Inservice Inspection (CISI) Program Plan was developed in accordance with the requirements of 10 CFR 50.55a, "Codes and Standards" (Reference 27), subject to the limitations and modifications contained within Paragraph (b) of the regulation. This plan has been developed to comply with the 2007 Edition with the 2008 Addenda of American Society of Mechanical Engineers (ASME) Boiler and Pressure Vessel (BPV) Code, Section XI, Rules for Inservice Inspection of Nuclear Power Plant Components, and implements the requirements of:

- TS 3.6.1, Containment
- TS 5.5.6, Pre-Stressed Concrete Containment Tendon Surveillance Program
- ASME Section XI, Subsection IWE, Requirements for Class MC and Metallic Liners of Class CC Components of Light-Water Cooled Plants
- ASME Section XI, Subsection IWL, Requirements for Class CC Concrete Components of Light-Water-Cooled Plants

The Inservice Inspection (ISI) Program Plan details the requirements for the examination and testing of ISI Class 1, 2, 3, MC, and CC pressure retaining components, supports, containment structures, metal liners, and post-tensioning systems at BYR Units 1, 2, and Common (0). Unit Common components are included in the Unit 1 sections, reports, and tables. This ISI Program Plan also includes Containment Inservice Inspection (CISI), Risk-Informed Inservice Inspection (RI-ISI), Augmented Examinations (AUG), and System Pressure Testing (SPT) requirements imposed on or committed to by BYR. The ISI Program Plan is also credited as the existing program for BYR License Renewal Aging Management Programs (AMPs) (reference Section 3.8 of this submittal).

The Fourth ISI and Third CISI Intervals are effective from July 16, 2016, through July 15, 2025, for BYR (see Tables 3.5.3-1, 3.5.3-2, and 3.5.3-3 for detailed notes regarding current extensions being taken). With the update to the ISI Program for the Fourth ISI Interval for ISI Class 1, 2, and 3 components, including their supports, the CISI Program is also being updated to its Third CISI Interval for ISI Class MC and CC components. This update will enable all the ISI and CISI Program components/piping structural elements (elements) to be based on the same effective Edition and Addenda of ASME Section XI, as well as share a common interval start and end date. The common ASME Code of Record for the Fourth ISI Interval and the Third CISI Interval is the 2007 Edition with the 2008 Addenda.

ATTACHMENT 1b
Description and Assessment

Paragraph IWA-2430(c)(1) of ASME Section XI allows an inspection interval to be extended or decreased by as much as one year, and paragraph IWA-2430(d) allows an inspection interval to be extended when a unit is out of service continuously for six months or more. The extension may be taken for a period of time not to exceed the duration of the outage. See Tables 3.5.3-1, 3.5.3-2, and 3.5.3-3 for intervals, periods, and extensions that apply to BYR's Fourth ISI Interval and Third CISI Interval.

The Fourth ISI Interval and the Third CISI Interval are divided into two or three inspection periods as determined by calendar years within the intervals. Tables 3.5.3-1, 3.5.3-2, and 3.5.3-3 identify the period start and end dates for the Fourth ISI Interval and the Third CISI Interval as defined by the Inspection Program. In accordance with Paragraph IWA-2430(c)(3), the inspection periods specified in these tables may be decreased or extended by as much as 1 year to enable inspections to coincide with BYR's refueling outages.

The inspection of ISI Class CC Components and Surfaces for the Third CISI Interval shall be performed in accordance with Paragraphs IWL-2410 and IWL-2420. Tables 3.5.3-2 and 3.5.3-3 identify the inspection schedules.

The BYR CISI Plan includes ASME Section XI ISI Class MC pressure retaining components and their integral attachments (including the ISI Class CC metal liner), and ISI Class CC components and structures, and post-tensioning systems that meet the criteria of Subarticle IWA-1300. This CISI Plan also includes information related to augmented examination areas, component accessibility, and examination review.

The inspection of containment structures, components, and post-tensioning systems are performed per EGC procedures. In addition, vendor procedures are used to complete more complex surveillances such as tendon testing.

Table 3.5.3-1: BYR Units 1 & 2 Third and Fourth CISI Interval/Period/Outage Matrix (for ISI Class MC Component Examinations)

Unit 1		Period	Interval	Period	Unit 2	
Outage Number	**Projected Outage Started Date**	**Start Date to End Date**	**Start Date to End Date**	**Start Date to End Date**	**Projected Outage Started Date**	**Outage Number**
B1R21	Spring 2017 (Start 3rd CISI Interval)	1st 7/16/16 to 7/15/19	3rd (Unit 1) 7/16/16 to 7/15/25 (1) 3rd (Unit 2) 7/16/16 to 7/15/25 (1)	1st 7/16/16 to 7/15/19	Fall 2017 (Start 3rd CISI Interval)	B2R20
B1R22	Fall 2018				Spring 2019	B2R21
B1R23	Spring 2020	2nd 7/16/19 to 7/15/22		2nd 7/16/19 to 7/15/22	Fall 2020	B2R22
B1R24	Fall 2021				Spring 2022	B2R23
B1R25	Spring 2023	3rd 7/16/22 to 7/15/25		3rd 7/16/22 to 7/15/25	Fall 2023	B2R24
B1R26	Fall 2024 (End 3rd CISI Interval)				Spring 2025 (End 3rd CISI Interval)	B2R25
B1R27	Spring 2026 (Start 4th CISI Interval)	1st 7/16/25 to 7/15/28	4th(Unit 1) 7/16/25 to 7/15/35 (2) 4th(Unit 2) 7/16/25 to 7/15/35 (2)	1st 7/16/25 to 7/15/28	Fall 2026 (Start 4th CISI Interval)	B2R26
B1R28	Fall 2027				Spring 2028	B2R27
B1R29	Spring 2029	2nd 7/16/28 to 7/15/32		2nd 7/16/28 to 7/15/32	Fall 2029	B2R28
B1R30	Fall 2030				Spring 2031	B2R29
B1R31	Spring 2032	3rd 7/16/32 to 7/15/35		3rd 7/16/32 to 7/15/35	Fall 2032	B2R30
B1R32	Fall 2033 (End 4th CISI Interval)				Spring 2034 (End 4th CISI Interval)	B2R31

Note 1: The BYR Units 1 and 2 Third CISI Interval was reduced by one year as permitted by Paragraph IWA-2430(c)(1) in order to coincide with the plant refueling outage schedule. For the BYR Units 1 and 2 CISI interval, the July 15, 2025, planned end date will result in the Units 1 and 2 CISI interval end date being six months early from the established sequence of intervals based on the Relief Request I3R-01 CISI interval start date (January 16, 2006).

Note 2: The schedule for the Fourth CISI interval is proposed and may be subject to change. The Fourth interval CISI program has yet to be developed.

Table 3.5.3-2: BYR Units 1 & 2 Third and Fourth CISI Interval/Period/Outage Matrix (for ISI Class CC-Concrete Component Examinations)

Unit 1		5-Year Period	Interval	5-Year Period	Unit 2	
Outage Number	**Projected Outage Start Date or Outage Duration**	**Exam # - Date (2 Year Window)**	**Start Date to End Date**	**Exam # - Date (2 Year Window)**	**Projected Outage Start Date or Outage Duration**	**Outage Number**
B1R18	Fall 2012	No Section XI Exams	2nd (Unit 1) 7/16/06 to 10/15/16 (4) 2nd (Unit 2) 7/16/06 to 10/15/16 (4)	No Section XI Exams	Spring 2013	B2R17
B1R19	Spring 2014	No Section XI Exams		No Section XI Exams	Fall 2014	B2R18
B1R20	Fall 2015 (End 2nd CISI Interval)	4th – 1/16/16 (1/16/15 to 1/15/17) (1)(2)(3)		4th – 6/12/16 (6/12/15 to 6/11/17) (1)(2)(3)	Spring 2016 (End 2nd CISI Interval)	B2R19
B1R21	(Start of 3rd CISI Interval) Spring 2017	No Section XI Exams	3rd (Unit 1) 7/16/16 (4) to 7/15/25 3rd (Unit 2) 7/16/16 to 7/15/25	No Section XI Exams	(Start 3rd CISI Interval) Fall 2017	B2R20
B1R22	Fall 2018	No Section XI Exams		No Section XI Exams	Spring 2019	B2R21
B1R23	Spring 2020	No Section XI Exams		No Section XI Exams	Fall 2020	B2R22
B1R24	Fall 2021	5th – 1/16/21 (1/16/20 to 1/15/22) (1)(3)		5th – 6/12/21 (6/12/20 to 6/11/22) (1)(3)	Spring 2022	B2R23
B1R25	Spring 2023	No Section XI Exams		No Section XI Exams	Fall 2023	B2R24
B1R26	Fall 2024 (End 3rd CISI Interval)	No Section XI Exams		No Section XI Exams	Spring 2025 (End 3rd CISI Interval)	B2R25
B1R27	(Start 4th CISI Interval) Spring 2026	6th – 1/16/26 (1/16/25 to 1/15/27) (1)(2)(3)	4th (Unit 1) 7/16/25 to 7/15/35 (5) 4th (Unit 2) 7/16/25 to 7/15/35 (5)	6th – 6/12/26 (6/12/25 to 6/11/27) (1)(2)(3)	(Start 4th CISI Interval) Fall 2026	B2R26
B1R28	Fall 2027	No Section XI Exams		No Section XI Exams	Spring 2028	B2R27
B1R29	Spring 2029	No Section XI Exams		No Section XI Exams	Fall 2029	B2R28
B1R30	Fall 2030	7th – 1/16/31 (1/16/30 to 1/15/32) (1)(2)(3)		7th – 6/12/31 (6/12/30 to 6/11/32) (1)(2)(3)	Spring 2031	B2R29
B1R31	Spring 2032	No Section XI Exams		No Section XI Exams	Fall 2032	B2R30
B1R32	Fall 2033 (End 4thCISI Interval)	No Section XI Exams		No Section XI Exams	Spring 2034 (End 4thCISI Interval)	B2R31

Note 1: The Subsection IWL examination schedule for ISI Class CC concrete surfaces meets the requirements of Subarticle IWL-2400. Paragraph IWL-2510 examinations will be performed once every 5 years. They will begin not more than 1 year prior to the specified date and will be completed not more than 1 year after such date. The initial Subsection IWL concrete examinations for each unit were required to be completed between September 9, 1996 and September 8, 2001 by 10 CFR 50.55a. The rolling 5-year examination date and associated 2-year window for each unit is determined from these first examination dates (1/16/01 and 6/12/01 for Units 1 and 2, respectively). Therefore, the schedule of the concrete surface examinations is relative to the baseline (1st 5-Year Period) concrete surface examinations that were completed when the use of the requirements of Subsection IWL of ASME Section XI was initially mandated.

Note 2: The ISI Class CC concrete surface examination 2 Year Window will straddle the 2nd and 3rd CISI Intervals, as well as, the 3rd and 4th CISI Intervals. Therefore, any examinations performed before or after the interval start date should coincide with the Subsection IWL requirements of the approved Code of Record for that given interval. Any outage required ISI Class CC concrete surface examinations should be performed in B1R20 (Unit 1) and B2R19 (Unit 2), and B1R27 (Unit 1) and B2R26 (Unit 2) to fall within the 2 Year Window.

Note 3: All BYR ISI Class CC concrete surfaces should be accessible for examination during operational periods and completion of examinations should not be outage dependent.

Note 4: The BYR Units 1 and 2 Second CISI Interval for IWL-concrete was extended by six months as permitted by Paragraph IWA-2430(d)(1) in order to coincide with the plant refueling outage schedule (note that the BYR Units 1 and 2 Second CISI Interval was extended three extra months to coincide with the IWL-concrete examination schedule; however, the extra three months will not roll-over to the next Third CISI Interval for IWL-concrete).

Note 5: The schedule for the Fourth CISI interval is proposed and may be subject to change. The Fourth Interval CISI Plan has yet to be developed.

Table 3.5.3-3: BYR Units 1 & 2 Third and Fourth CISI Interval/Period/Outage Matrix (for ISI Class CC-Tendon Component Examinations)

Unit 1		5-Year Period	Interval	5-Year Period	Unit 2	
Outage Number	**Projected Outage Start Date or Outage Duration**	**Exam # - Date (2 Year Window)**	**Start Date to End Date**	**Exam # - Date (2 Year Window)**	**Projected Outage Start Date or Outage Duration**	**Outage Number**
B1R21	(Start 3rd CISI Interval) Spring 2017	No Section XI Exams		No Section XI Exams	(Start 3rd CISI Interval) Fall 2017	B2R20
B1R22	Fall 2018	35th – 9/11/18 (9/11/17 to 9/10/19) (1)(2)(3)		No Section XI Exams	Spring 2019	B2R21
B1R23	Spring 2020	No Section XI Exams	3rd (Unit 1) 7/16/16 to 7/15/25 (4) 3rd (Unit 2) 7/16/16 to 7/15/25 (4)	35th – 5/27/20 (5/27/19 to 5/26/21) (1)(2)(3)	Fall 2020	B2R22
B1R24	Fall 2021	No Section XI Exams		No Section XI Exams	Spring 2022	B2R23
B1R25	Spring 2023	40th – 9/11/23 (9/11/22 to 9/10/24) (1)(2)(3)		No Section XI Exams	Fall 2023	B2R24
B1R26	Fall 2024 (End 3rd CISI Interval)	No Section XI Exams		40th – 5/27/25 (5/27/24 to 5/26/26) (1)(2)(3)	Spring 2025 (End 3rd CISI Interval)	B2R25
B1R27	(Start 4th CISI Interval) Spring 2026	No Section XI Exams		No Section XI Exams	(Start 4th CISI Interval) Fall 2026	B2R26
B1R28	Fall 2027	45th – 9/11/28 (9/11/27 to 9/10/29) (1)(2)(3)	4th (Unit 1) 7/16/25 to 7/15/35 (5)	No Section XI Exams	Spring 2028	B2R27
B1R29	Spring 2029	No Section XI Exams	4th (Unit 2) 7/16/25 to 7/15/35 (5)	45th – 5/27/30 (5/27/29 to 5/26/31) (1)(2)(3)	Fall 2029	B2R28
B1R30	Fall 2030	No Section XI Exams		No Section XI Exams	Spring 2031	B2R29
B1R31	Spring 2032	50th – 9/11/33 (9/11/32 to 9/10/34) (1)(2)(3)		No Section XI Exams	Fall 2032	B2R30
B1R32	Fall 2033 (End 4th CISI Interval)	No Section XI Exams		50th – 5/27/35 (5/27/34 to 5/26/36) (1)(2)(3)	Spring 2034 (End 4th CISI Interval)	B2R31

Note 1: The Subsection IWL examination schedule for ISI Class CC post-tensioning system meets the requirements of Subarticle IWL-2400. Paragraph IWL-2520 examinations will be performed once every 5 years based on a rolling 5-year frequency (+/- 1 year) from the date of completion of the previous examinations (9/7/83 through 9/11/83 and 5/23/86 through 5/27/85 for Units 1 and 2, respectively) under the BYR Tendon Surveillance program. These original dates were based on the initial Structural Integrity Tests (SITs).

Note 2: ASME Section XI Item Number L2.10 and L2.20 physical tests and examinations are performed during this surveillance. These tests and examinations are performed every other 5-year period for each individual Unit such that the two Units alternate every five years. BYR meets the requirements of ASME Section XI, Paragraph IWL-2421, "Sites with Multiple Plants." The BYR containments utilize the same pre-stressing system, are essentially identical in design, were constructed within two years, and are similarly exposed to and protected from the outside environment.

Note 3: With the exception of some dome tendon anchorages, which are considered not accessible due to safety hazards, all BYR ISI Class CC post- tensioning systems should be accessible for examination during operational periods. In the event one or more of the inaccessible dome tendons anchorages are selected under Paragraph IWL-2521, the requirements of Paragraph IWL-2521.1, "Exemptions," shall be applied. Completion of ISI Class CC post-tensioning system examinations for BYR should not be outage dependent.

Note 4: The requirements of 10 CFR 50.55a(b)(2)(viii) Paragraph (E) shall be applied to examinations and tests performed in accordance with ASME Section XI, Subsection IWL.

Note 5: The schedule for the Fourth CISI interval is proposed and may be subject to change. The Fourth Interval CISI Plan has yet to be developed.

3.5.3.1 Third Interval CISI Program

Pursuant to 10 CFR 50.55a(g), licensees are required to update their CISI Programs to meet the requirements of ASME Section XI once every ten years or inspection interval. The CISI Program is required to comply with the latest Edition and Addenda of ASME Section XI incorporated by reference in 10 CFR 50.55a twelve months prior to the start of the Third CISI Interval per 10 CFR 50.55a(g)(4)(ii). The start of the Third CISI Interval was on July 16, 2016, for BYR Units 1 and 2. Based on this date, the latest Edition and Addenda of the referenced Code twelve months prior to the start of the Third CISI Interval was the 2007 Edition with the 2008 Addenda.

The BYR Third Interval CISI Program Plan was developed in accordance with the requirements of 10 CFR 50.55a, including all published changes through December 11, 2014, and the 2007 Edition with the 2008 Addenda of ASME Section XI, subject to the limitations and modifications contained within Paragraph (b) of the regulation. The BYR Third Interval CISI Program Plan addresses Subsections IWE, IWL, Mandatory Appendices, approved ASME Code Cases, approved alternatives through relief requests and SEs, and utilizes Inspection Program as defined therein.

The BYR Third CISI Interval is effective from July 16, 2016, through July 15, 2025, for Units 1 and 2, respectively (note that the BYR Units 1 and 2 Second CISI Interval end dates for IWL-concrete were modified by extensions; however, the Third CISI Interval start date remains unchanged).

The start and end dates for the Third ISI Interval and Second CISI Interval were aligned, as well as subsequent intervals per the wording in previous Third ISI Interval and Second CISI Interval Relief Request I3R-01. Therefore, a Fourth ISI Interval and Third CISI Interval relief request is not required.

Previous Relief Request I3R-01 stated:

> Relief is requested to modify the end dates of the Byron Station Unit 2 Second ISI Interval and of the Byron Station Units 1 and 2 First CISI Intervals and the start and end dates of all subsequent ISI and CISI Intervals for Byron Station Units 1 and 2.

I3R-01 also stated that:

> All inspection periods for Class 1, 2, 3, and MC components will commence for the next interval based on the modified common interval start date. Any examination methods unique to and specifically required in the third period under the previous interval, that will likewise be required in the next interval, will be scheduled and completed in the first period of the subsequent interval. The examinations will be conducted and credited under the rules of the new code of record (i.e., 2007 Edition through the 2008 Addenda of ASME Section XI). These examinations originally unique to the third period of the previous interval will henceforth be conducted in the first period of all subsequent ISI intervals, and deferral to the end of future intervals will not be available. In addition, the rolling five-year IWL frequency applicable to Class CC components that are subject to Subsection IWL requirements will be maintained as currently scheduled.

Thus, the BYR Unit 2 end of interval CISI examinations will be conducted at the end of the first period of the Fourth ISI Interval using the 2007 Edition with the 2008 Addenda of ASME Section XI.

3.5.3.2 Inaccessible Areas

The following conditions are required to be reported in the ISI Summary Report per IWA-6000:

Reference 50.55a(b)(2)(viii)(E) – For Class CC applications, the applicant or licensee must evaluate the acceptability of inaccessible areas when conditions exist in accessible areas that could indicate the presence of or the result in degradation to such inaccessible areas. For each inaccessible area identified, the applicant or licensee must 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.

Reference 50.55a(b)(2)(ix)(A) – For Class MC applications, the following apply to inaccessible areas.

(1) The applicant or licensee must evaluate the acceptability of inaccessible areas when conditions exist in accessible areas that could indicate the presence of or could result in degradation to such inaccessible areas.

(2) For each inaccessible area identified for evaluation, the applicant or licensee must provide the following in the ISI Summary Report as required by IWA–6000:

   (i) A description of the type and estimated extent of degradation, and the conditions that led to the degradation;
   (ii) An evaluation of each area, and the result of the evaluation; and
   (iii) A description of necessary corrective actions.

3.5.3.3 Code Cases

Per 10 CFR 50.55a(b)(5), ASME Code Cases that have been determined to be suitable for use in ISI Program Plans by the NRC are listed in RG 1.147, "Inservice Inspection Code Case Acceptability - ASME Section XI, Division 1" (Reference 28). The most recent version of a given Code Case incorporated in the revision of RG 1.147 referenced in 10 CFR 50.55a(b)(5)(i) at the time it is applied within the ISI Program shall be used. The latest revision of RG 1.147 incorporated into this document is Revision 18. As this guide is revised, newly approved Code Cases may be evaluated for plan implementation at BYR per Paragraph IWA-2441(e) and proposed for use in revisions to the ISI Program Plan.

Per the latest revision of RG 1.147, if a Code Case is implemented by a licensee and a later version of the Code Case is incorporated by reference into 10 CFR 50.55a and listed in Tables 1 and 2 of RG 1.147 during the licensee's present 120-month ISI Program interval, the licensee may use either the later version or the previous version. An exception to this provision would be the inclusion of a limitation or condition on the use of the Code Case that is necessary, for example, to enhance safety.

The use of Code Cases (other than those listed in RG 1.147) may be authorized by the NRC upon request pursuant to 10 CFR 50.55a(z).

There are no CISI related ASME Code Cases currently being utilized by BYR outside of those ASME Code Cases contained in RG 1.147, Revision 18.

3.5.3.4 Relief Requests

In accordance with 10 CFR 50.55a, when a licensee either proposes alternatives to ASME Section XI requirements, which provide an acceptable level of quality and safety, determines compliance with ASME Section XI requirements would result in hardship or unusual difficulty without a compensating increase in the level of quality and safety, or determines that specific ASME Section XI requirements for inservice inspection are impractical, the licensee shall notify the NRC and submit information to support the determination.

There are no containment related relief requests or any additional CISI code cases approved for use at BYR through a request for alternatives. As detailed above in Section 3.5.3.1, Relief Request I3R-01 was authorized by the NRC to align the start and end dates for the Third ISI Interval and Second CISI Interval. A Fourth ISI Interval and Third CISI Interval relief request was not required.

3.5.3.5 Augmented Examination Areas

The containment sections of the ISI Classification Basis Document discuss the containment design and components. Metal containment surface areas subject to accelerated degradation and aging require augmented examination per Examination Category E-C and Paragraph IWE-1240.

Similarly, concrete surfaces may be subject to Detailed Visual examination in accordance with Paragraph IWL-2310(b), if declared to be "Suspect Areas."

A significant condition is a condition that is identified as requiring application of additional augmented examination requirements under Paragraphs IWE-1240 or IWL-2310.

No significant conditions were identified in the First CISI Interval; however, significant conditions were identified in the Second CISI Interval as requiring application of additional augmented examination requirements under Paragraph IWE-2420 or IWL-2310.

In the Second CISI Interval, metal loss in excess of 10% of the BYR Unit 1 containment liner at two locations below the MB at Elev. 377' have been identified as augmented surface areas requiring successive examinations in accordance with Paragraph IWE-2420(b). The indications were evaluated and accepted but re-examination of these two locations in the next inspection period (First Period, Third CISI Interval) is required.

These surface areas have been categorized in accordance with Table IWE-2500-1, Examination Category E-C, Item Number E4.11, requiring detailed visual examinations (i.e., VT-1) of 100% of the identified surface area each inspection period until the areas examined remain essentially unchanged for the next inspection period. When/If such areas no longer require augmented examination in accordance with Paragraph IWE-2420(d), the examination requirements and associated extent and frequency of Examination Category E-A apply for the remainder of the interval.

3.5.3.6 Component Accessibility

ISI Class MC and CC components subject to examination shall remain accessible for either direct or remote visual examination from at least one side per the requirements of ASME Section XI, Paragraph IWE-1230.

Paragraph IWE-1231(a)(3) requires 80% of the pressure-retaining boundary that was accessible after construction to remain accessible for either direct or remote visual examination, from at least one side of the vessel, for the life of the plant. BYR generated a calculation that addresses compliance with this requirement by calculating the containment pressure boundary surface area that was accessible for examination at the beginning of the CISI Program and determining the limit for surface area which may be made inaccessible for the balance of plant life.

Portions of components embedded in concrete or otherwise made inaccessible during construction are exempted from examination, provided that the requirements of ASME Section XI, Paragraph IWE-1232 have been fully satisfied.

In addition, inaccessible surface areas exempted from examination include those surface areas where visual access by line of sight with adequate lighting from permanent vantage points is obstructed by permanent plant structures, equipment, or components; provided these surface areas do not require examination in accordance with the inspection plan, or augmented examination in accordance with Paragraph IWE-1240.

3.5.3.7 Responsible Individual and Responsible Engineer

ASME Section XI, Subsection IWE requires the Responsible Individual to be involved in the development, performance, and review of the CISI examinations. The Responsible Individual shall meet the requirements of ASME Section XI, Paragraph IWE-2320.

ASME Section XI, Subsection IWL requires the Responsible Engineer to be involved in the development, approval, and review of the CISI examinations. The Responsible Engineer shall meet the requirements of ASME Section XI, Paragraph IWL-2330.

3.5.3.8 Examination Categories

Tables 3.5.3.8-1 and 3.5.3.8-2 provide a summary of the ASME Section XI pressure retaining components, supports, containment structures, metal liners, post-tensioning systems, system pressure testing, and augmented examination program components for the Fourth ISI Interval and the Third CISI Interval at BYR. If a particular Examination Category and Item Number do not apply to BYR, they are not included in these tables.

Table 3.5.3.8-1: Unit 1 Inservice Inspection Summary Table				
Examination Category (with Examination Category Description)	Item Number	Description	Exam Requirements	Total Number of Components by System
E-A Containment Surfaces	E1.11	Containment Vessel Pressure Retaining Boundary – Accessible Surface Areas	General Visual	CC: 5 CS: 6 CV: 6 FC: 2 FP: 1 FW: 8 IA: 1 MS:4 NT: 56 OG: 3 PR: 1 PS: 5 RE: 2 RF: 1 RH: 2 RY: 3 SA: 1 SD: 8 SI: 8 SX: 4 VQ: 5 WM: 1 WO: 4 XX: 47
	E1.30	Containment Vessel Pressure Retaining Boundary – Moisture Barriers	General Visual	1
E-C Containment Surfaces Requiring Augmented Examination	E4.11	Containment Surface Areas – Visible Surfaces	Visual, VT-1	2
	E4.12	Containment Surface Areas – Surface Area Grid, Minimum Wall Thickness Locations	Volumetric (Ultrasonic Thickness)	0
E-G Bolted Connections	E8.10	Containment Vessel Pressure Retaining Boundary – Bolted Connections, Surfaces	Visual, VT-1	NT: 47 XX: 28
L-A	L1.11	Concrete Surfaces – All Accessible Surface Areas	General Visual	42

Table 3.5.3.8-1: Unit 1 Inservice Inspection Summary Table				
Examination Category (with Examination Category Description)	**Item Number**	**Description**	**Exam Requirements**	**Total Number of Components by System**
Concrete	L1.12	Concrete Surfaces – Suspect Areas (No Suspect Areas Identified)	Detailed Visual	--
L-B Unbonded Post-Tensioning System	L2.10	Tendon	IWL-2522	483
	L2.20	Tendon – Wire or Strand	IWL-2523.2	483
	L2.30	Tendon – Anchorage Hardware and Surrounding Concrete	Detailed Visual	966
	L2.40	Tendon – Corrosion Protection Medium)	IWL-2525.2(a), IWL-2526	--
	L2.50	Tendon – Free Water	IWL-2525.2(b)	--

Note for Cat. E-A: Examination requirements of Examination Category E-A components includes all unique identified inspectable surface areas (i.e., each penetration is 1 component (total 158))

Note for Cat. E-G: Examination requirements of Examination Category E-G components Bolted Connections: Each connection bolt group is counted as 1 item (i.e., 20 bolt flange connection equals 1 item)

Note for Cat. L-A: Examination requirements of Examination Category L-A components Counted three main Areas (Exterior wall, Exterior Dome, and Tendon gallery ceiling)

Note for Cat. L-B: Examination requirements of Examination Category L-B components equals total number of bearing plates (each bearing plate includes Anchorage hardware and surrounding concrete) and includes (4) Distinct Areas:

Horizontal Wall Tendons	402 bearing plates
Dome Tendons	240 bearing plates
Upper Vertical Tendons	162 bearing plates
Lower Vertical Tendons	162 bearing plates
(Total)	(966 bearing plates)

Table 3.5.3.8-2: Unit 2 Inservice Inspection Summary Table

Examination Category (with Examination Category Description)	Item Number	Description	Exam Requirements	Total Number of Components by System
E-A Containment Surfaces	E1.11	Containment Vessel Pressure Retaining Boundary – Accessible Surface Areas	General Visual	CC: 5 CS: 6 CV: 6 FC: 2 FP: 1 FW: 8 IA: 1 MS:4 NT: 56 OG: 3 PR: 1 PS: 5 RE: 2 RF: 1 RH: 2 RY: 3 SA: 1 SD: 8 SI: 8 SX: 4 VQ: 5 WM: 1 WO: 4 XX: 47
	E1.30	Containment Vessel Pressure Retaining Boundary – Moisture Barriers	General Visual	1
E-C Containment Surfaces Requiring Augmented Examination	E4.11	Containment Surface Areas – Visible Surfaces	Visual, VT-1	0
	E4.12	Containment Surface Areas – Surface Area Grid, Minimum Wall Thickness Locations	Volumetric (Ultrasonic Thickness)	0
E-G Bolted Connections	E8.10	Containment Vessel Pressure Retaining Boundary – Bolted Connections, Surfaces	Visual, VT-1	NT: 92 XX: 28
L-A	L1.11	Concrete Surfaces – All Accessible Surface Areas	General Visual	42

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Table 3.5.3.8-2: Unit 2 Inservice Inspection Summary Table				
Examination Category (with Examination Category Description)	**Item Number**	**Description**	**Exam Requirements**	**Total Number of Components by System**
Concrete	L1.12	Concrete Surfaces – Suspect Areas (No Suspect Areas Identified)	Detailed Visual	--
L-B Unbonded Post-Tensioning System	L2.10	Tendon	IWL-2522	483
	L2.20	Tendon – Wire or Strand	IWL-2523.2	483
	L2.30	Tendon – Anchorage Hardware and Surrounding Concrete	Detailed Visual	966
	L2.40	Tendon – Corrosion Protection Medium)	IWL-2525.2(a), IWL-2526	--
	L2.50	Tendon – Free Water	IWL-2525.2(b)	--

Note for Cat. E-A: Examination requirements of Examination Category E-A components includes all unique identified inspectable surface areas (i.e., each penetration is 1 component (total 158))

Note for Cat. E-G: Examination requirements of Examination Category E-G components Bolted Connections: Each connection bolt group is counted as 1 item (i.e., 20 bolt flange connection equals 1 item).

Note for Cat. L-A: Examination requirements of Examination Category L-A components counted three main Areas (Exterior wall, Exterior Dome, and Tendon gallery ceiling)

Note for Cat. L-B: Examination requirements of Examination Category L-B components equals total number of bearing plates (each bearing plate includes Anchorage hardware and surrounding concrete) and includes (4) Distinct Areas:

Horizontal Wall Tendons	402 bearing plates
Dome Tendons	240 bearing plates
Upper Vertical Tendons	162 bearing plates
Lower Vertical Tendons	162 bearing plates
(Total)	(966 bearing plates)

3.5.4 Supplemental Inspection Requirements

In the Safety Evaluation Report for NEI 94-01 Revision 2-A, the NRC stated the following requirement for the performance of Supplemental Visual Inspections in SE Section 3.1.1.3, Adequacy of Pre-Test Inspections (Visual Examinations):

> Subsections IWE and IWL (References 13 and 14) of the ASME Code, Section XI, as incorporated by reference in 10 CFR 50.55a, require general visual examinations two times within a 10-year interval for concrete components (Subsection IWL), and three times within a 10-year interval for steel components (Subsection IWE). To avoid duplication or deletion of examinations, licensees using NEI TR 94-01, Revision 2, have to develop a schedule for containment inspections that satisfy the provisions of Section 9.2.3.2 of this TR and ASME Code, Section XI, Subsection IWE and IWL requirements.

In addition to the IWE and IWL examinations scheduled in accordance with the CISI Program, the performance of inspections in accordance with the requirements for Appendix J Primary Containment Inspection will be utilized to ensure compliance with the visual inspection requirements of NEI 94-01, Revision 3-A. These inspections are conducted under a task in the work order for the ILRT test in accordance with BYR procedures. These containment inspections must be completed with satisfactory findings before the ILRT test commences.

3.5.5 Primary Containment Leakage Rate Testing Program – Type B and Type C Testing Program

BYR Types B and C testing program requires testing of electrical penetrations, airlocks, hatches, flanges, and CIVs in accordance with 10 CFR 50, Appendix J, Option B and RG 1.163 (Reference 4). The results of the test program are used to demonstrate that proper maintenance and repairs are made on these components throughout their service life. The Types B and C testing program provides a means to protect the health and safety of plant personnel and the public by maintaining leakage from these components below appropriate limits. In accordance with Units 1 and 2 TS 5.5.16, the allowable maximum pathway total Types B and C leakage is 0.6 L_a. Prior to September 2014, for Unit 1, 1.0 L_a was 899.03 SCFH and 0.6 L_a = 539.42 SCFH, and for Unit 2 L_a was 829.99 SCFH and 0.6 L_a = 497.99 SCFH. In September 2014 L_a was revised. For Unit 1, 1.0 L_a was revised to 815.75 SCFH and 0.6 L_a = 489.45 SCFH and for Unit 2, 1.0 L_a was revised to 753.97 SCFH and 0.6 L_a = 452.38 SCFH.

As discussed in NUREG-1493 (Reference 9), Type B and Type C tests can identify the vast majority of all potential containment leakage paths. Type B and Type C testing will continue to provide a high degree of assurance that containment integrity is maintained.

A review of the Type B and Type C test results from 2008 through 2018 for BYR has shown substantial margin between the actual as-found (AF) and as-left (AL) outage summations and the regulatory requirements as described below:

- The as-found minimum pathway leak rate average for BYR Unit 1 shows an average of 11.05% of 0.6 La with a high of 18.16% 0.6 La.
- The as-left maximum pathway leak rate average for BYR Unit 1 shows an average of 18.07% of 0.6 La with a high of 23.29% 0.6 La.
- The as-found minimum pathway leak rate average for BYR Unit 2 shows an average of 14.67% of 0.6 La with a high of 19.29% 0.6 La.

- The as-left maximum pathway leak rate average for BYR Unit 2 shows an average of 24.24% of 0.6 La with a high of 28.63% 0.6 La.

Tables 3.5.5-1 and 3.5.5-2 provide LLRT data trend summaries for BYR inclusive of the 2012 (Unit 1) and 2014 (Unit 2) ILRTs.

Table 3.5.5-1: BYR Unit 1 Types B and C LLRT Combined As-Found/As-Left Trend Summary

RFO/Year	2008	2009	2011	2012	2014	2015	2017	2018
	B1R15	**B1R16**	**B1R17**	**B1R18**	**B1R19**	**B1R20**	**B1R21**	**B1R22**
AF Min Path (SCFH)	61.809	97.945	54.434	48.174	33.347	44.429	54.650	65.272
Fraction of 0.6 L_a (percent)	11.46 (1)	18.16	10.09	8.93	6.18	9.08 (2)	11.17	13.34
AL Max Path (SCFH)	85.877	119.472	125.647	80.868	60.876	71.811	94.803	112.102
Fraction of 0.6 L_a (percent)	15.92 (1)	22.15	23.29	14.99	11.29	14.67 (2)	19.37	22.90
AL Min Path (SCFH)	52.371	73.056	85.460	43.282	31.650	43.835	58.469	63.286
Fraction of 0.6 L_a (percent)	9.71 (1)	13.54	15.84	8.02	5.87	8.96 (2)	11.95	12.93

Note (1): L_a = 899.03 SCFH and 0.6 L_a = 539.42 SCFH.
Note (2): L_a = 815.75 SCFH and 0.6 L_a = 489.45 SCFH.

Table 3.5.5-2: BYR Unit 2 Types B and C LLRT Combined As-Found/As-Left Trend Summary

RFO/Year	2008	2010	2011	2013	2014	2016	2017	2019
	B2R14	**B2R15**	**B2R16**	**B2R17**	**B2R18**	**B2R19**	**B2R20**	**B2R21**
AF Min Path (SCFH)	82.39	80.54	70.15	46.55	68.17	48.79	72.53	87.25
Fraction of 0.6 L_a (percent)	16.54 (1)	16.17	14.09	9.35	15.07 (2)	10.79	16.03	19.29
AL Max Path (SCFH)	142.58	134.16	122.90	81.09	115.13	97.86	107.25	120.43
Fraction of 0.6 L_a (percent)	28.63 (1)	26.94	24.68	16.28	25.45 (2)	21.63	23.71	26.62
AL Min Path (SCFH)	67.93	68.44	61.32	41.60	64.03	44.20	65.03	86.15
Fraction of 0.6 L_a (percent)	13.64 (1)	13.74	12.31	8.35	14.15 (2)	9.77	14.38	19.04

Note (1): L_a = 829.99 SCFH and 0.6 L_a = 497.99 SCFH.
Note (2): L_a = 753.97 SCFH and 0.6 L_a = 452.38 SCFH.

3.5.5.1 Type B and Type C Local Leak Rate Testing Program Implementation Review

BYR Units 1 and 2 have no Type B components on the nominal test frequency of 30 months due to an as-found test failure.

Unit 1 has two (2) Type C components on the nominal test frequency of 30 months due to an as-found test failure. Unit 2 has no Type C component on the nominal test frequency of 30 months due to an as-found test failure.

BYR Types B and C Component Performance

The percentage of the total number of BYR Unit 1 Type B tested components that are on performance-based extended test intervals is 50.0%.

The percentage of the total number of BYR Unit 2 Type B tested components that are on performance-based extended test intervals is 42.9%.

Those Type B penetrations not on an extended test frequency are either:

- Used during RFOs and therefore must be AL tested each RFO subsequent to use, or
- Limited to a test frequency of 30 months per the Primary Containment Leakage Rate Testing Program.

The percentage of the total number of BYR Unit 1 Type C tested components that are on 60-month extended performance-based test intervals is 64.9%.

The percentage of the total number of BYR Unit 2 Type C tested components that are on 60-month extended performance-based test intervals is 73.0%.

The Type C penetrations not on a 60-month test frequency for a reason other than exceedance of their administrative leakage limit during an as-found Type C test are either:

- On a 30-month frequency (every RFO) following valve replacement or major maintenance to re-establish their performance history of two satisfactory sequential AF tests,
- Used or removed during RFOs to support Flex or outage requirements,
- Tested on an RFO frequency to satisfy IST test frequency requirements, or
- Tested every other RFO to satisfy RV replacement frequency requirements.

3.6 Operating Experience (OE)

During the conduct of the various examinations and tests conducted in support of the Containment related programs previously mentioned, issues that do not meet established criteria or that provide indication of degradation, are identified, placed into the site's corrective action program, and corrective actions are planned and performed.

For the BYR Primary Containment, the following site specific and industry events have been evaluated for impact on BYR:

- Information Notice (IN) 1992-20, "Inadequate Local Leak Rate Testing"
- IN 1999-10, Revision 1, "Degradation of Prestressing Tendon Systems in Prestressed Concrete Containments"
- IN 2004-09, "Corrosion of Steel Containment and Containment Liner"
- IN 2010-12, "Containment Liner Corrosion"
- IN 2014-07, "Degradation of Leak-Chase Channel Systems for Floor Welds of Metal Containment Shell and Concrete Containment Metallic Liner"

- Regulatory Issue Summary (RIS) 2016-07, "Containment Shell of Liner Moisture Barrier Inspection"

Each of these issues is discussed in detail in Sections 3.6.1 through 3.6.6 respectively.

3.6.1 IN 1992-20, "Inadequate Local Leak Rate Testing"

The NRC issued IN 92-20 to alert licensees of problems with local leak rate testing two-ply stainless steel bellows used on piping penetrations at four different plants: Quad Cities Nuclear Power Station, Dresden Nuclear Station, Perry Nuclear Power Plant and the Clinton Station. Specifically, LLRTs could not be relied upon to accurately measure the leakage rate that would occur under accident conditions since, during testing, the two plies in the bellows were in contact with each other, restricting the flow of the test medium to the crack locations. Any two-ply bellows of similar construction may be susceptible to this problem. The common issue in the four events was the failure to adequately perform local leak rate testing on different penetration configurations leading to problems that were discovered during ILRT tests in the first three cases.

In the event at Quad Cities the two-ply bellows design was not properly subjected to LLRT pressure and the conclusion of the utility was that the two-ply bellows design could not be Type B LLRT tested as configured.

In the events at both Dresden and Perry flanges were not considered a leakage path when the Type C LLRT test was designed. This omission led to a leakage path that was not discovered until the plant performed an ILRT test.

In the event at Clinton relief valve discharge lines that were assumed to terminate below the suppression pool minimum drawdown level were discovered to terminate at a level above that datum. These lines needed to be reconfigured and the valves should have been Type C LLRT tested.

Discussion:

This IN was reviewed for Braidwood Station (BRW) on April 12, 1993, and it was determined that no action or response was required. The BRW response is applicable to BYR.

3.6.2 IN 1999-10, Revision 1, "Degradation of Prestressing Tendon Systems in Prestressed Concrete Containments"

The NRC issued IN 99-10 to alert addressees to describe the degradation associated with the tendon prestressing system of prestressed concrete containments (PCCs). The specific items addressed included: (1) prestressing tendon wire breakage, (2) the effects of high temperature on the prestressing forces in tendons, and (3) trend analysis of prestressing forces.

This IN was based on the results of inspections of PCCs and PCC tendons which identified a number of concerns related to the degradation of prestressing tendon systems in PCCs and the ability of the containment structure to perform its function. Findings relevant to these concerns are discussed below.

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Description and Assessment

(1) Prestressing Tendon Wire Breakage

Recent observations related to containment prestressing systems have revealed conditions that may precipitate breakage of tendon wires. Conditions such as uneven shim stack heights on the anchor-heads, spalling and cracking of concrete beneath the anchor-head base plates, free water in the bottom grease caps, poorly drained top anchorage ledges, and the absence of filler grease in various areas can lead to corrosion of tendons and eventually to wire breakage.

(2) Effects of High Temperature on the Prestressing Forces in Tendons

Licensees at a number of plants have reported lower-than-predicted prestressing forces for vertical, hoop, and dome tendons. Investigations and analyses have indicated that the relaxation losses in prestressing tendon range from 15.5 to 20 percent over 40 years at an average sustained temperature of 32°C (90°F) around the tendons. However, the tendon relaxation loss values assumed in the original design of PCCs vary between 4 and 12 percent. These values were determined at the presumed ambient temperature of 20°C (68°F).

(3) Comparison and Trending of Prestressing Forces

It is important to adhere to the guidance in RG 1.35.1, "Determining Prestressing Forces for Inspection of Prestressed Concrete Containments," or equivalent methods to maintain the safety function of the prestressing tendon system and the concrete containment. Moreover, proper comparison and trending analysis are critical in determining the future trends in prestressing force in PCCs. Licensees have reported losses using the average forces determined from the lift-off testing, thereby masking the true variation in the loss of prestressing forces. An analysis using an average of the lift-off forces for regression analysis does not give results that are statistically valid.

As nuclear power plants continue to age, in particular, plants with a PCC, the management and mitigation of the effects of degradation as a result of aging become increasingly more important. The containment structure serves as the final barrier against the release of fission products to the environment under postulated design-basis accident conditions. Therefore, it is essential that its integrity be maintained. The focus on the prestressing tendon system for containment integrity is based on the vital role it plays. In addition to the issue of tendon relaxation, other aspects of the prestressing tendon system, such as controlling the material condition of the tendon galleries and maintenance of the tendon system to minimize corrosion, are also important.

PCC degradations, such as concrete spalling, water infiltration into tendon galleries, and concrete cracking in the containment and the containment dome, all affect the containment's ability to perform its intended function. It remains important to ensure that the cumulative effects of degradation mechanisms do not compromise the safety of the containment. The attributes discussed in this IN will be useful in identifying the potential problem areas and in evaluating the results of the inservice inspections of containments.

<u>Discussion:</u>

The original action for IN 99-10 was assigned to BYR, however engineering personnel from LaSalle, Braidwood, BYR, and the structural department in Corporate Engineering reviewed the issues concurrently and prepared a joint response. The discussion regarding each of the findings included in IN 99-10 is detailed below for BYR.

ATTACHMENT 1b
Description and Assessment

(1) Prestressing Tendon Wire Breakage

BYR has never experienced any problems with tendon wire breakage. As part of the original Technical Specifications, which is based on RG 1.35 requirements, BYR has conducted inspection of the tendons and their anchorage hardware and has found no deterioration of these components. The station's ISI program maintains this inspection effort on a predefined basis, consistent with licensing requirements. Additionally, through a revision of 10 CFR 50.55a, the containments will in the future be inspected per the technical requirements of ASME Section XI, IWL. The station's ISI program has been updated to reflect the IWL requirements.

As a further note, in early 1998, BYR completed replacement of Unit 1 Steam Generators. This project allowed for an opportunity to evaluate the condition of the post tensioning system beyond normal surveillance requirements. To accommodate the steam generator replacement, a temporary construction opening through the Containment wall was required. This opening required the detensioning and removal of 18 hoop and 9 vertical tendons. During the removal process, all 27 tendons and anchorage hardware were visually examined with no deleterious or degrading conditions identified.

(2) Effects of High Temperature on the Prestressing Forces in Tendons

In the design of the containments at BYR, a relaxation of 12.5 thousand pounds per square inch (ksi) (approximately 8%) was used in the original design. While this percentage is slightly less than that noted in the IN, the ambient temperature conditions in northern Illinois are significantly different from those representing the nuclear plants located in the southern portion of the United States (where a higher relaxation loss factor might be expected).

Relaxation loss accounts for only a portion of the total loss of prestressing forces expected during the lifetime of the containments. The time-dependent prestress loss factors, shrinkage and creep in the concrete, also play an important part in calculating the prestressing loss. Nevertheless, the true concern is to verify that the as-found lift-off force of the tendons determined during ISI work meets the acceptance criteria found in the Technical Specifications or IWL criteria. BYR ISI results have always been acceptable.

(3) Comparison and Trending of Prestressing Forces

The lift-off forces determined through the ISI program at BYR have always met the acceptance criteria for the minimum values found in the Technical Specifications or IWL criteria. Due to the design of the containments, which took into account the prestressing sequence of the tendons, the original lock-off forces in the tendons varies. Accordingly, during ISI the actual lift-off force for each tendon is compared against its unique, predicted value and the minimum design value. An averaging of the as-found tendon forces is not applicable and was not used.

In anticipation of the 10 CFR 50.55a requirements to trend prestressing loss in the tendons, a regression analysis was performed on the "common" tendons. A regression analysis on the "randomly" chosen tendons is not pertinent because the predicted lift-off force for these other tendons would be different from each other. The regression analysis concluded that the predicted tendon force would not be less than the minimum design prestress force before the next inspection interval (10 CFR 50.55a(b)(2)(ix)). However, the regression analysis is not very meaningful at this time since there is a scarcity of data to trend (i.e., there are very few inspection periods to report).

3.6.3 IN 2004-09, "Corrosion of Steel Containment and Containment Liner"

The NRC issued IN 2004-09 to alert addressees to recent occurrences of corrosion in freestanding metallic containments and in liner plates of reinforced and pre-stressed concrete containments. Any corrosion (metal thinning) of the liner plate or freestanding metallic containment could change the failure threshold of the containment under a challenging environmental or accident condition. Thinning changes, the geometry of the containment shell or liner plate, which may reduce the design margin of safety against postulated accident and environmental loads. Recent experience has shown that the integrity of the moisture barrier (MB) seal at the floor-to-liner or floor-to-containment junction is important in avoiding conditions favorable to corrosion and thinning of the containment liner plate material.

There have been numerous industry events and NRC INs related to containment liner corrosion. The root cause of the containment liner issue is exposure of the metal liner to water/fluids, etc. An amendment to Section 50.55a of Title 10 of the Code of Federal Regulations (10 CFR 50.55a) (61 FR 41303) became effective September 9, 1996. This amendment requires the use of Subsections IWE and IWL of Section XI of the ASME Boiler and Pressure Vessel Code to perform inservice inspections of containment components. These subsections provide detailed requirements for inservice inspection of Class MC pressure-retaining components and their integral attachments and of metallic shells and penetration liners of Class CC pressure-retaining components and their integral attachments. Inspection of concrete containment shell and steel liner plate in accordance with 10 CFR 50.55a involves consideration of potential corrosion areas. Such inspection includes examination, evaluation, repair, and replacement of corroded areas of the liner plate.

As a result of these required containment inservice inspections, licensees have found that over time, the existing floor-to-containment seal can degrade, allowing moisture into the crevice between the containment liner plate and floor. Small amounts of stagnant water behind the floor seal area promote pitting corrosion. To identify corrosion in this area, licensees have had to remove the original floor seal and either excavate the concrete or do a visual inspection aided by fiber optics. Licensee corrective actions for this condition have typically included inspections to determine the extent of corrosion, evaluations of containment integrity, and installation of new floor-to-containment moisture seal barriers.

In some instances, corrosion has been found at higher elevations of the liner plates. Generally, the instances of such corrosion have been associated with foreign objects (wooden pieces, workers' gloves, wire brush handles, etc.) lodged between the liner plate and the concrete. As the corrosion is initiated in the areas not visible during visual examinations, such instances of corrosion were found when corrosion had penetrated through the liner thickness. Some licensees have performed ultrasonic examination of the suspect areas (areas of obvious bulging, hollow sound, etc.) to detect such corroded areas.

Discussion:

NRC IN 04-09 was reviewed for applicability at BYR. No actions are required as the result of this review.

The subject IN discusses the potential adverse impact on the integrity of containment liner plates if adequate measures are not taken to prevent corrosion or timely detection and elimination of causes of corrosion degradation.

ATTACHMENT 1b
Description and Assessment

The following points are made in the subject IN:

- The requirements of ASME Code Section XI Subsection IWE comprise an acceptable method to employ when addressing reliability of the containment liner plate and its integral attachments;

- Proper and complete application and implementation of a periodic inspection program is essential to effectively identify degradation in a timely manner; and

- Rigorous and timely execution of corrective actions identified during examinations are crucial aspects of a successful inspection program.

The current Containment ISI Program Plan at BYR, pursuant to the requirements of 10 CFR 50.55a, describes the provisions for the examination of the containment liner plates and their integral attachments through the application of procedures that are based on the requirements of ASME Code Section XI, Subsection IWE.

The past periodic examinations performed on the liner plates and their integral attachments have identified several areas for improvement. The implementation of the corrective actions (i.e., replacement of MB, application of level I coatings) and continued monitoring of suspect areas (i.e., UT of degraded coated areas every refueling cycle) help prevent further degradation. Liner plate degradation below the acceptance criteria has not been observed.

There are no new examination requirements in this IN and therefore, the current Containment ISI Program and the applicable procedures are deemed adequate.

3.6.4 IN 2010-12, "Containment Liner Corrosion"

The NRC issued IN 2010-12 to alert plant operators to three events that occurred where the steel liner of the containment building was corroded and degraded. At the Beaver Valley and Brunswick plants, material had been found in the concrete, which trapped moisture against the liner plate and corroded the steel. In one case, it was material intentionally placed in the building and in the other case; it was foreign material, which had inadvertently been left in the form when the wall was poured. But the result in both cases was that the material trapped moisture against the steel liner plate leading to corrosion. In the third case, Salem, an insulating material placed between the concrete floor and the steel liner plate absorbed moisture and led to corrosion of the liner plate.

Discussion:

This issue is applicable to EGC station programs and SSCs; however, implementation of IWE examinations, as well as applicable Appendix J testing assure containment structures or liner integrity. There are no operability concerns identified. EGC units have implemented periodic examinations during refueling outages on metallic containment structures or liners in accordance with Section XI, Subsection IWE. The applicable EGC visual examination procedure requires the conditions described in the IN examples to be recorded. Conditions that may affect containment surface integrity are then required to be evaluated by engineering evaluation or repair/replacement prior to startup from refueling outages.

A review of similar station events has revealed that metallic containment surfaces or liner corrosion were identified at some EGC units during periodic IWE examinations and during refueling

outage(s). However, the conditions were dispositioned in accordance applicable rules of ASME Section XI.

Station vulnerability was analyzed, and it was determined that rigorously implementing the examinations and tests in accordance with the requirements of IWE and Appendix J, and dispositioning observed conditions in accordance with ASME Section XI rules are existing barriers that ensure the integrity of metallic containment surfaces or liners. No additional actions are recommended.

3.6.5 IN 2014-07, "Degradation of Leak-Chase Channel Systems for Floor Welds of Metal Containment Shell and Concrete Containment Metallic Liner"

The NRC issued IN 2014-07 to inform the industry of issues concerning degradation of floor weld leak-chase channel systems of steel containment shell and concrete containment metallic liner that could affect leak-tightness and aging management of containment structures. Specifically, this IN provides examples of operating experience at some plants of water accumulation and corrosion degradation in the leak-chase channel system that has the potential to affect the leak-tight integrity of the containment shell or liner plate. In each of the examples, the plant had no provisions in its ISI plan to inspect any portion of the leak-chase channel system for evidence of moisture intrusion and degradation of the containment metallic shell or liner within it. Therefore, these cases involved the failure to perform required visual examinations of the containment shell or liner plate leak-chase systems in accordance with the ASME Code Section XI, Subsection IWE, as required by 10 CFR 50.55a(g)(4).

The containment basemat metallic shell and liner plate seam welds of pressurized water reactors are embedded in 3' to 4' thick concrete floor during construction and are typically covered by a leak-chase channel system that incorporates pressurizing test connections. This system allows for pressure testing of the seam welds for leak-tightness during construction and also while in service, as required. A typical basemat shell or liner weld leak-chase channel system consists of steel channel sections that are fillet welded continuously over the entire bottom shell or liner seam welds and subdivided into zones, each zone with a test connection.

Each test connection consists of a small carbon or stainless-steel tube (less than 1" diameter) that penetrates through the back of the channel and is seal-welded to the channel steel. The tube extends up through the concrete floor slab to a small access (junction) box embedded in the floor slab. The steel tube, encased in a pipe, projects up through the bottom of the access box with a threaded coupling connection welded to the top of the tube, allowing for pressurization of the leak-chase channel. After the initial tests, steel threaded plugs or caps are installed in the test tap to seal the leak-chase volume. Gasketed cover plates or countersunk plugs are attached to the top of the access box flush with the containment floor. In some cases, the leak-chase channels with plugged test connections may extend vertically along the cylindrical shell or liner to a certain height above the floor.

Discussion:

BYR has a different design from the typical description provided in the IN report. Based on review of BYR's configuration, the pressurization pipes are above the concrete slab, making the potential for moisture intrusion unlikely. Per review of NRC IN 2014-07, the configuration of the leak-chase channels in these events were different as the pressurization pipes are recessed below the floor or concrete slab and covered, which could result in moisture accumulation in the access box resulting in possible moisture intrusion into the pressurization caps the leak-chase channel and result in an

un-inspectable degraded condition. Therefore, the BYR leak-chase channel design and layout varies from that of this IN.

Based on review of this NRC IN 2014-07, there are no operability concerns associated with the leak-chase channel systems for floor welds or metal containment shell and concrete containment metallic liner. The station leak-chase channels exist on both units; however, they have been inspected during previous surveillances. Also, actions are currently in place to add explicit identifications into the IWE scope of the containment liner during future outages based on commitments made to License Renewal.

This event is applicable to BYR based on the procedures and process not having explicit instructions to inspect the pressurization components. There is a need to include the examination of these items into the IWE Program to ensure examinations are conducted under new program owners. The leak-chase system that is installed in both BYR Units does not fulfill any part of the containment pressure retaining boundary function, and is therefore, not part of the ASME Section XI IWE Program per IWE-1100. However, the leak-chase systems do cover part of the liner plates and welds that are in the IWE Program and need to be monitored to ensure the integrity of the inaccessible welds are maintained. It is important to know their condition since their failure could cause the inaccessible area to degrade.

The Corporate containment program procedure and the containment inspection procedure have been revised to identify degradation of these leak-chases for no other reason than to provide assurance that the inaccessible regions that are in the program do not degrade or at least perform an assessment if degradation is found. In addition, the BYR site has taken several actions to include inspection of the pressurization pipe caps into the scope of the IWE program. There is no station vulnerability as the pressurization pipes have been inspected. These inspections are currently specified in the IWE Program Inspection Scope for the containment liner.

3.6.6 NRC RIS 2016-07, "Containment Shell or Liner Moisture Barrier Inspection"

The NRC issued RIS 2016-07 to reiterate the NRC staff's position in regard to ISI requirements for MB materials, as discussed in the ASME Code, Section XI, Subsection IWE. The NRC staff identified several instances in which containment shell or liner MB materials were not properly inspected in accordance with ASME Code Section XI, Table IWE-2500-1, Item E1.30. Note 4 (Note 3 in editions before 2013) for Item E1.30 under the "Parts Examined" column states:

> Examination shall include moisture barrier materials intended to prevent intrusion of moisture against inaccessible areas of the pressure retaining metal containment shell or liner at concrete-to-metal interfaces and a metal-to-metal interfaces which are not seal welded. Containment moisture barrier materials include caulking, flashing and other sealants used for this application.

Examples of inadequate inspections have included licensees not identifying sealant materials at metal-to-metal interfaces as MBs because they do not specifically match Figure IWE-2500-1, and licensees not inspecting installed MBs (as required by Item E1.30) because the material was not included in the original design or was not identified as a "moisture barrier" in design documents.

Discussion:

RIS 2016-07 addresses examples of sites that were not performing MB inspections as required under ASME Section XI Subsection IWE. Accurate identification of the containment MBs would

have corrected the recognized issue. Examples included sites that were not performing inspections because the material was not included in the original design or was not identified as a MB in design documents. Other sites did not identify sealant materials at metal-to-metal interfaces as MBs because they do not specifically match Figure IWE-2500-1 and, therefore, did not perform visual examinations.

This issue is applicable to BYR. Any site can be susceptible to misinterpreting Code requirements or possibly incorrectly identifying sealant materials as non-moisture barrier materials. However, similar deficiencies are not present. BYR performed a review of the containment design when the CISI program was developed and identified all areas that were designed to prohibit water intrusion into inaccessible areas of the containment liner. Aside from replacement (like-for-like) of degraded sections of MBs, there have been no changes/modifications to MBs installed in Unit 1 or Unit 2.

The BYR CISI Program visually examines all MBs each inspection period to identify any potential water intrusion into inaccessible areas of the containment liner. PMs are in place to generate work orders so that MBs are inspected in each inspection period. This ensures these inspections do not get missed during refueling outages.

The MBs at BYR are monitored and remain in good condition. Visual examinations of all MBs are performed under the CISI Program. If new MBs requiring visual inspection were to be added, then this would go through the Design Change Process and subject to review by the ISI/CISI Program Owner(s). This review barrier would evaluate the inclusion into the CISI Program. Additionally, the CISI Program database acts as a barrier to prevent the occurrence of a missed inspection.

BYR currently does not have this IN issue. As an enhancement, BYR has identified each type of MB area instead of generalizing all MBs (foam or leak chase caps) in IWE model work orders to provide clarify on MB inspections.

3.7 Results of Recent Containment Inspections

3.7.1 Primary Containment Coatings Condition Assessment, Unit 1 RFO B1R21, Spring 2017

Safety related coating assessment of the Service Level I Primary Containment coated surfaces at BYR Unit 1 during the 2017 B1R21 RFO.

Interior surfaces of the primary containment, components, and equipment were inspected and assessed.

Inspection Findings:

401' Elevation Liner Plate (OMB)

Some sections of mechanically damaged areas on the liner plate are typically repaired every refueling outage. The following locations on Elev. 401' have been repaired during previous outages and are in good condition: R-8 to R-11; R-17 to R-18; and R-19 to R-20.

The BYR Unit 1 containment liner plate was originally coated with Carbozinc 11, an inorganic zinc primer, and top coated with Phenoline 305, a phenolic epoxy. Equipment and scaffolding transport during outages are the most common cause of impact damage to the containment liner plate. This type of impact damage typically results in loss of the topcoat material, due to cracking and

chipping, and is not an age-related degradation. It is, however, still a significant coatings issue. The adhesive bond may be compromised where the damage is most severe, creating potential loose debris. Any loose or delamination coating material identified throughout the containment was stabilized (scraped back to sound, tightly adhered material, with the chips contained and disposed).

377' Elevation Liner Plate (OMB)

The liner plate on this elevation has general mechanical damage due to the high traffic of personnel, equipment and scaffolding crews during outages. Some areas have been repaired during previous outages.

377' Elevation (IMB)

The IMB concrete walls have general mechanically damaged from equipment and tool movement in and out of the areas, mainly at the entrances and equipment staging areas. The coating in these areas have chips and scratches but the remaining coating appears intact. All other areas of the walls and floors have minimal mechanical damage and are in good condition.

390' Elevation (IMB)

The coatings on Elev. 390 IMB are in good condition.

401' Elevation RCP PP, Deck (IMB)

The entrance wall coating in good condition with minor mechanical damage at stairway to 401' Elev. IMB Deck. Reactor Cooling Pump (RCP) "A" located on Elev. 401' at R-14, is in good condition with minor mechanical damage to coating. Reactor Cooling Pumps "B" at R-19, "C" at R-4, and "D" at R-8 are in similar condition. The coating on the outer wall of Elev. 401' IMB is in good condition with only minor mechanical damage consisting of nicks, scratches, and abrasions.

412' Elevation Liner Plate (OMB)

On Elev. 412' OMB, the liner plate is in good condition and has been recoated from R-12 to R-17 during previous outages. The liner between R-17 to R-21 and between R-21 and R-11 is in good condition with no coating degradation and minimal mechanical damage. Though the liner has minimal mechanical damage, it is recommended that spot repairs be made where damage is visible.

426' Elevation

The Liner Plate Coating System is Carbozinc 11, an inorganic zinc primer, and is top coated with Phenoline 305, a phenolic epoxy, throughout the Containment. The liner has been recoated in previous outages from R0-9 to R0-4 and from R0-1 to R0-4 up to about 8'. The remaining liner at floor elevation has random mechanical damage from outage activities, which should be repaired during future outages. The Polar Crane was unavailable for inspection but appeared to be in good condition based on a limited observation from the floor elevation. No delamination was observed on the containment dome. The overall condition of the liner plate on Elev. 426' is good.

<u>377' Elevation Test Panels (IMB)</u>

The concrete test panels and the steel test panels located on Elev. 377' are in good condition with no defects observed.

<u>Recommendations and Conclusions</u>

No severely degraded Service Level I, safety related coating areas were identified during the B1R21 outage that would prevent the safe operation and shut down of the facility. Below are degraded coating areas that should be scheduled for repair during future outages. Most of these areas are similar to or are the items that were identified in the previous Unit 1 containment safety related coating evaluation performed in 2015 during the B1R20 outage.

The following are suggested areas to concentrate on in future outage schedules:

Liner plate mechanical damage of coating that goes through to steel substrate with noticeable active rusting and pitting corrosion.

- Valves with corrosion on welds and suspected unqualified coating.
- Rusted and uncoated supports and welds.
- Unqualified coating and surface rust on orange 10" piping in overhead areas.
- Rusted pipe supports in many locations inside containment IMB & OMB.
- Rusted pipe, valves and suspected unqualified coating inside Reactor Coolant Fan Chiller (RCFC) Plenums.
- All suspected unqualified coatings on 390' and 401' IMB on valves and motors.
- Uncoated welds with rust on inner Shield wall.
- Damaged coating from burning or welding located IMB & OMB.
- Uncoated piping located at each elevation, some possibly by design.

The B1R21 outage coating assessment identified areas of coating degradation that should be scheduled for future repair. No coating conditions were identified that jeopardize structural integrity, plant operations, or the safe startup or shutdown of the plant.

Repair work should be planned for future outages to address the more severe areas of coating degradation identified, mostly on the OMB liner plate and piping. Such repairs reduce radiation levels resulting from fixed contamination on exposed substrates, mitigate progressive coating degradation, and prevent damage to exposed steel and concrete substrates. Areas of bare, rusting carbon steel should also be scheduled for repair to mitigate pitting corrosion. Bare grout is also recommended to be coated. The moisture seal and related coatings at Elev. 377' should continue to be repaired on each future outage.

3.7.2 <u>Primary Containment Coatings Condition Assessment, Unit 1 RFO B1R22, Fall 2018</u>

Safety related coating assessment of the Service Level I Primary Containment coated surfaces was completed at BYR Unit 1 during the 2018 B1R22 RFO.

Interior surfaces of the primary containment, components, and equipment were inspected and assessed.

Inspection Findings:

Containment Liner Plate, All Elevations, Outer Missile Barrier (OMB)

The Containment liner plate (liner) is inspected every outage to assess the overall condition of the safety related protective coatings. The liner was originally coated with Carbozinc 11, an inorganic zinc primer, and top coated with Carboline Phenoline 305, a phenolic epoxy. Areas of coating degradation identified on the liner consisted of general mechanical damage and isolated areas of disbonded top coat. Degraded areas of loose coating are typically repaired, or hand tool cleaned with a paint scraper to remove loose top coat back to sound, intact coating. This is a routine outage coating maintenance item that does not impact operability. The coating damaged areas were observed in all areas of containment except for the very top areas of Elev. 426'. Most of the damaged areas were on the 377', 401', and 412' elevations. Mechanical damage to the liner (from equipment and tool transportation during outages) was the general coating defect observed. Mechanical damage on each of the elevations identified is located from containment floor/grating levels up to about 6'. This type of damage typically results in loss of the topcoat material, due to cracking and chipping.

Any loose or delaminated coating material found throughout the containment was stabilized, (scraped back to sound, tightly adhered material, with the coating chips contained and properly disposed of).

A requirement associated with the containment safety related coating evaluation is to identify areas on the liner plate and inner concrete walls where loose coating is to be scraped and collected. Table 3.7.2-1 indicates the areas where loose coating was identified and removed.

Table 3.7.2-1: Scraped Loose Coating Areas > 1 Sq. Foot

Elev. 377	Elev. 401	Elev. 412	Elev. 426
R-16 to R-4	R-17 to R-19	R-15 to R-18	R-8
R-4 to R-5	R-10 to R-16		R-10
			R-16

The liner plate is generally in good condition on all elevations. The areas that receive most mechanical damage are constantly being repaired during each outage, and this should continue into future outages.

401' Elevation, Liner Plate (OMB)

Some sections of mechanically damaged areas on the liner plate are typically repaired every refueling outage. The following locations on Elev. 401' have been repaired during previous outages and are in good condition: R-8 to R-11, R-17 to R-18, and R-19 to R-20. Repairs were completed this outage on the liner plate from R-1 to R-4 and from R-21 to R-1.

On Elev. 401' OMB the liner plate is moderately damaged from scaffold and tool movement up to the 6' elevation, mainly near the equipment hatch between R0-16 and R0-21, with areas of top coat mechanical damage down to sound primer. The liner coating system is in good condition and is tightly bonded.

ATTACHMENT 1b
Description and Assessment

377' Elevation, Liner Plate (OMB)

The containment liner on Elev. 377' has mechanical impact damage. The areas of most mechanical damage are located across from the four RCFCs, especially "A" and "B". The floor areas in front of the RCFCs are narrow and the damaged coating is from carried tools and equipment. There was minor MB removed for UT and VT inspections this outage with coating repairs afterwards.

412' and 426' Elevation, Liner Plate (OMB)

The safety related coatings on the containment liner on Elev. 412' and Elev. 426' are in good condition except for a few areas.

377' Elevation, Equipment and Piping (OMB)

The equipment and piping on Elev. 377' OMB level is in good condition. The smaller 1" and 2" service air piping and 4' floor drain lines that were coated in the past are out of service and have been deleted from the site coating maintenance program. The floor has some minor mechanical damage but is not a major concern as the coating is tightly adhered to the concrete substrate. The recommendation for 377' is to concentrate on the Containment Liner and MB repairs in future outages.

412' Elevation (OMB)

The safety related coatings on equipment, piping, and structural steel on Elev. 412' are in good condition except for a few areas.

426' Elevation (OMB)

The upper areas of the liner plate appeared to be in good condition, including the Dome and the Polar Crane.

377', 390', and 401' Elevations (IMB)

Most of the coating deficiencies on elevations 377', 390', and 401' consist of uncoated piping and support hangers or damage to coatings on inner concrete walls, resulting from the modification or removal of supports. These areas should be scheduled for repair during the next outage.

The steel and concrete test coupons are located on Elev. 377' IMB. The test panels are coated with the common safety related coating systems used throughout the containment. Carbozinc 11, inorganic zinc as a primer (not top coated) for carbon steel, inorganic zinc with a Carboline Phenoline 305 epoxy topcoat for the carbon steel liner plate and sealed concrete coated with an epoxy surface and top coated with an epoxy finish coat (coating system for concrete not identified to UESI). Examination of the coupons is a standard requirement of the inspection walk down. The zinc coated steel coupons were in good condition. The steel coupons with zinc primer and epoxy topcoat were in good condition. The concrete coupons were also in good condition.

Recommendations and Conclusions

Areas of mechanical damage with inorganic zinc primer intact are providing corrosion protection to the steel substrate and do not require immediate action. Areas on the containment liner where the

protective coating has disbanded, exposing the steel substrate, should be scheduled for repair during the next outage. Also, areas of rusting on piping should be repaired to mitigate corrosion. Any loose, flaking coating that was not removed to sound coating during the current outage should be scheduled for removal next outage to assure that licensing commitments are in compliance. The B1R22 outage coating assessment identified areas of degraded coating that require repair. No current coating conditions were identified that appear to impact structural integrity, plant operations, or the safe shutdown. Repair work should be planned for future outages to address the degraded coating areas identified. Such repairs will reduce radiation levels resulting from fixed contamination on exposed substrates, mitigate progressive coating degradation, and prevent damage to exposed steel and concrete substrates. Although some repairs were made near the 401' Equipment Hatch, there still is a considerable amount of mechanical damage to the containment liner in this area. These areas should be continuously monitored and ultimately repaired. Exposed, rusting carbon steel areas should be repaired. Bare concrete and grout should also be coated for decontaminability issues.

List of Areas Requiring Coating Repair by Location

Note: Some areas are from last outage that were not repaired.

- 377' R-19 OMB, Liner plate
- 377' R-10 IMB, Concrete Wall coating damage
- 390' R-17 IMB, Uncoated welds on supports
- 401' R-9 IMB, Uncoated supports and handrail kick plates
- 401' R-9 IMB, Uncoated 4" box beam support inboard wall
- 401' OMB, "A" RCFC uncoated piping
- 401' R-19 OMB, Burn marks on concrete wall coating.
- 401' R-1 IMB, Uncoated I- beam at floor level with light rust
- 426' R-20 OMB, Damage to Liner plate coating
- 426' R-14 OMB, Damage to Liner plate coating
- 426' R-6 OMB, Damage to coating on equipment hatch
- 426' R-17 OMB, Reactor Head Stand, various areas of coating damage

3.7.3 <u>Primary Containment Coatings Condition Assessment, Unit 2 RFO B2R20, Fall 2017</u>

Safety related coating assessment of the Service Level I Primary Containment coated surfaces were completed at BYR Unit 2 during the 2017 B2R20 RFO.

Interior surfaces of the primary containment, components, and equipment were inspected and assessed.

Inspection Findings:

<u>Primary Containment Liner Plate, All Elevations, Outside Missile Barrier (OMB)</u>

The original protective coating applied to the containment liner wall is Carbozinc 11, an inorganic primer, top coated with a phenolic epoxy top coat (possibly Carboline), Phenoline 305. The coating system on the liner (OMB) at elevations 377', 401', 412', and 426' in general, appears to be in good condition. Random locations of cracked top coating were observed with exposed, intact zinc primer at each elevation. Cracked topcoat areas are more general on the liner wall at Elev. 377', (the basement). Deficiencies range in size from ¼" diameter to ½ sq. ft. Zinc primer under the cracked, delaminated top coat is intact and appears to be in good condition. The cracked/delaminated top coat most likely occurred during outages, probably the result of object impact over a number of

years, caused by personnel moving and staging scaffolding, tools and other equipment during refuel outages. Coating deficiencies are typically repaired every refueling outage as a normal maintenance practice. Areas of loose coating and age cracking are removed back to tightly adherent coating and not recoated if outage schedule constraints does not permit enough time to properly perform repairs. Numerous coating deficiencies on the containment liner have been repaired during previous outages and appear to be in good condition. Current degraded areas on the containment liner (i.e., R-22 to R-28, R-31 to R-33, R-35 to R-36, and R-37 to R-42) have not been repaired. They are to be scheduled for repair during the B2R21 outage.

Primary Containment, Inner Wall, Components and Piping System

Components and piping systems on all elevations (377', 401', 412', and 426') are generally coated with Carbozinc 11 primer only. The primer is generally intact and in good conditions on all components. However, bare substrate is exposed on numerous components and piping systems. Most affected areas are where the coating was removed for component modification and was not repaired. Light uniform surface rusting is visible on subject areas; however, pitting corrosion was not observed. Numerous piping systems have never been coated. The exposed substrate on those systems exhibit light to moderate uniform surface rusting, with no apparent pitting corrosion observed. Numerous bare substrate areas were repaired during previous outages and remain in good condition.

Primary Containment Concrete Surfaces

Protective coatings on concrete walls and floors are in good condition. Mechanical damage to the coating is the most common coating defect. Other coating deficiencies are minor stress cracks in the concrete coating, nicks and scratched in the top coat that do not expose concrete substrate. The majority of coating defects are on the floor at Elev. 377'.

Concrete Walls and Floor, All Elevations, Inside Missile Barrier (IMB)

Protective coatings on concrete walls and floor at elevations 377', 390', and 401' appear to be in good condition. Mechanical damage to the coating is the most common coating defect. Other coating deficiencies are: burnt coatings where grinding and welding occurred, discoloration of top coat, minor stress cracks in concrete walls/coating, nicks and scratched that do not expose concrete substrate. The majority of coating defects are on the floor in high foot traffic areas of Elev. 377'. The upper twenty-five (25)' of concrete walls are not coated.

Steel Components and Piping Systems

Steel components and piping systems on all elevations are generally coated with Carbozinc 11 primer only. The primer appears to be intact and in good conditions on all components. However, bare substrate is exposed on numerous components and piping systems. In some areas, it is apparent coating was intentionally removed from these areas and not recoated. Light uniform surface rusting is visible on subject areas; however, pitting corrosion was not observed. Numerous piping systems have never been coated. The substrate of those systems exhibit light to moderate uniform surface rusting, with no apparent pitting corrosion observed. Numerous bare substrate areas have been prepared and coated over the life of the plant; those repairs are in good condition.

ATTACHMENT 1b
Description and Assessment

Dome above Polar Crane Rail

The protective coating on the dome appears to be in good condition. The inspection was performed using a high-power flash/spotlight. No apparent coating deficiencies were observed.

Polar Crane

Coatings on the Polar Crane appear to be in good condition with no apparent coating deficiencies.

Discussion and Summary

An inspection and condition assessment were performed of the safety related protective coatings applied to the Primary Containment liner wall (OMB), components, miscellaneous structures, piping and concrete walls and floors inside BYR's Unit 2 primary containment building. Emphasis was placed on coatings applied to accessible areas of the pressure boundary (liner wall). The main objective of the assessment is to identify newly degraded coating and/or apparent unqualified coatings, quantify the extent of these conditions and report finds to EGC's on-site coating engineer. A substantial number of previously identified coating deficiencies were prepared and coated with Keeler and Long (K&L) 9600NB. A list of subject areas is documented below. Other areas were revisited to ascertain if subject deficiencies have changed in size and appearance.

Inspection data collected should assist the site Responsible Coating Engineer in determining the effects of degraded coating on plant operation; to ensure that the ECCS and the safety-related containment spray system (CSS) remain capable of performing their intended safety functions and to mitigate corrosion of the containment liner and its integral structural and mechanical components.

Recommendations and Conclusions

The B2R20 Primary Containment safety related coating assessment identified few areas of coating degradation resulting from age and heat. Coating deficiencies identified during previous outages have not significantly changed. There were no current degraded coating conditions that were identified that could impact structural integrity or the safe operation and shutdown of the facility.

Plant management should continue planning for coating remediation during future outages. There remains a need to monitor for and address the areas of coating degradation and bare substrate areas that exhibits corrosion. Such repairs will reduce radiation levels resulting from fixed contamination on exposed substrates, mitigate progressive coating degradation, and prevent damage to exposed steel and concrete substrates. There is a significant amount of mechanical damage to the liner plate that has been spot repaired during past outages. The practice of preventive maintenance should continue.

Two lists of coating deficiencies are documented. The first list of areas and components below were identified during B2R19 outage. Subject areas and components were repaired during B2R20 outage. The second list consist of components identified during B2R20 containment walk down inspection and are recommended for future remediation.

ATTACHMENT 1b
Description and Assessment

List of Area Locations Recommended for Coating Repair

377' Elevation (OMB)

- 4" bare substrate pipe located near R-41 on Elev. 377'. Pipe has never been coated.
- Rusted 2" RCFC pipes (A & D) located near R-39 of Elev. 377'. Pipes have never been coated.
- Overhead hanger exhibits light surface corrosion in welds and on edges, near R-28. Access item from Elev. 377'. Scaffolding support required.
- Overhead pipe and valves have never been coated. Light surface corrosion is visible. Access item from Elev. 377', near R-28. Scaffolding support required.
- 4" bare substrate pipe located on Elev. 377', near R-40. Pipe has never been coated, exhibits light surface corrosion.
- Fire box apparatus, pipes and welds exhibits light surface corrosion, Elev. 377'. Boxes are located in several different locations.
- Overhead pipes have never been coated. Light surface corrosion is visible. Access item from Elev. 377', near R-31. Scaffolding support required.
- Fire box apparatus, pipe and welds exhibits light surface corrosion, several locations, Elev. 377'.
- Inorganic Zinc outside of 2D RCFC outlet box welds near R-23 Elev. 377'.
- Uncoated 2" pipe with light surface rusting in weld and on elbow. Pipe located overhead Elev. 377', near R-33 OMB. Scaffolding support required.
- Coatings on concrete floor is in very good condition, embed plate recommended for repair, Elev. 377'.

401' Elevation (OMB)

- Bare substrate pipe with light surface corrosion. Pipe has never been coated. It is located on Elev. 401', near R-23.
- Top of I-Beam exhibits light surface corrosion, Elev. 401', near R-30.
- Bare substrate pipe with light surface corrosion. Pipe has never been coated. It is located on Elev. 401', near P-14.
- Mechanical damage on I-Beams. Light surface corrosion is present. It is located on Elev. 401', near R-40.
- Unqualified coating applied on piping near R-28 Elev. 401'. Six-foot step ladder needed for access.

426' Elevation (OMB)

- Mechanical damage and burnt coating on kick plate of a platform stair landing, numerous areas, component located on Elev. 426'. Scaffolding support required.
- Mechanical damage and burnt coating on kick plate of a platform stair landing, numerous areas, component located on Elev. 426'. Scaffolding support required.
- Unqualified coating applied on piping near R-31, Elev.426'.
- Unqualified coating applied on piping near R-42, Elev.426'.
- Bare substrate area on base of (4) accumulator tanks located on Elev. 426'.
- Welded areas of hand rails exhibit very light surface corrosion, numerous areas Elev. 426'.

ATTACHMENT 1b
Description and Assessment

401' Elevation (IMB)

- Mechanical damage of carbon steel on I-Beam. Light surface corrosion, Elev. 401' IMB.
- Pipes and valves have never been coated, light surface corrosion is visible, located near R-40 Elev. 401'.
- Floor I-Beam has bare substrate and light surface corrosion near R-32, Elev. 401' IMB.
- 4" bare substrate pipe. Pipe has never been coated, light to medium surface corrosion is visible, located near R-32, Elev. 401' IMB.
- Table 3.7.3-1 below contains coating deficiencies listed above that are recommended for coating repair during B2R21 outage.

Table 3.7.3-1: Coatings Deficiencies Recommended for Repair in B2R21

Elevation	Degree	Size	Description
377' OMB	R-28	Hanger	Surface rusting
377' OMB	R-28	4" x Valve & 2" pipe	Surface rusting
377' OMB	R-31	2" pipe	Surface rusting
377' OMB	R-33	2" pipe	Surface rusting
377' OMB	R-39	2" pipe	Bare substrate
377' OMB	R-40	4" pipe	Surface rusting
377' OMB	R-41	4" pipe	Bare substrate
377' OMB	2D – RCFC	Outlet	Surface rusting
377' OMB	Various locations	Fire Apparatus	Surface rusting
377' OMB	Various	Embed	Mech. damage
401' OMB	Near P-14	2" pipe	Surface rusting
401' OMB	R-23	Pipe 4" X 2"	Surface rusting
401' OMB	R-28	4" pipe	Unqualified coating
401' OMB	R-30	Floor beam	Surface rusting
401' OMB	R-40	Floor I-beam	Surface rusting
426' OMB	Kick plate	Platform landing	Surface rusting
426' OMB	R-31	4" pipes	Unqualified coating
426' OMB	R-42	4" & 2" pipes	Unqualified coating
426' OMB	Various	Accumulators	Surface rusting
426' OMB	Various	Handrails	Surface rusting
401' IMB	R-32	I-beam	Surface rusting
401' IMB	R-32	4" pipe	Surface rusting
401' IMB	R-40	Pipes & valves	Surface rusting
401' IMB	R-42	I-beam	Surface rusting

Coating Repairs Made During B2R20

401' Elevation (OMB)

- Inorganic zinc repair on 8" elbow at R-30.
- Inorganic zinc on overhead 8' pipe.
- Inorganic zinc on vertical 8" pipe and 8' tube steel in "C" Plenum.
- Rusted piping in overhead at R-28, Penetration #6. Pipe coated with expired coating.

377' Elevation (OMB)

- Inorganic zinc support hanger on inboard wall in stairway at R-38.
- 2" Bare and rusted drain pipes in doorways of (B & C) RCFC Boxes.
- Inorganic Zinc surface rust on tank stiffener on tank bottom near R-22.

- Rusted 1 ½" piping and welds in overhead at R-25.
- Uncoated 2" and 4" piping with rusted welds at R-26.
- Rusted bottom door plate on 2C RCFC at R-30.
- 2" Tube steel support weld at R-33.

412' Elevation (OMB)

- Inorganic zinc bare area on bottom of overhead 10" pipe at R-29.
- Inorganic zinc rusted areas on steel plates on floor at R-32.

426' Elevation (OMB)

- RO-40, Bare areas on tank bottom flange between bolts 3 and 4.
- Damage to liner from burn at R-25.
- Rusted pipe and welds at penetration to liner.
- Bare and rusted 4" and 2" piping at R-31 and R-42 similar piping.
- Mechanical damage to Tank at R-40 surface rust ↑ 5'.
- Mechanical damage to handrails at R-37 and R-36.
- Mechanical damage to Equipment hatch steel support beams at R-27 floor level, coating stabilization during B2R20.
- Coating damage to steel imbed near fuel pool at R-38 "A" Steam generator wall, coating stabilization in B2R20.
- Rusted piping and welds on 4" pipe at R-42 was coated with expired material.
- Shows missing coating, rusted welds, and undocumented coating on 4" and 2" pipe at R-31.

377' Elevation (IMB)

- Rusted piping and welds near RO-36.
- Rusted piping and welds near RO-39.

390' Elevation (IMB)

- Rusted piping and welds near R-36 outboard wall, coating stabilization B2R20.
- Rusted piping inboard wall at R-39.

401' Elevation (IMB)

- Rusted piping and welds at R-31, 1½" Pipe and welds.
- Mechanical damage burned coating on steel at R-29 inboard wall, coating stabilization.
- Mechanical damage burned coating inner wall at R-32, stabilization of burned concrete coating.
- Mechanical damage burned coating on steel imbed at R-32.
- Mechanical damage burned coating at R-24 Inboard wall, stabilization of burned concrete coating.
- Mechanical damage burned coating and uncoated pipe at R-26 near floor, stabilization of burned concrete coating.
- Uncoated support beam with uniform surface rusting in welds at grating on outboard wall near R-37.

3.7.4 Primary Containment Coatings Condition Assessment, Unit 2 RFO B2R21, Spring 2019

Safety related coating assessment of the Service Level I Primary Containment coated surfaces was completed at BYR Unit 2 during the 2019 B2R21 RFO.

Interior surfaces of the primary containment, components, and equipment were inspected and assessed.

Inspection Findings

Primary Containment, Liner Plate, All Elevations, Outside Missile Barrier (OMB)

The original protective coating applied to the containment liner wall is Carbozinc 11, (an inorganic primer) top coated with a phenolic epoxy top coat, possibly Carboline, Phenoline 305. The coating system on the liner (OMB) at elevations 377', 401', 412', and 426' generally appears to be in good condition. Random locations of cracked top coating were observed with exposes, intact zinc primer at each elevation. Cracked topcoat areas are more general on the liner wall at Elev. 377' (the basement). Deficiencies range in size from ¼" diameter to ½ sq. ft. Zinc primer under the cracked, delaminated top coat is intact and appears to be in good condition. The cracked/delaminated top coat most likely occurred during outages, probably the result of object impact over a number of years, caused by personnel moving and staging scaffolding, tools and other equipment during refuel outages. Coating deficiencies are typically repaired every refueling outage as a normal maintenance practice. Areas of loose coating and age cracking are removed back to tightly adherent coating and not recoated if outage schedule constraints does not permit enough time to properly perform repairs. Numerous coating deficiencies on the containment liner have been repaired during previous outages and appear to be in good condition.

Primary Containment, Inner Wall, Components and Piping Systems

Components and piping systems on all elevations (377', 401', 412' and 426') are generally coated with Carbozinc 11 primer only. The primer is generally intact and in good conditions on all components. However, bare substrate is exposed on numerous components and piping systems. Most affected areas are where the coating was removed for component modification and was not repaired. Light uniform surface rusting is visible on subject areas, pitting corrosion was not observed. Numerous piping systems have never been coated. The exposed substrate on those systems exhibit light to moderate uniform surface rusting, with no apparent pitting corrosion observed. Numerous bare substrate areas were repaired during previous outages and remain in good condition.

Primary Containment Concrete Surfaces

Protective coatings on concrete walls and floors are generally in good condition. Mechanical damage to the coating is the most common coating defect. Other coating deficiencies are minor stress cracks in the concrete coating, nicks and scratched in the top coat that do not expose concrete substrate. The majority of coating defects are on the floor at Elev. 377'.

Concrete Walls and Floor, All Elevations, Inside Missile Barrier (IMB)

Protective coatings on concrete walls and floor at elevations 377', 390', and 401' appears to be in good condition. Mechanical damage to the coating is the most common coating defect. Other coating deficiencies are burnt coatings where grinding and welding occurred, discoloration of top

coat, minor stress cracks in concrete walls/coating, nicks and scratched that do not expose concrete substrate. The majority of coating defects are on the floor in high foot traffic areas of Elev. 377'. The upper twenty-five (25)' of concrete walls are not coated.

Steel Components and Piping Systems

Steel components and piping systems on all elevations are generally coated with Carbozinc 11 primer only. The primer appears to be intact and in good conditions on all components. However, bare substrate is exposed on numerous components and piping systems. In some areas, it is apparent that the protective coating was intentionally removed from these areas and not reapplied. Light uniform surface rusting is visible on subject areas, no pitting corrosion was observed. Numerous piping systems were never coated. The substrate of those systems exhibit light to moderate uniform surface rusting, with no apparent pitting corrosion observed. Numerous bare substrate areas have been prepared and coated over the life of the plant; those repairs are in good condition.

Containment Dome Above Polar Crane Rail

The protective coating on the dome generally appears to be in good condition. The inspection was performed remotely, using a high-power flash/spot light. No apparent coating deficiencies were observed.

Polar Crane

Coatings on the Polar Crane generally appear to be in good condition with no apparent coating deficiencies.

Discussion and Summary

UESI performed an inspection and condition assessment of the safety related protective coatings applied to the Primary Containment liner wall (OMB), components, miscellaneous structures, piping and concrete walls and floors inside BYR's Unit 2 primary containment building. Emphasis was placed on coatings applied to accessible areas of the pressure boundary (liner wall). The main objective of the assessment is to identify newly degraded coating and/or apparent unqualified coatings, quantify the extent of these conditions and report finds to EGC's on-site coating engineer. A substantial number of previously identified coating deficiencies were prepared and coated with Keeler and Long (K&L) 9600N. A list of subject areas is documented below. Other areas were revisited to ascertain if subject deficiencies have changed in size and appearance.
Inspection data collected should assist the site Responsible Coating Engineer in determining the effects of degraded coating on plant operation; to ensure that the ECCS and the safety-related CSS remain capable of performing their intended safety functions and to mitigate corrosion of the containment liner and its integral structural and mechanical components.

Conclusions and Recommendations

The B2R21 Primary Containment safety related coating assessment identified few areas of coating degradation resulting from age and heat. Coating deficiencies identified during previous outages have not significantly changed. There were no current degraded coating conditions that were identified that could impact structural integrity or the safe operation and shutdown of the facility; however, five (5) steel test coupons had severe delamination and were removed from containment

and stored in a box. Coatings engineer has control of removed panels and should be kept for further evaluation.

Plant management should continue planning for coating remediation during future outages. There remains a need to monitor for and address the areas of coating degradation and bare substrate areas that exhibits corrosion. Such repairs will reduce radiation levels resulting from fixed contamination on exposed substrates, mitigate progressive coating degradation, and prevent damage to exposed steel and concrete substrates. There is a significant amount of mechanical damage to the liner plate that has been spot repaired during past outages. The practice of preventive maintenance should continue.

Two lists of coating deficiencies are documented. The first list of areas and components below were identified during B2R20 outage. Subject areas and components were repaired during B2R21 outage. The second list consist of components identified during the B2R21 containment walk down inspection and are recommended for future remediation.

Areas and Components Repaired During B2R21

401' Elevation (OMB)

- Structural steel at RO-30.
- Structural steel at RO-40.
- Piping 2SX06DD-10" AT 2D RCFC (Sock-let) at RO-25.
- Piping 2SX04DA-14"AT PENT #6 at RO-28.
- Piping 2SX06EB-10" AT 2B RCFC (Sock-let) at RO-35.
- Piping 2SX06CA-14" AT 2A RCFC.

377' Elevation (OMB)

- Pipe and steel components (I-Beam) at RO-28.
- Electrical outlet box welded to 2VP01CD RCFC Exterior at RO-23.
- Anchor Plates at RO-24.

412' Elevation (OMB)

None

426' Elevation (OMB)

- Valve Body and Pipe at RO-26. Unqualified coating due to low dry film thickness measurements (DFT).
- Gallery steel at personnel hatch at RO-26/27.
- FP piping and valve at RO-31.
- FP piping and valve at RO-42.
- Accumulator bases at RO-23, 29, 35, and 39.
- Miscellaneous Handrails at RO-30.

377' Elevation (IMB)

Removed five (5) delaminated steel test coupons #s 1, 8, 12, 23 and 24.

ATTACHMENT 1b
Description and Assessment

390' Elevation (IMB)

None

401' Elevation (IMB)

Structural steel at RI-32.

Areas and Components Recommended for Repair During B2R22 and Future Outages

377' Elevation (OMB)

- Overhead piping on Elev. 377' RO-25. Rust Grade of 2-G.
- Mechanical damage to substrate at penetration P-61 Elev. 377' RO-28. Rust Grade 7-S.
- Uncoated pipe on Elev. 377' RO-30. Rust Grade 4-G. This uncoated pipe runs through several elevations.
- Overhead 4" uncoated piping on Elev. 377' RO-31 with a Rust Grade 2-G.
- Pipe with union coming up from cement floor on Elev. 377' RCFC 2C.
- Pipe with union coming up from cement floor on Elev. 377' RCFC 2D.
- Piping on Elev. 377' RCFC 2B, Rust Grade 1-G.
- Check corner of RCFC Box 2A for any additional loose or flaking coating. Recoat of RCFC Box 2A should be considered during future outages.
- Rust Grade of 7-G on uncoated overhead pipe with a Rust Grade of "0" 4" out on each side of valve Elev. 377' RO-42.
- Rust Grade 1-G on fire box on Elev. 377' RO-37. This is consistent with all the fire boxes on every elevation.
- Rust Grade 4-G on stiffener and hardware Elev. 377' RO-40.

401' Elevation (OMB)

- Mechanical damage on stiffener, Rust Grade 8-G, EL 401 RO-37.
- Two (2) areas of mechanical damage to the substrate on overhead plate. EL 401' RO-40. Rust Grade 2-S within a 6" X 6" area. Rust Grade "0" on 2" pipe connection.

412' Elevation (OMB)

- Uncoated pipe on Elev. 412' RO-42 Rust Grade 2-G.
- Area of spot corrosion on vertical steel was plate, Rust Grade 2-S within a (6" x 6") area.
- Rust Grade G-5 on uncoated upper piping connection on Elev. 412' RO-28.
- Rust Grade 8-S on overhead piping Elev. 412' RO-36.

426' Elevation (OMB)

- Rust band that goes all the way around accumulator tank 2C6-8. Rust Grade 9-S.
- Spot corrosion on Elev. 426' OMB wall at RO-39, Rust Grade 9-S.
- Mechanical damage to handrail, Rust Grade 8-S.
- Exposed substrate on 2" pipe due to welding.
- Unqualified coating on fire valve 2FP778 and piping on Elev. 426' RO-26. Mils on pipe and valve were to low and time would not permit a second coat to be applied.

377' Elevation (IMB)

- Steel plate with a Rust Grade 2-G on concrete floor on Elev. 377' RI-40.
- Mechanical damage down to the cement on Elev. 377' IMB near ECCS sumps.
- Continue with the scrapping of all loose, delaminated and flaking coating near the ECCS sumps and screens, Elev. 377' IMB.

Table 3.7.4-1 below contains coating deficiencies listed above that were recommended for coating repair during B2R22 outage.

Table 3.7.4-1: Coating Deficiencies Recommended for Repair During B2R22

Elevation	Degree	Size/ Component	Rust Grade	Description
377' OMB	RO-25	2" Pipe	2-G	Bare substrate
377' OMB	RO-28	Pen #61	7-S	Mech. damage
377' OMB	RO-30	4" Pipe	4-G	Surface rusting
377' OMB	RO-30	6" Pipe	3-G	Surface rusting
377' OMB	RO-31	4" Pipe	2-G	Surface rusting
377' OMB	RO-37	Fire Box	1-G	Surface rusting
377' OMB	RO-39	4" Pipe/Flange	8-G to 1-G	Surface rusting
377' OMB	RO-40	Stiffener	4-G	Surface rusting
377' OMB	RO-42	Pipe/Flange	7-G to "0"	Surface rusting
377' OMB	RCFC 2A	Angle Iron	3-G	Surface rusting
377' OMB	RCFC 2A Box	Floors	N/A	Coating degraded
377' OMB	RCFC 2B	2" Pipe	1-G	Surface rusting
377' OMB	RCFC 2C	Floor Steel containment	2-G	Surface rusting
377' OMB	RCFC 2D	Pipe/Union	0	Surface rusting
401' OMB	RO-26	4" around flange	3-G	Surface rusting
401' OMB	RO-36	10" Pipe	5-S	Surface rusting
401' OMB	RO-37	Stiffener	8-G	Mech. damage
412' OMB	RO-28	6" Pipe	5-G	Surface rusting
412' OMB	RO-36	8" Pipe	8-S	Surface rusting
412' OMB	RO-42	1" Pipe	2-G	Surface rusting
426' OMB	Accumulator tank 2C6-8	Around accumulator tank	9-G	Surface rusting
426' OMB	RO-39	OMB Wall	9-S	Surface rusting
426' OMB	Various	Hand Rails	8-S	Surface rusting
377' IMB	RO-33	Pipes & Valves	1-G	Surface rusting
377' IMB	RI-40	Floor Plate	2-G	Surface rusting
377' IMB	Near ECCS sumps	2" mechanical damage to cement	N/A	Mech. damage
377' IMB	Near ECCS sumps	I-Beam	4-S	Surface rusting
401' IMB	RO-26	2" Pipe	"0"	Surface rusting
401' IMB	RO-40	2" Pipe/I-Beam	2-S to "0"	Surface rusting
412' IMB	RI-28	Plate	2-S	Surface rusting
412' IMB	RO-30	Hardware/2" Pipe	"0" to 3-G	Surface rusting
426' IMB	RO-26	Fire Valve/Pipe	N/A	Unqualified coating
426' IMB	RO-30	Uncoated Weld	1-G	Surface rusting
426' IMB	RO-31	2" Pipe	New weld exposed Grade 10	Bare substrate
426' IMB	Various	Hand Rails	5-G	Surface rusting

3.7.5 Unit 1 IWE Examination, RFO B1R20, September 2015

The purpose of this inspection is to ensure that the structural integrity of ASME Class MC pressure retaining surfaces and Class CC metallic shell and penetration liners are maintained. Condition Assessment of Class MC and CC components is achieved by performing examinations of the accessible surfaces. All examinations were performed so as to comply with Article IWE of the ASME Boiler and Pressure Vessel Code, Section XI, 2001 Edition through the 2003 Addenda. The results of previous examinations were reviewed to identify any areas or components that required an augmented or focused examination.

The examination results of the Class MC pressure retaining surfaces and CC shell and penetration liners (including pressure retaining bolting) and MB(s) were reviewed, compared to acceptance standards specified in IWE-3500 of ASME Section XI, 2001 Edition through the 2003 Addenda, and evaluated by the appropriate personnel.

The examination scope included inspection of the liner seams at dome for evidence of active degradation. The bolted connections require VT-3, unless VT-1 is warranted as a result of VT-3. Visual examinations in Area 5 Penetrations are at elevation 374' and higher. The following penetrations were subject to examination: P1 – P16, P18, P19, P21 – P34, P36, P37, P39, P41 – P45, P47 – P57, P59 – P61, P63 – P66, and P68 – P75. P98 is only inspectable from inside the containment. There are no IWE components for P98 from outside of containment.

The results of the visual examination of IWE surfaces are detailed in Table 3.7.5-1 below. Note that the contents of Table 3.7.5-1 do not include the results of inspections where there were No Reportable Indications (NRI).

Table 3.7.5-1: BYR Unit 1 IWE Examination, Outage B1R20 (September 2015)			
Component	**Exam Type(s)**	**Direct/ Remote**	**Comments**
1PC-002-SURFACE, 1PC-003-SURFACE, 1PC-004-SURFACE, 1PC-005-SURFACE, 1PC-006-SURFACE, 1PC-012-SURFACE, 1PC-013-SURFACE, 1PC-014-SURFACE, 1PC-015-SURFACE	General Visual	Direct	Aggregate buildup on top of penetration, no impact on the penetration. Partially coated surface with minor surface rust. Found acceptable with no further evaluation required.
1PC-011-SURFACE, 1PC-023-SURFACE, 1PC-025-SURFACE, 1PC-026-SURFACE, 1PC-028-SURFACE, 1PC-029-SURFACE, 1PC-030-SURFACE, 1PC-031-SURFACE, 1PC-039-SURFACE, 1PC-041-SURFACE, 1PC-043-SURFACE, 1PC-045-SURFACE, 1PC-047-SURFACE, 1PC-048-SURFACE, 1PC-050-SURFACE, 1PC-051-SURFACE, 1PC-052-SURFACE, 1PC-053-SURFACE, 1PC-055-SURFACE, 1PC-057-SURFACE, 1PC-059-SURFACE	General Visual	Direct	Partially coated surface, minor surface rust. Found acceptable with no further evaluation required.

Table 3.7.5-1: BYR Unit 1 IWE Examination, Outage B1R20 (September 2015)			
Component	**Exam Type(s)**	**Direct/ Remote**	**Comments**
1PC-060-SURFACE, 1PC-061-SURFACE, 1PC-065-SURFACE, 1PC-069-SURFACE, 1PC-070-SURFACE, 1PC-071-SURFACE, 1PC-072-SURFACE, 1PC-075-SURFACE	General Visual	Direct	Partially coated surface, minor surface rust. Found acceptable with no further evaluation required.
1PC-016-SURFACE, 1PC-018-SURFACE, 1PC-019-SURFACE, 1PC-042-SURFACE, 1PC-049-SURFACE	General Visual	Direct	Partially coated surface, minor surface rust with no metal loss. Found acceptable with no further evaluation required.
1PC-021-SURFACE	General Visual	Direct	Not coated, minor surface rust with caulking debris resting on top of penetration. Found acceptable with no further evaluation required.
1PC-022-SURFACE, 1PC-024-SURFACE, 1PC-027-SURFACE, 1PC-032-SURFACE, 1PC-033-SURFACE, 1PC-037-SURFACE, 1PC-056-SURFACE, 1PC-066-SURFACE, 1PC-068-SURFACE	General Visual	Direct	Not coated, minor surface rust. Found acceptable with no further evaluation required.
1PC-034-SURFACE	General Visual	Direct	Entire penetration surface coated red. A small area of scratched coating from mechanical contact. Found acceptable with no further evaluation required.
1PC-044-SURFACE, 1PC-073-SURFACE	General Visual	Direct	Piece of duct tape on penetration surface. Partially coated, minor surface rust. Found acceptable with no further evaluation required.

Table 3.7.5-1: BYR Unit 1 IWE Examination, Outage B1R20 (September 2015)			
Component	**Exam Type(s)**	**Direct/ Remote**	**Comments**
1PC-076-SURFACE, 1PC-077-SURFACE, 1PC-082-SURFACE, 1PC-083-SURFACE, 1PC-086-SURFACE, 1PC-087-SURFACE, 1PC-090-SURFACE, 1PC-094-SURFACE, 1PC-099-SURFACE, 1PC-102-SURFACE	General Visual	Direct	Surface rust is present, no metal loss or adverse effect to the structural integrity of the penetration. Found acceptable with no further evaluation required.
1PC-078-SURFACE, 1PC-079-SURFACE, 1PC-080-SURFACE, 1PC-081-SURFACE, 1PC-084-SURFACE, 1PC-085-SURFACE, 1PC-088-SURFACE, 1PC-089-SURFACE, 1PC-096-SURFACE, 1PC-101-SURFACE	General Visual	Remote	Surface rust is present, no metal loss or adverse effect to the structural integrity of the penetration. Found acceptable with no further evaluation required.
1PC-095-SURFACE, 1PC-097-SURFACE	General Visual	Direct	Minor surface rust is present, no metal loss or adverse effect to the structural integrity of the penetration. Found acceptable with no further evaluation required.
1PC-100-SURFACE	General Visual	Remote	Caustic material resting on top of penetration. Surface rust is present, no metal loss or adverse effect to the structural integrity of the penetration. Found acceptable with no further evaluation required.
1E-027-HDBOLTING, 1E-027-SURFACE, 1E-029-HDBOLTING, 1E-029-SURFACE	General Visual, VT-3	Direct, Remote	Minor surface discoloration on flange surface of both 1E-27 and 1E-29, no impact on seating surface or structural integrity of either penetration. Found acceptable with no further evaluation required.
1PC-074-SURFACE, 1PC-074-HDBOLTING	General Visual, VT-3	Direct	External surface of penetration had rust around entire diameter, base metal intact. Discoloration of flange surfaces from corrosion. No metal loss. Flange conditions good. Discoloration from duct tape left on surface of flange, no erosion under duct tape. Bolting threads had minor nicks/gouges; however, nut could easily thread. Some white coating on penetration to wall was flaking off, no base metal loss. Found acceptable with no further evaluation required.

Table 3.7.5-1: BYR Unit 1 IWE Examination, Outage B1R20 (September 2015)			
Component	**Exam Type(s)**	**Direct/ Remote**	**Comments**
1PC-063-SURFACE, 1PC-063-HDBOLTING	General Visual, VT-3	Direct	Surface rust around the diameter of the penetration, no metal loss. Piece of duct tape on cap. Found acceptable with no further evaluation required.
1LINER-SURFACE (includes all around weld on P21 – P34, P36, P37, P39, P41 – P45, P47 – P57, P59 – P61, P63 – P66, P68 – P91, P99 – P102)	General Visual	Direct, Remote	Mechanical damage to outer coating at numerous locations. Staining on outside surface of coating, mostly by R2 – R3. Chipped coating at sections all throughout the full circumference, heavy traffic areas and largely at R10 – R11. Localized bulges in liner due to the way the concrete has been shaped around the liner. Found acceptable with no further evaluation required.
1LINER-SURFACE (includes all around weld on P1 – P16, P18, P19)	General Visual	Direct, Remote	Mechanical damage to outer coating at numerous locations. Staining on outside surface of coating, mostly by R4 – R5. Chipped coating at sections all throughout the full circumference, heavy traffic areas and largely at R3 – R4. Localized bulges in liner due to the way the concrete has been shaped around the liner. Found acceptable with no further evaluation required.
1LINER-SURFACE (includes all around weld on E15 – E28, E43 – E56)	General Visual	Direct, Remote	Mechanical damage to outer coating at numerous locations. Staining on outside surface of coating, mostly by R1 – R2. A screwed plug was identified to be missing from a leak test channel between R9 and R10 on the containment liner at elevation 412', at the horizontal run of the channel, about 3' off the ground from 412'. The missing plug has no effect on the structural integrity of the containment liner, but it does need to be replaced during B1R20. The missing plug was replaced during B1R20. Chipped coating at sections all throughout the full circumference, heavy traffic areas and largely at R21 – R1. Localized bulges in liner due to the way the concrete has been shaped around the liner. Piece of duct tape on liner, has no impact on coating. Found acceptable with no further evaluation required.
1LINER-SURFACE (includes all around weld on E1 – E14, E29 – E42, P95 – P97, I1 – I5)	General Visual	Direct, Remote	Mechanical damage to outer coating at numerous locations from 426' up to 440'. Staining on outside surface of coating, mostly around R11 – R12. Chipped coating at sections all throughout the full circumference, only a few feet off of 426' in heavy traffic areas and largely around the Equipment Hatch where the bolting contacts the liner. Localized bulges in liner due to the way the concrete has been shaped around the liner. Oil drips from polar crane running down the coated liner. Found acceptable with no further evaluation required.
1DOME-LINER-SURFACE (includes all around weld on P94)	General Visual	Direct, Remote	Discoloration along dome seams. Staining on exterior of coating from existing attachments. Small areas of chipped coating along circumferential walkway. Localized bulges in liner due to the way the concrete has been shaped around the liner. Pieces of duct tape on liner, has no impact on coating. Found acceptable with no further evaluation required.
1P-104-EPALED-LTIP-SURFACE	General Visual	Direct	Minor chips in coating. Found acceptable with no further evaluation required.

ATTACHMENT 1b
Description and Assessment

Table 3.7.5-1: BYR Unit 1 IWE Examination, Outage B1R20 (September 2015)			
Component	**Exam Type(s)**	**Direct/ Remote**	**Comments**
1P-104-EPAL-ASSEMBLY-SURFACE	General Visual	Direct, Remote	Chipped coating from heavy traffic and mechanical contact. Minor surface rust around electrical attachments on ceiling inside airlock. Found acceptable with no further evaluation required.
1P-104-EPALED-ASSEMBLY-SURFACE, 1P-104-EPALID-ASSEMBLY-SURFACE,	General Visual	Direct, Remote	Areas of chipped coating from mechanical contact. Found acceptable with no further evaluation required.
1P-104-EPALED-EAP-BOLTING	General Visual, VT-3	Direct, Remote	Bolting coating, one bolt has minor coating chip. Found acceptable with no further evaluation required.
1P-104-EPALED-EVP-SURFACE, 1P-104-EPALID-EVP-SURFACE,	General Visual	Direct	Small areas of chipped coating. Found acceptable with no further evaluation required.
1P-104-EPALED-USSP-SURFACE, 1P-104-EPALED-LSSP-SURFACE	General Visual	Direct	Minor spots of chipped coating. Found acceptable with no further evaluation required.
1P-103-EH-ASSEMBLY-BOLTING	General Visual	Direct, Remote	All bolt exhibit minor damage to threads in regions outside of the nut travel path, intact. Found acceptable with no further evaluation required.
1P-103-EH-ASSEMBLY-SURFACE, 1P-103-PALCYL-ASSEMBLY-SURFACE, 1P-103-PALID-ASSEMBLY-SURFACE	General Visual	Direct, Remote	Areas of chipped coating from mechanical contact, duct tape is present. Found acceptable with no further evaluation required.
1P-103-PALED-ASSEMBLY-SURFACE	General Visual	Direct, Remote	Areas of chipped coating from mechanical contact. Found acceptable with no further evaluation required.
1P-103-PALID-SGP-BOLTING	General Visual, VT-3	Direct, Remote	Light surface rust, no metal loss, bolting intact. Found acceptable with no further evaluation required.
1P-103-PALID-SGP-SURFACE	General Visual	Direct, Remote	Minor coating chips, light surface rust – no active corrosion. Found acceptable with no further evaluation required.
1P-103-PALID-LTP-SURFACE, 1P-103-PALID-UTP-SURFACE	General Visual	Direct	Minor surface rust on airlock side, no metal loss. Found acceptable with no further evaluation required.

Table 3.7.5-1: BYR Unit 1 IWE Examination, Outage B1R20 (September 2015)			
Component	**Exam Type(s)**	**Direct/ Remote**	**Comments**
1P-103-PALED-SGP-BOLTING	General Visual, VT-3	Direct	Light surface rust, no metal loss, bolting intact. Found acceptable with no further evaluation required.
1P-103-PALED-SGP-SURFACE	General Visual	Direct	Minor coating chips, light surface rust – no active corrosion. Found acceptable with no further evaluation required.
1P-103-PALID-LSSP-SURFACE, 1P-103-PALID-USSP-SURFACE, 1P-103-PALED-LSSP-SURFACE	General Visual	Direct	Minor spots of chipped coating. Found acceptable with no further evaluation required.

3.7.6 Unit 1 IWE Examination, RFO B1R21, February 2017

The purpose of this inspection is to ensure that the structural integrity of ASME Class MC pressure retaining surfaces and Class CC metallic shell and penetration liners are maintained. Condition Assessment of Class MC and CC components is achieved by performing examinations of the accessible surfaces. All examinations were performed so as to comply with Article IWE of the ASME Boiler and Pressure Vessel Code, Section XI, 2007 Edition through the 2008 Addenda.

The results of previous examinations were reviewed to identify any areas or components that required an augmented or focused examination.

The examination results of the Class MC pressure retaining surfaces and CC shell and penetration liners (including pressure retaining bolting) and MB(s) were reviewed, compared to acceptance standards specified in IWE-3500 of ASME Section XI, 2007 Edition through the 2008 Addenda, and evaluated by the appropriate personnel.

The examination scope included inspection of the liner seams at dome for any evidence of active degradation as well as inspection of the basemat leak chase channel piping at R5, R7, R13, and R20 OMB. Verification of piping and caps to ensure they are intact to prevent water ingress into the leak chase channel system was performed. The bolted connections require a VT-1. Visual examinations in Area 5 Penetrations are at elevation 374' and up. The following penetrations were subject to examination: P1 – P16, P18, P21 – P34, P36, P37, P39, P41 – P45, P47 – P57, P59 – P61, P63 – P66, and P68 – P75. P98 is only inspectable from inside the containment. There are no IWE components for P98 outside of containment.

The results of the visual examination of IWE surfaces are detailed in Table 3.7.6-1 below. Note that the contents of Table 3.7.6-1 do not include the results of inspections where there were No Reportable Indications (NRI).

ATTACHMENT 1b
Description and Assessment

Table 3.7.6-1: BYR Unit 1 IWE Examination, Outage B1R21 (February 2017)			
Component	**Exam Type**	**Direct/ Remote**	**Comments**
1E-005-SURFACE	General Visual	Remote	Minor surface rust on uncoated portion. Evaluated and found acceptable.
1E-006-SURFACE	General Visual	Remote	Minor surface rust on uncoated portion. Staining on coated portions from floor above (IWL Zone 1-3). Evaluated and found acceptable.
1E-007-SURFACE	General Visual	Remote	Staining on coated portion from floor above (IWL Zone 1-3). Evaluated and found acceptable.
1E-013-SURFACE	General Visual	Direct	Minor staining on coated portion from floor above (IWL Zone 1-3). Evaluated and found acceptable.
1E-014-SURFACE	General Visual	Direct	Minor staining on coated portion from floor above (IWL Zone 1-3). Evaluated and found acceptable.
1E-017-SURFACE	General Visual	Remote	Minor surface rust on uncoated portion. Evaluated and found acceptable.
1E-020-SURFACE	General Visual	Remote	Minor staining on coated portion (IWL Zone 1-4). Evaluated and found acceptable.
1E-024-SURFACE	General Visual	Direct	Minor surface rust on uncoated portion. Evaluated and found acceptable.
1E-025-SURFACE	General Visual	Direct	Minor surface rust on uncoated portion. Evaluated and found acceptable.
1E-027-SURFACE	General Visual	Direct	Minor staining on coated portion (IWL Zone 1-4). Evaluated and found acceptable.
1E-028-SURFACE	General Visual	Direct	Minor surface rust on uncoated portion. Evaluated and found acceptable.
1E-029-SURFACE	General Visual	Remote	Minor surface rust on uncoated portion. Evaluated and found acceptable.
1E-031-SURFACE	General Visual	Remote	Minor surface rust on uncoated portion. Evaluated and found acceptable.
1E-032-SURFACE	General Visual	Remote	Minor surface rust on uncoated portion. Evaluated and found acceptable.
1E-033-SURFACE	General Visual	Remote	Minor surface rust on uncoated portion. Evaluated and found acceptable.
1E-035-SURFACE	General Visual	Remote	Minor surface rust on uncoated portion. Evaluated and found acceptable.
1E-036-SURFACE	General Visual	Direct	A 5.5" x 2.0" section with only primer applied to penetration, not fully coated. Evaluated and found acceptable.
1E-037-SURFACE	General Visual	Direct	Minor surface rust on uncoated portion. Evaluated and found acceptable.
1E-038-SURFACE	General Visual	Direct	Minor surface rust on uncoated portion. Evaluated and found acceptable.
1E-039-SURFACE	General Visual	Direct	Minor surface rust on uncoated portion. Evaluated and found acceptable.
1E-040-SURFACE	General Visual	Direct	Minor surface rust on uncoated portion. Evaluated and found acceptable.
1E-041-SURFACE	General Visual	Direct	Minor surface rust on uncoated portion. Evaluated and found acceptable.
1E-042-SURFACE	General Visual	Direct	Minor surface rust on uncoated portion. Evaluated and found acceptable.
1E-043-SURFACE	General Visual	Remote	Minor surface rust on uncoated portion. Evaluated and found acceptable.
1E-044-SURFACE	General Visual	Remote	Minor surface rust on uncoated portion. Evaluated and found acceptable.
1E-045-SURFACE	General Visual	Remote	Minor surface rust on uncoated portion. Evaluated and found acceptable.
1E-046--SURFACE	General Visual	Remote	Minor surface rust on uncoated portion. Evaluated and found acceptable.
1E-047-SURFACE	General Visual	Remote	Minor surface rust on uncoated portion. Paper towels laying on top of penetration. Evaluated and found acceptable.
1E-048-SURFACE	General Visual	Remote	Minor surface rust on uncoated portion. Evaluated and found acceptable.
1E-049-SURFACE	General Visual	Remote	Minor surface rust on uncoated portion. Evaluated and found acceptable.
1E-050-SURFACE	General Visual	Direct	Minor surface rust on uncoated portion. Evaluated and found acceptable.
1E-051-SURFACE	General Visual	Direct	Minor surface rust on uncoated portion. Evaluated and found acceptable.

ATTACHMENT 1b
Description and Assessment

Table 3.7.6-1: BYR Unit 1 IWE Examination, Outage B1R21 (February 2017)			
Component	**Exam Type**	**Direct/ Remote**	**Comments**
1E-054-SURFACE	General Visual	Direct	0.25 square inch section of chipped paint with very minor surface rust, no metal loss exists. Evaluated and found acceptable.
1LINER-SURFACE-377	General Visual	Direct, Remote	Localized bulges. Mechanical damage/chipped coating, R1 – R21, some areas with very minor surface rust present but no observed metal loss. Stained coating at various sections, R1 – R21. Some small sections of flaked coating. Evaluated and found acceptable.
1LINER-SURFACE-401	General Visual	Direct, Remote	Localized bulges. Mechanical damage/chipped coating, R1 – R21, some areas with very minor surface rust but no observed metal loss. Stained coating at various sections, R1 – R21. Some small sections of flaked coating. A screwed plug was identified to be missing from a leak test channel between R-18 and R-19, right next to the emergency hatch on Elev. 401'. The missing plug has no effect on the structural integrity of the containment liner. The missing plug was replaced during B1R21. Evaluated and found acceptable.
1LINER-SURFACE-412	General Visual	Direct, Remote	Localized bulges. Mechanical damage/chipped coating, R1 – R21, some areas with very minor surface rust but no observed metal loss. Stained coating at various sections, R1 – R21. Some small sections of flaked coating. A screwed plug was identified to be missing from a leak test channel at R-2 on the horizontal run of the channel, about 3' off the 412' grating. The missing plug has no effect on the structural integrity of the containment liner. The missing plug was replaced during B1R21. Evaluated and found acceptable.
1LINER-SURFACE-426	General Visual	Direct, Remote	Localized bulges. Mechanical damage/chipped coating, R1 – R21, some areas with very minor surface rust but no observed metal loss. Stained coating at various sections, R1 – R21. Some small sections of flaked coating. Evaluated and found acceptable.
1DOME-LINER-SURFACE	General Visual	Direct, Remote	Localized bulges. Mechanical damage/chipped coating, mostly around grating walkway. Locations with stained coating. Polar crane brackets and other welded attachments have surface rust present but no observed metal loss. Evaluated and found acceptable.

3.7.7 Unit 2 IWE Examination, RFO B2R19, March 2016

The purpose of this inspection is to ensure that the structural integrity of ASME Class MC pressure retaining surfaces and Class CC metallic shell and penetration liners are maintained. Condition Assessment of Class MC and CC components is achieved by performing examinations of the accessible surfaces. All examinations were performed so as to comply with Article IWE of the ASME Boiler and Pressure Vessel Code, Section XI, 2001 Edition through the 2003 Addenda.

The results of previous examinations were reviewed to identify any areas or components that required an augmented or focused examination.

The examination results of the Class MC pressure retaining surfaces and CC shell and penetration liners (including pressure retaining bolting) and MB(s) were reviewed, compared to acceptance standards specified in IWE-3500 of ASME Section XI, 2001 Edition through the 2003 Addenda, and evaluated by the appropriate personnel.

The examination scope included inspection of the entire liner plate, including the dome liner and the liner itself. The liner plate examination also included examination of all pertinent components inside containment for all electrical, instrumentation, and mechanical penetrations.

The results of the visual examination of IWE surfaces are detailed in Table 3.7.7-1 below. Note that the contents of Table 3.7.7-1 do not include the results of inspections where there were No Reportable Indications (NRI).

ATTACHMENT 1b
Description and Assessment

Table 3.7.7-1: BYR Unit 2 IWE Examination, Outage B2R19 (March 2016)			
Component	**Exam Type(s)**	**Direct/ Remote**	**Comments**
2I-003-SURFACE	General Visual	Direct	Chipped coating on closure plate. Found acceptable with no further evaluation required.
2PC-012-SURFACE	General Visual	Direct	Closure plate to sleeve weld has light surface rust. Found acceptable with no further evaluation required.
2PC-013-SURFACE	General Visual	Direct	Minor surface rust on closure plate, closure plate to sleeve weld, and closure plate to pipe weld. Found acceptable with no further evaluation required.
2PC-027-SURFACE	General Visual	Direct	Light surface rust on sleeve and sleeve to closure plate weld as well as on closure plate. It appears that surface rust came from corrosion of gusset plate to cross member connection on gallery steel 6 ft. above Pen. 27. Found acceptable with no further evaluation required.
2PC-031-SURFACE	General Visual	Direct	Minor surface rust on closure plate. Found acceptable with no further evaluation required.
2PC-033-SURFACE	General Visual	Direct	Light surface rust on sleeve, with a couple small rust spots on plate to sleeve weld. Found acceptable with no further evaluation required.
2PC-052-SURFACE	General Visual	Direct	Minor surface rust on sleeve and closure plate to sleeve weld. Found acceptable with no further evaluation required.
2PC-053-SURFACE	General Visual	Direct	Light surface rust on sleeve. Found acceptable with no further evaluation required.
2PC-055-SURFACE	General Visual	Direct	Small amount of mastic on sleeve and closure plate. Minor surface rust on closure plate weld. Found acceptable with no further evaluation required.
2PC-063-SURFACE	General Visual	Direct	Light surface rust on sleeve, sleeve to flange weld, and flange. Found acceptable with no further evaluation required.
2PC-065-SURFACE	General Visual	Direct	Light surface rust on sleeve for approximately 3 in. back from plate to sleeve weld. Found acceptable with no further evaluation required.
2PC-071-SURFACE	General Visual	Direct	Light surface rust on sleeve for approximately 3 in. back from plate to sleeve weld. Found acceptable with no further evaluation required.
2PC-074-SURFACE	General Visual	Direct	Light surface rust on sleeve, sleeve to flange weld, and flange. Found acceptable with no further evaluation required.
2P-103-PALED-EVP-SURFACE	General Visual	Direct	Small spot of chipped coating. Found acceptable with no further evaluation required.
2P-103-PALID-ASSEMBLY-SURFACE	General Visual	Direct	Damaged coating from chips and mechanical impact across the surface of the door. Dirt and staining of coated surfaces along with tape residue left on the floor. Found acceptable with no further evaluation required.
2P-104-EPALED-EVP-SURFACE	General Visual	Direct	Flaked coating around edge of flange surface, minor surface rust present, no degradation or metal loss. Found acceptable with no further evaluation required.
2P-104-EPALID-EVP-SURFACE	General Visual	Direct	Flaked coating around edge of flange surface, minor surface rust present, no degradation or metal loss. Found acceptable with no further evaluation required.

3.7.8 Unit 2 IWE Examination, RFO B2R20, October 2017

The purpose of this inspection is to ensure that the structural integrity of ASME Class MC pressure retaining surfaces and Class CC metallic shell and penetration liners are maintained. Condition Assessment of Class MC and CC components is achieved by performing examinations of the accessible surfaces. All examinations were performed so as to comply with Article IWE of the ASME Boiler and Pressure Vessel Code, Section XI, 2007 Edition through the 2008 Addenda.

The results of previous examinations were reviewed to identify any areas or components that required an augmented or focused examination.

The examination results of the Class MC pressure retaining surfaces and CC shell and penetration liners (including pressure retaining bolting) and MB(s) were reviewed, compared to acceptance standards specified in IWE-3500 of ASME Section XI, 2007 Edition through the 2008 Addenda, and evaluated by the appropriate personnel.

The examination scope included inspection of the entire liner plate, including the dome liner and the liner itself. The liner plate examination also included examination of all pertinent components inside containment for all electrical, instrumentation, and mechanical penetrations.

The results of the visual examination of IWE surfaces are detailed in Table 3.7.8-1 below. Note that the contents of Table 3.7.8-1 do not include the results of inspections where there were No Reportable Indications (NRI) and the inspection results were evaluated and found acceptable.

ATTACHMENT 1b
Description and Assessment

Table 3.7.8-1: BYR Unit 2 IWE Examination, Outage B2R20 (October 2017)			
Component	**Exam Type**	**Direct/ Remote**	**Comments**
2E-001-SURFACE	General Visual	Direct	Minor surface rust on uncoated portion, no metal loss. Evaluated and found acceptable.
2E-002-SURFACE	General Visual	Remote	Minor surface rust on uncoated portion, no metal loss. Evaluated and found acceptable.
2E-003-SURFACE	General Visual	Remote	Minor surface rust on uncoated portion, no metal loss. Evaluated and found acceptable.
2E-007-SURFACE	General Visual	Remote	Minor surface rust on uncoated portion, no metal loss. Evaluated and found acceptable.
2E-008-SURFACE	General Visual	Remote	Minor surface rust on uncoated portion, no metal loss. Evaluated and found acceptable.
2E-009-SURFACE	General Visual	Direct	Minor surface rust on uncoated portion, no metal loss. Evaluated and found acceptable.
2E-010-SURFACE	General Visual	Direct	Minor surface rust on uncoated portion, no metal loss. Evaluated and found acceptable.
2E-014-SURFACE	General Visual	Direct	Minor surface rust on uncoated portion, no metal loss. Evaluated and found acceptable.
2E-018-SURFACE	General Visual	Remote	Excess concrete on penetration from overpour. Evaluated and found acceptable.
2E-019-SURFACE	General Visual	Remote	Excess concrete on penetration from overpour. Evaluated and found acceptable.
2E-020-SURFACE	General Visual	Remote	Excess concrete on penetration from overpour. Staining from ceiling/insulation above. Minor surface rust on uncoated portion, no metal loss. Evaluated and found acceptable.
2E-021-SURFACE	General Visual	Remote	Minor surface rust on uncoated portion, no metal loss. Evaluated and found acceptable.
2E-026-SURFACE	General Visual	Direct	Mechanical gouges/dings on penetration flange. Appearance of uneven coating. Evaluated and found acceptable.
2E-027-SURFACE	General Visual	Direct	Minor surface rust on uncoated portion, no metal loss. Evaluated and found acceptable.
2E-027-HDBOLTING	VT-1	Direct	Minor presence of surface rust on bolting, no metal loss. Evaluated and found acceptable.
2E-028-SURFACE	General Visual	Direct	Minor surface rust on uncoated portion, no metal loss. Staining from ceiling insulation above. Debris/dirt buildup on penetration. Evaluated and found acceptable.
2E-028-HDBOLTING	VT-1	Direct	Minor presence of surface rust on bolting, no metal loss. Evaluated and found acceptable.
2E-029-SURFACE	General Visual	Remote	Minor surface rust on uncoated portion, no metal loss. Dirt/grime from ceiling above and joint sealant in corner of the wall. Evaluated and found acceptable.
2E-033-SURFACE	General Visual	Remote	Staining from paint on top of coated surface. Evaluated and found acceptable.
2E-034-SURFACE	General Visual	Remote	Debris build up. Staining from paint on top of coated surface. Evaluated and found acceptable.
2E-035-SURFACE	General Visual	Remote	Staining from paint on top of coated surface. Evaluated and found acceptable.
2E-036-SURFACE	General Visual	Direct	Dirt/grime staining from joint sealant in corner of wall. Coating degradation identified during IWL surveillance, not on the IWE surface. Evaluated and found acceptable.
2E-037-SURFACE	General Visual	Direct	Coating degradation identified during IWL surveillance, not on the IWE surface. Evaluated and found acceptable.
2E-038-SURFACE	General Visual	Direct	Coating degradation identified during IWL surveillance, not on the IWE surface. Evaluated and found acceptable.
2E-039-SURFACE	General Visual	Direct	Coating degradation identified during IWL surveillance under, not on the IWE surface. Evaluated and found acceptable.
2E-040-SURFACE	General Visual	Direct	Debris build up on top of penetration. Coating degradation identified during IWL surveillance, not on the IWE surface. Evaluated and found acceptable.

Table 3.7.8-1: BYR Unit 2 IWE Examination, Outage B2R20 (October 2017)			
Component	**Exam Type**	**Direct/ Remote**	**Comments**
2E-041-SURFACE	General Visual	Direct	Debris build up on top of penetration. Coating degradation identified during IWL surveillance, not on the IWE surface. Evaluated and found acceptable.
2E-043-SURFACE	General Visual	Remote	Minor surface rust on uncoated portion, no metal loss. Evaluated and found acceptable.
2E-045-SURFACE	General Visual	Remote	Minor surface rust on uncoated portion, no metal loss. Evaluated and found acceptable.
2E-046-SURFACE	General Visual	Remote	Debris on top of penetration from ceiling/insulation above. Evaluated and found acceptable.
2E-047-SURFACE	General Visual	Remote	Minor surface rust on uncoated portion, no metal loss. Evaluated and found acceptable.
2E-049-SURFACE	General Visual	Remote	Minor surface rust on uncoated portion, no metal loss. Excess concrete on penetration from overpour. Two dime-sized spots of chipped coating, by mechanical means, with no metal loss. Evaluated and found acceptable.
2E-050-SURFACE	General Visual	Direct	Minor surface rust on uncoated portion, no metal loss. Evaluated and found acceptable.
2E-050-HDBOLTING	VT-1	Direct	Minor presence of surface rust on bolting, no metal loss. Evaluated and found acceptable.
2E-051-SURFACE	General Visual	Direct	Minor surface rust on uncoated portion, no metal loss. Evaluated and found acceptable.
2E-051-HDBOLTING	VT-1	Direct	Minor presence of surface rust on bolting, no metal loss. Evaluated and found acceptable.
2E-052-SURFACE	General Visual	Direct	Small spots where coating was not applied. Minor surface rust on uncoated portion, no metal loss. Mechanical gouges/dings on penetration flange. Evaluated and found acceptable.
2E-053-SURFACE	General Visual	Direct	Staining from ceiling/insulation above. Small spots where coating was not applied. Minor surface rust on uncoated portion, no metal loss. Evaluated and found acceptable.
2E-054-SURFACE	General Visual	Direct	Small spots where coating was not applied. Minor surface rust on uncoated portion, no metal loss. Mechanical gouges/dings on penetration flange. Evaluated and found acceptable.
2E-055-SURFACE	General Visual	Direct	Small spots where coating was not applied. Evaluated and found acceptable.
2E-056-SURFACE	General Visual	Direct	Small spots where coating was not applied. Mechanical gouges/dings on penetration flange. Evaluated and found acceptable.
2LINER-SURFACE-377	General Visual	Direct, Remote	Localized bulges. Mechanical gouges/chipped coating, heaviest by R39 – R27. Spots of stained coating. Some uncoated areas with minor surface rust (mostly by penetrations), no metal loss. Small areas of flaked coating. Evaluated and found acceptable.
2LINER-SURFACE-401	General Visual	Direct	Localized bulges. Mechanical gouges/chipped coating, heaviest by R35 – R23. Spots of stained coating. Some uncoated areas with minor surface rust (by penetrations), no metal loss. Some small areas of flaked coating. Evaluated and found acceptable.
2LINER-SURFACE-412	General Visual	Remote	Spots of stained coating. Mechanical gouges/chipped coating, mostly R23 – R33. Localized bulges. Some uncoated areas with minor surface rust (mostly by penetrations), no metal loss. Some scattered spots of flaked coating. Evaluated and found acceptable.
2LINER-SURFACE-426	General Visual	Direct	Mechanical gouges/chipped coating, heaviest at R22 – R28. Some uncoated areas with minor surface rust, no observed metal loss. Some areas of flaked coating. Some spots of stained coating. Localized bulges. Evaluated and found acceptable.

Table 3.7.8-1: BYR Unit 2 IWE Examination, Outage B2R20 (October 2017)			
Component	**Exam Type**	**Direct/ Remote**	**Comments**
2DOME-LINER-SURFACE	General Visual	Remote	Localized bulges. Small areas of mechanical gouging/chipped coating, condensed around grating. Polar crane brackets and other welded attachments have minor surface rust, no metal loss. Spots of stained coating. Evaluated and found acceptable.

3.7.9 Unit 2 IWE Examination, RFO B2R21, April 2019

The purpose of this inspection is to ensure that the structural integrity of ASME Class MC pressure retaining surfaces and Class CC metallic shell and penetration liners are maintained. Condition Assessment of Class MC and CC components is achieved by performing examinations of the accessible surfaces. All examinations were performed so as to comply with Article IWE of the ASME Boiler and Pressure Vessel Code, Section XI, 2007 Edition through the 2008 Addenda.

The results of previous examinations were reviewed to identify any areas or components that required an augmented or focused examination.

The examination results of the Class MC pressure retaining surfaces and CC shell and penetration liners (including pressure retaining bolting) and MB(s) were reviewed, compared to acceptance standards specified in IWE-3500 of ASME Section XI, 2007 Edition through the 2008 Addenda, and evaluated by the appropriate personnel.

The examination scope included inspection of the following areas:

- Fuel Transfer Tube
- Containment Liner MB
- Personnel Air Lock Exterior Door
- Personnel Air Lock Interior Door
- Personnel Air Lock Cylinder Assembly
- Emergency Personnel Air Lock Exterior Door
- Emergency Personnel Air Lock Interior Door
- Emergency Personnel Air Lock Surface
- Equipment Hatch
- Instrumentation and Mechanical Penetrations
- Pipe Penetration Bolting (2PC-063-HDBolting only)

The results of the visual examination of IWE surfaces are detailed in Table 3.7.9-1 below. Note that the contents of Table 3.7.9-1 do not include the results of inspections where there were No Reportable Indications (NRI) and the inspection results were evaluated and found acceptable.

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Description and Assessment

Table 3.7.9-1: BYR Unit 2 IWE Examination, Outage B2R21 (April 2019)			
Component	**Exam Type**	**Direct/ Remote**	**Comments**
2PC-007-SURFACE	General Visual	Direct	Light surface rust. Evaluated and found acceptable.
2PC-008-SURFACE	General Visual	Direct	Light surface rust. Evaluated and found acceptable.
2PC-009-SURFACE	General Visual	Direct	Light surface rust. Evaluated and found acceptable.
2PC-010-SURFACE	General Visual	Direct	Light surface rust. Evaluated and found acceptable.
2PC-044-SURFACE	General Visual	Direct	Light surface rust. Evaluated and found acceptable.
2PC-045-SURFACE	General Visual	Direct	Light surface rust. Evaluated and found acceptable.
2PC-047-SURFACE	General Visual	Direct	Light surface rust. Evaluated and found acceptable.
2PC-048-SURFACE	General Visual	Direct	Light surface rust. Evaluated and found acceptable.
2PC-051-SURFACE	General Visual	Direct	Light surface rust. Evaluated and found acceptable.
2PC-052-SURFACE	General Visual	Direct	Light surface rust. Evaluated and found acceptable.
2PC-053-SURFACE	General Visual	Direct	Light surface rust. Evaluated and found acceptable.
2PC-054-SURFACE	General Visual	Direct	Light surface rust. Evaluated and found acceptable.
2PC-057-SURFACE	General Visual	Direct	Light surface rust. Evaluated and found acceptable.
2PC-065-SURFACE	General Visual	Remote	Light surface rust. Evaluated and found acceptable.
2PC-066-SURFACE	General Visual	Direct	Light surface rust. Evaluated and found acceptable.
2PC-068-SURFACE	General Visual	Direct	Light surface rust. Evaluated and found acceptable.
2PC-069-SURFACE	General Visual	Direct	Light surface rust. Evaluated and found acceptable.
2PC-072-SURFACE	General Visual	Direct	Light surface rust. Evaluated and found acceptable.
2PC-073-SURFACE	General Visual	Direct	Light surface rust. Evaluated and found acceptable.
2PC-077-SURFACE	General Visual	Direct	Light surface rust on pipe to penetration. Evaluated and found acceptable.
2PC-078-SURFACE	General Visual	Direct	Light surface rust on pipe to penetration. Evaluated and found acceptable.
2PC-081-SURFACE	General Visual	Direct	Light surface rust on pipe to penetration. Evaluated and found acceptable.
2PC-082-SURFACE	General Visual	Direct	Light surface rust on pipe to penetration. Evaluated and found acceptable.
2PC-083-SURFACE	General Visual	Direct	Light surface rust on pipe to penetration. Evaluated and found acceptable.
2PC-085-SURFACE	General Visual	Direct	Light surface rust on pipe to penetration. Evaluated and found acceptable.
2PC-086-SURFACE	General Visual	Direct	Light surface rust on pipe to penetration. Evaluated and found acceptable.
2PC-089-SURFACE	General Visual	Direct	Light surface rust on pipe to penetration. Evaluated and found acceptable.
2PC-091-SURFACE	General Visual	Direct	Light surface rust on pipe to penetration. Evaluated and found acceptable.
2PC-094-SURFACE	General Visual	Direct	Light surface rust. Evaluated and found acceptable.
2PC-095-SURFACE	General Visual	Direct	Light surface rust. Evaluated and found acceptable.
2PC-095-SURFACE	General Visual	Direct	Light surface rust. Evaluated and found acceptable.

3.7.10 Unit 1 IWL Examination, Spring/Summer 2011

BYR completed the ASME Class CC examinations and tests for the Unit 1 containment surfaces during 2011. The examinations were performed in accordance with ASME Section XI, 2001 Edition through 2003 Addenda.

Accessible surfaces were examined using the General Visual (GV) method.

The examinations were conducted either directly or remotely and by a VT-qualified examiner. The scope of examination was limited to outside surfaces of the Unit 1 Containment structure.

Several Recordable Indications (RIs) were noted, mostly in the form of minor hairline cracks, small-sized voids and bug holes, grease and rust stains, minor surface irregularity (due to original construction), patches, exposed steel bars and, cutouts around tendon anchor hardware. All RIs met the owner-defined acceptance criteria.

A minor amount of fresh grease was observed in the tendon tunnel to have leaked at the location of vertical tendon cans V148 and V66. The leakage was from the interface between the tendon can base plates and the concrete ceiling surface. The leakage was attributed to the gradual loosening of the tendon can bolts due to continuous structural vibrations due to plant operations. The tendon tunnels are inspected on a 20-month basis (more aggressively than a 5-year frequency) specifically for this reason. This frequency has proven effective in detecting leakage before significant leakage has occurred. Therefore, no inspection frequency adjustment was required as a result of this observation. There was no operability concern. The amount of leaked grease on the floor below was well within the acceptable threshold of 10% of the sheathing duct volume for the tendons as established by the applicable ASME Code. Additionally, tendon grease can anchorage bolting was tightened to prevent further grease leakage.

No additional Detailed Visual examinations were required around the Steam Generator Replacement Project concrete cutout since the scope of examinations was previously completed. No augmented examinations were required or newly identified.

Table 3.7.10-1 provides discussion and evaluation of the conditions/indications identified during the General and Detailed examinations performed in accordance with IWL-2310 and IWL-2510 as well as any actions associated with degradation identified in accessible areas/surfaces.

ATTACHMENT 1b
Description and Assessment

Table 3.7.10-1 - Unit 1 Concrete Indications, Spring/Summer 2011					
Area of Examination	**Elevation**	**Examination Category**	**Exam Type**	**Direct/ Remote**	**Comments**
Zone 1-C Containment wall, between sides CA & CB, in Buttresses C	374' – 562'	L1.11	General Visual	Remote	Multiple hairline cracks < 0.04". Old grease stains on wall. Multiple patches, scattered areas, one patched area has delamination. Several small-size voids < 1" diam., < ½" in depth, scattered. Several spalls around tie holes and elsewhere < 8" in diam., no rebar exposed. Several small-size bug holes < 2" in diam., < ½" in depth, scattered. Minor surface irregularity, stains on wall. The delaminated patch is superficial, no rebar is exposed, condition is acceptable as-is. No further evaluation required.
Zone 1-1 Ventilation room, Aux Building	467'	L1.11	General Visual	Direct	Several hairline cracks < 0.04", scattered. Several small-sized old grease stains, scattered. Patch over joint formed by two separate pours. Several small-size voids < 1" in diam., < ½" in depth, scattered. Small spalling of surface at pour line < 8" long and ½" deep. Surface coated in 1'-strip above 467' elevation from beam to opposite wall. Several small size bug holes < 2" in diam., < ½" in depth, scattered. Acceptable with no further evaluation required.
Zone 1-2 Aux Building	451'	L1.11	General Visual	Direct	Several hairline cracks < 0.04", scattered. Several small-size old grease stains, scattered. Several small-size voids < 1" in diam., < ½" in depth, scattered. Minor separation between floor and wall. Rust stains from steel above. Several small-size bug holes < 2" in diam., < ½" in depth, scattered. The two grease drops are insignificant in volume and therefore acceptable. No further evaluation required.
Zone 1-3 Electrical Equipment room, Aux Building	426'	L1.11	General Visual	Direct	Several small-size voids < 1" in diam., < ½" in depth, scattered. Minor separation between the buttress and wall. Rust stains from steel above. Several small-size bug holes < 2" in diam., < ½" in depth, scattered. Rough surface between E41 and E40, extending up to E34 and E33. Acceptable with no further evaluation required.
Zone 1-4 Electrical Penetration room, Aux Building	414'	L1.11	General Visual	Direct	Several small-size voids < 1" in diam., < ½" in depth, scattered. Hole in wall, 3" in diam., 1.5" deep (concrete cover is not lost). Slight shrinking/separation of joint filler material between floor and wall. Several small-size bug holes < 2" in diam., < ½" in depth, scattered. Rough surfaces, scattered. Acceptable with no further evaluation required.
Zone 1-4A Aux Building	374' – 414'	L1.11	General Visual	Direct	A steel threaded rod sticking out of concrete. Several small-size voids < 1" in diam., < ½" in depth, scattered. Staining along the joint in 374', stains from steel framing at 414'. Several small-size bug holes < 2" in diam., < ½" in depth, scattered. Tie holes with rough edges. Acceptable with no further evaluation required.
Zone 1-5 Aux Building	414'	L1.11	General Visual	Direct	Several small-size voids < 1" in diam., < ½" in depth, scattered. Slight shrinking/separation of joint filler material between floor and wall. Several small-size bug holes < 2" in diam., < ½" in depth, scattered. Minor surface irregularity. Acceptable with no further evaluation required.

Table 3.7.10-1 - Unit 1 Concrete Indications, Spring/Summer 2011					
Area of Examination	**Elevation**	**Examination Category**	**Exam Type**	**Direct/ Remote**	**Comments**
Zone 1-6 Containment Chiller room, Aux Building	414'	L1.11	General Visual	Direct	Several small-size voids < 1" in diam., < ½" in depth, scattered. Several small-size bug holes < 2" in diam., < ½" in depth, scattered. Rough surfaces, scattered. Acceptable with no further evaluation required.
Zone 1-7 Mechanical Penetration room, Aux Building	374' – 412'	L1.11	General Visual	Direct	Multiple hairline cracks < 0.04", length varies. Some areas with patches. Several small-size voids < 1" in diam., < ½" in depth, scattered. Small cut-outs around some of the penetrations, no rebar exposed. Multiple non-corrosion stains. Small areas with degraded coating, no impact on coating surfaces. Several small-size bug holes < 2" in diam., < ½" in depth, scattered. Minor surface irregularities and appearance. Acceptable with no further evaluation required.
Zone 1-8 East MSIV room, Aux Building	374'	L1.11	General Visual	Direct	Several small-size voids < 1" in diam., < ½" in depth, scattered. Small amount of missing filler from an expansion joint. The wall was only halfway coated from the bottom. Several small-size bug holes < 2" in diam., < ½" in depth, scattered. Minor surface irregularity. Acceptable with no further evaluation required.
Zone 1-8A East MSIV room, Aux Building	400'	L1.11	General Visual	Direct	Several small-size voids < 1" in diam., < ½" in depth, scattered. Several small-size bug holes < 2" in diam., < ½" in depth, scattered. Acceptable with no further evaluation required.
Zone 1-9 West MSIV room, Aux Building	374'	L1.11	General Visual	Direct	Several small-size voids < 1" in diam., < ½" in depth, scattered. Small amount of missing filler from an expansion joint. The wall was only halfway coated from the bottom. Several small-size bug holes < 2" in diam., < ½" in depth, scattered. Minor surface irregularities. Acceptable with no further evaluation required.
Zone 1-9A West MSIV room, Aux Building	400'	L1.11	General Visual	Direct	Several small-size voids < 1" in diam., < ½" in depth, scattered. Several small-size bug holes < 2" in diam., < ½" in depth, scattered. Acceptable with no further evaluation required.
Zone 1-11 Aux Building	426'	L1.11	General Visual	Direct	Several small-size bug holes < 2" in diam., < ½" in depth, scattered. Minor surface irregularities. Acceptable with no further evaluation required.
Zone 1-12 Buttress #1 (AB side), from ground up	400' – 562'	L1.11	General Visual	Direct	Multiple hairline cracks < 0.04". Minor amount of grease leakage from tendon can #18-BA, numerous old grease stains on wall. Grease leakage is substantially less than 10% by volume. Several small-size voids < 1" in diam., < ½" in depth, scattered. Several concrete spalls around tendon cans < 8" in diam., no rebar exposed. Several small-size bug holes < 2" in diam., < ½" in depth, scattered. Minor surface irregularity. Acceptable with no further evaluation required.
Zone 1-12A Buttress #1 (AB side), below grade	374' – 400'	L1.11	General Visual	Direct	Multiple hairline cracks < 0.04". Minor old grease stains on wall. Several small-size voids < 1" in diam., < ½" in depth, scattered. Several small-size bug holes < 2" in diam., < ½" in depth, scattered. Minor surface irregularity. Acceptable with no further evaluation required.

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Table 3.7.10-1 - Unit 1 Concrete Indications, Spring/Summer 2011					
Area of Examination	**Elevation**	**Examination Category**	**Exam Type**	**Direct/ Remote**	**Comments**
Zone 1-13 Buttress #1 (AC side), from ground up	400' – 562'	L1.11	General Visual	Direct	Multiple hairline cracks < 0.04". Minor amount of grease leakage from tendon can #43-AC and #44-AC, numerous old grease stains on wall. Several small-size voids < 1" in diam., < ½" in depth, scattered. Several concrete spalls (some around tendon cans) < 8" in diam., no rebar exposed. Several small-size bug holes < 2" in diam., < ½" in depth, scattered. Minor surface irregularity. Acceptable with no further evaluation required.
Zone 1-13A Buttress #1 (AC side), below grade	374' – 400'	L1.11	General Visual	Direct	Multiple hairline cracks < 0.04". Old grease stains on wall, minor inactive leakage on tendon can #7-AC. Grease leakage is substantially less than 10% by volume. Several small-size voids < 1" in diam., < ½" in depth, scattered. Concrete spall near tendon can #3-AC, < 6" in diam., no rebar exposed. Several small-size bug holes < 2" in diam., < ½" in depth, scattered. Minor surface irregularities. Acceptable with no further evaluation required.
Zone 1-14 Buttress #2 (BC side), from bottom up	374' – 562'	L1.11	General Visual	Direct	Multiple hairline cracks < 0.04". Numerous old grease stains on wall and on some tendon cans. Several small-size voids < 1" in diam., < ½" in depth, scattered. Several small-size bug holes < 2" in diam., < ½" in depth, scattered. Minor surface irregularities, piece of wood in cold joint near tendon cans H43CB and H42CB. Acceptable with no further evaluation required.
Zone 1-15 Buttress #2 (BA side), from bottom up	374' – 562'	L1.11	General Visual	Direct	Multiple hairline cracks < 0.04". A threaded rod in tie hole near tendon can H27BA (not a rebar). Numerous old grease stains on wall and on some tendon cans. Several small-size voids < 1" in diam., < ½" in depth, scattered. Several small-size bug holes < 2" in diam., < ½" in depth, scattered. Minor surface irregularities. Acceptable with no further evaluation required.
Zone 1-16 Buttress #3 (CA side), from ground up	400' – 562'	L1.11	General Visual	Direct	Multiple hairline cracks < 0.04". Minor amount of old grease leakage on several tendon cans and wall. Several small-size voids < 1" in diam., < ½" in depth, scattered. Several minor concrete spalls < 8" in diam., no rebar exposed. Several small-size bug holes < 2" in diam., < ½" in depth, scattered. Minor surface irregularities. Acceptable with no further evaluation required.
Zone 1-16A Buttress #3 (CA side), below grade	374' – 400'	L1.11	General Visual	Direct	Multiple hairline cracks < 0.04". Old grease stains on wall. Several small-size voids < 1" in diam., < ½" in depth, scattered. Several small-size bug holes < 2" in diam., < ½" in depth, scattered. Minor surface irregularities. Acceptable with no further evaluation required.
Zone 1-17 Buttress #3 (CB side), from ground up	400' – 562'	L1.11	General Visual	Direct	Multiple hairline cracks < 0.04". Minor amount of old grease leakage on several tendon cans and wall. Several small-size voids < 1" in diam., < ½" in depth, scattered, one near tendon can #H51CB is approximately 6" long and ¾" wide. Several small-size bug holes < 2" in diam., < ½" in depth, scattered. Minor surface irregularities. Acceptable with no further evaluation required.

Table 3.7.10-1 - Unit 1 Concrete Indications, Spring/Summer 2011					
Area of Examination	**Elevation**	**Examination Category**	**Exam Type**	**Direct/ Remote**	**Comments**
Zone 1-17A Buttress #3 (CB side), below grade	374' – 400'	L1.11	General Visual	Direct	Multiple hairline cracks < 0.04". Old grease stains on wall. Several small-size voids < 1" in diam., < ½" in depth, scattered. Several small-size bug holes < 2" in diam., < ½" in depth, scattered. Minor surface irregularities. Acceptable with no further evaluation required.
Zone 1-18A/B/C/D Upper Vertical Tendon Gallery	Approx. 582'	L1.11	General Visual	Direct	Multiple hairline cracks < 0.04". Multiple old grease stains, small leak by V77, V81. Several small-size voids < 1" in diam., < ½" in depth, scattered. Spalled/chipped concrete near V13, V51, V80, V125 (no rebar exposed). Non corrosion stains on floor. Coating on some vertical cans is slightly fading. Acceptable with no further evaluation required.
Zone 1-19A/B/C/D Lower Vertical Tendon Tunnel	Approx. 382'	L1.11	General Visual	Direct	Multiple hairline cracks < 0.04". Multiple locations with fresh grease leakage, specifically at V66 and V148. The amount of grease leakage is well within the 10% of duct volume acceptance criteria. Several small-size voids < 1" in diam., < ½" in depth, scattered. Several small-size bug holes < 2" in diam., < ½" in depth, scattered. Minor evidence of efflorescence at several locations. Efflorescence is negligible as there is no significant change since 2006. Acceptable with no further evaluation required.
Zone 1-20 Containment Dome	Varies above 582'	L1.11	General Visual	Direct	Multiple hairline cracks < 0.04". Coating thickness not uniform, minor coating degradation, some color variations, previous recoating in good conditions. Acceptable with no further evaluation required.
Zone 1-21A Dome Tendon Gallery, between Azimuth 180 and 360	562' – 579'	L1.11	General Visual	Direct	Multiple hairline cracks < 0.04". Non-structural rebar (used as discretionary reinforcement around openings) exposed at D3-33B, no active rust. This was previously recorded; rebar will be covered with grout. Patched concrete near D2-40T and D3-21C. Several small-size voids < 1" in diam., < ½" in depth, scattered. Several spalled/chipped concrete around dome tendon can boxed edges. Non-corrosion stains on wall. Several small-size bug holes < 2" in diam., < ½" in depth, scattered. Minor surface irregularities, piece of wood embedded in concrete near D2-26C, missing plug from tendon can D1-9B. Acceptable with no further evaluation required.
Zone 1-21B Dome Tendon Gallery, between Azimuth 180 and 0	562' – 579'	L1.11	General Visual	Direct	Multiple hairline cracks < 0.04". Exposed wire mesh above B-C buttress. Patched concrete near D2-40T and D3-21C. Several small-size voids < 1" in diam., < ½" in depth, scattered. Several spalled/chipped concrete and also around some tendon can boxed edges. Non-corrosion stains on wall. Several small-size bug holes < 2" in diam., < ½" in depth, scattered. Minor surface irregularities, missing plug from tendon cans D1-36T, D1-36B. Acceptable with no further evaluation required.

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Description and Assessment

Table 3.7.10-1 - Unit 1 Concrete Indications, Spring/Summer 2011					
Area of Examination	**Elevation**	**Examination Category**	**Exam Type**	**Direct/ Remote**	**Comments**
Zone 1-22A Containment wall, between Buttresses A & B	448' – 562'	L1.11	General Visual	Remote	Multiple hairline cracks < 0.04", length varies. A piece of wood embedded in concrete between azimuths 70 and 90. Several small-size voids < 1" in diam., < ½" in depth, scattered. Several spalls around tie holes < 8" in diam., no rebar exposed. Several small-size bug holes < 2" in diam., < ½" in depth, scattered. Minor surface irregularity and appearance. Acceptable with no further evaluation required.
Zone 1-22B Containment wall, between Buttresses A & B	415' – 478'	L1.11	General Visual	Remote	Multiple hairline cracks < 0.04", length varies. Several small-size voids < 1" in diam., < ½" in depth, scattered. Several spalls around tie holes < 8" in diam., no rebar exposed. Multiple non-corrosion stains. Several small-size bug holes < 2" in diam., < ½" in depth, scattered. Minor surface irregularities and appearance. Acceptable with no further evaluation required.
Zone 1-23 Containment wall, between Buttresses A & C	400' – 562'	L1.11	General Visual	Remote	Multiple hairline cracks < 0.04", length varies. A threaded rebar projecting outward near ground, not structural rebar. Old inactive grease stains at corners of SGR opening (VT-1C performed remotely). SGR opening (no changes), delaminated patch work (1' x 3') from area of original construction opening, no rebar exposed. Delaminated patchwork has remained unchanged since the date of discovery (3/5/2010). Several small-size voids < 1" in diam., < ½" in depth, scattered. Several spalls around tie holes < 8" in diam., no rebar exposed. Some joint line edges contain spalls, all minor. Multiple non-corrosion stains. Several small-size bug holes < 2" in diam., < ½" in depth, scattered. Minor surface irregularities and appearance, a piece of wood embedded in concrete between Azimuths 70 and 90. Acceptable with no further evaluation required.
Zone 1-24 Containment wall, between Buttresses C & B	400' – 562'	L1.11	General Visual	Remote	Multiple hairline cracks < 0.04", length varies. Exposed rebar (previously documented, repairs scheduled) at Azimuth 250 (elev. 492' and 486'). A threaded rebar projecting outward near roof at elev. 451' (not structural rebar). Multiple old inactive grease stains on wall. Several small-size voids < 1" in diam., < ½" in depth, scattered. Several spalls around tie holes < 8" in diam., no rebar exposed. Some joint line edges contain minor spalls, some joints are not straight. Multiple non-corrosion stains. Several small-size bug holes < 2" in diam., < ½" in depth, scattered. Minor surface irregularities and appearance. Acceptable with no further evaluation required.

3.7.11 Unit 2 IWL Examination, Spring/Summer 2011

BYR completed the ASME Class CC examinations and tests for the Unit 2 containment surfaces during 2011. The examinations were performed in accordance with ASME Section XI, 2001 Edition through 2003 Addenda.

The examinations were conducted either directly or remotely and by a VT-qualified examiner.

The scope of examination was limited to outside surfaces of the Unit 2 Containment structure.

Several RIs were noted, mostly in the form of minor hairline cracks, small-sized voids and bug holes, grease and rust stains, minor surface irregularity (due to original construction), patches, exposed steel bars, and cutouts around tendon anchor hardware. All RIs met the owner-defined acceptance criteria. No augmented examinations were required or newly identified.

Grease leakage was observed in the tendon tunnel from tendon cans V224, V305, and V326 from the can seam welds (to be repaired in 2014 as part of the 30th-year tendon surveillance). The amount of grease was well within the 10% duct volume and was therefore acceptable. Tendon can V322 was also requested to be replaced due to some minor corrosion on one edge (no plate thickness loss was noted, just edge flaking; therefore, this condition was acceptable).

Table 3.7.11-1 provides discussion and evaluation of the conditions/indications identified during the General and Detailed examinations performed in accordance with IWL-2310 and IWL-2510 as well as any actions associated with degradation identified in accessible areas/surfaces.

Table 3.7.11-1: Unit 2 Concrete Indications, Spring/Summer 2011					
Area of Examination	**Elevation**	**Examination Category**	**Exam Type**	**Direct/ Remote**	**Comments**
Zone 2-D Containment wall, between sides DF & DE, in Buttress D	400' – 562'	L1.11	General Visual	Remote	Multiple hairline cracks < 0.04". Multiple patches, scattered areas. Several small-size voids < 1" in diam., < ½" in depth, scattered. Several spalls around tie holes < 8" in diam., no rebar exposed. Several small areas with chipped concrete, no rebar exposed, one area had some small wood pieces embedded in concrete. Non-corrosion stains. Several small-size bug holes < 2" in diam., < ½" in depth, scattered. Minor surface irregularity. Acceptable with no further evaluation required.
Zone 2-E Containment wall, between sides ED & EF, in Buttress E	374' – 562'	L1.11	General Visual	Remote	Multiple hairline cracks < 0.04", length varies. Several small-size voids < 1" in diam., < ½" in depth, scattered. One spalled area < 8" in diam., no rebar exposed. Several spalls around tie holes < 8" in diam., no rebar exposed. Piece of wood embedded in concrete near a cold joint line. Non-corrosion stains. Several small-size bug holes < 2" in diam., < ½" in depth, scattered. Minor surface irregularity. Acceptable with no further evaluation required.
Zone 2-F Containment wall, between sides FE & FD, in Buttress F	400' – 562'	L1.11	General Visual	Remote	Multiple hairline cracks < 0.04". Old grease stain. Multiple patches, scattered areas, in particular above and below 7th cold joint from bottom. Several small-size voids < 1" in diam., < ½" in depth, scattered. One spalled area < 8" in diam., no rebar exposed. Several spalls around tie holes < 8" in diam., no rebar exposed. Non-corrosion stains. Several small-size bug holes < 2" in diam., < ½" in depth, scattered. Minor surface irregularity. Acceptable with no further evaluation required.
Zone 2-1 Ventilation room, Aux Building	467'	L1.11	General Visual	Direct	Several hairline cracks < 0.04", scattered. Several small-sized old grease stains, scattered. Several small-size voids < 1" in diam., < ½" in depth, scattered. Missing concrete at the bottom of penetration < 3" long. Duct tape at the interface between coated and uncoated surfaces. Several small-size bug holes < 2" in diam., < ½" in depth, scattered. Acceptable with no further evaluation required.
Zone 2-2 Aux Building	451'	L1.11	General Visual	Direct	Several hairline cracks < 0.04", scattered. A drop of fresh grease at the end of 2 tendon drain caps. The two grease drops are insignificant in volume and therefore, acceptable. Several small-size voids < 1" in diam., < ½" in depth, scattered. Minor separation between floor and wall. Several small-size bug holes < 2" in diam., < ½" in depth, scattered. Rough surface texture on many areas. Acceptable with no further evaluation required.
Zone 2-3 Electrical Equipment room, Aux Building	426'	L1.11	General Visual	Direct	Several small-size voids < 1" in diam., < ½" in depth, scattered. A layered spalled concrete, 8" long, < 3" wide, < 1/8" deep near Pen. 13. Rough joint formation, entire length. Several small-size bug holes < 2" in diam., < ½" in depth, scattered. Rough surface texture on many areas. Acceptable with no further evaluation required.

Table 3.7.11-1: Unit 2 Concrete Indications, Spring/Summer 2011					
Area of Examination	**Elevation**	**Examination Category**	**Exam Type**	**Direct/ Remote**	**Comments**
Zone 2-4 Electrical Penetration room, Aux Building	414'	L1.11	General Visual	Direct	Several small-size voids < 1" in diam., < ½" in depth, scattered. A layer of spalled concrete, approximately 33" long, < 3" wide, < ¾" deep at the wall joint above E20 penetration. Several small-size bug holes < 2" in diam., < ½" in depth, scattered. Rough surfaces, scattered. Acceptable with no further evaluation required.
Zone 2-4A Aux Building	374' – 414'	L1.11	General Visual	Direct	A large patch, intact. Several small-size voids < 1" in diam., < ½" in depth, scattered. Staining along the joint at 374'. Several small-size bug holes < 2" in diam., < ½" in depth, scattered. Many minor surface irregularities, tie holes with rough edges. Acceptable with no further evaluation required.
Zone 2-5 Aux Building	414'	L1.11	General Visual	Direct	Several small-size voids < 1" in diam., < ½" in depth, scattered. Slight shrinking/separation of joint filler material between floor and wall. Several small-size bug holes < 2" in diam., < ½" in depth, scattered. Minor surface irregularity. Acceptable with no further evaluation required.
Zone 2-6 Containment Chiller room, Aux Building	414'	L1.11	General Visual	Direct	Several small-size voids < 1" in diam., < ½" in depth, scattered. Several small-size bug holes < 2" in diam., < ½" in depth, scattered. Rough surfaces, scattered, several oil stains on the wall. Acceptable with no further evaluation required.
Zone 2-7 Mechanical Penetration room, Aux Building	374' – 412'	L1.11	General Visual	Direct	Multiple hairline cracks < 0.04", length varies. Rebar inserted in concrete near P73. Some areas with patches. Several small-size voids < 1" in diam., < ½" in depth, scattered. Enlarged joint near P59. Multiple non-corrosion stains. Small areas with degraded coating, no impact on concrete surfaces. Several small-size bug holes < 2" in diam., < ½" in depth, scattered. Minor surface irregularities and appearance especially bulges near P48 and P56. Acceptable with no further evaluation required.
Zone 2-8 East MSIV room, Aux Building	374'	L1.11	General Visual	Direct	Several small-size voids < 1" in diam., < ½" in depth, scattered. Small amount of missing filler from an expansion joint. The wall was only halfway coated from the bottom. Several small-size bug holes < 2" in diam., < ½" in depth, scattered. Minor surface irregularity. Acceptable with no further evaluation required.
Zone 2-8A East MSIV room, Aux Building	400'	L1.11	General Visual	Direct	Several small-size voids < 1" in diam., < ½" in depth, scattered. Several small-size bug holes < 2" in diam., < ½" in depth, scattered. Acceptable with no further evaluation required.
Zone 2-9 West MSIV room, Aux Building	374'	L1.11	General Visual	Direct	Several small-size voids < 1" in diam., < ½" in depth, scattered. Small amount of missing filler from an expansion joint. The wall was only halfway coated from the bottom. Several small-size bug holes < 2" in diam., < ½" in depth, scattered. Minor surface irregularity. Acceptable with no further evaluation required.
Zone 2-9A West MSIV room, Aux Building	400'	L1.11	General Visual	Direct	Several small-size voids < 1" in diam., < ½" in depth, scattered. Several small-size bug holes < 2" in diam., < ½" in depth, scattered. Acceptable with no further evaluation required.

Table 3.7.11-1: Unit 2 Concrete Indications, Spring/Summer 2011					
Area of Examination	**Elevation**	**Examination Category**	**Exam Type**	**Direct/ Remote**	**Comments**
Zone 2-11 Aux Building	426'	L1.11	General Visual	Direct	Several small-size bug holes < 2" in diam., < ½" in depth, scattered. Minor surface irregularity. Acceptable with no further evaluation required.
Zone 2-12 Buttress #5 (DF side), below grade	400' – 562'	L1.11	General Visual	Direct	Multiple hairline cracks < 0.04". Multiple old grease stains. Several small-size voids < 1" in diam., < ½" in depth, scattered. Spalled concrete around tendon cans 13 and 14 (approximately 4" x 8" x 2"), no rebar exposed. Several small-size bug holes < 2" in diam., < ½" in depth, scattered. Minor surface irregularities, embedded wood in concrete near tendon cans 35 and 65. Acceptable with no further evaluation required.
Zone 2-12A Buttress #5 (DF side), below grade	374' – 400'	L1.11	General Visual	Direct	Multiple hairline cracks < 0.04". Multiple old grease stains. Several small-size voids < 1" in diam., < ½" in depth, scattered. Several small-size bug holes < 2" in diam., < ½" in depth, scattered. Minor surface irregularities. Acceptable with no further evaluation required.
Zone 2-13 Buttress #5 (DE side), from bottom up	400' – 562'	L1.11	General Visual	Direct	Multiple hairline cracks < 0.04". Multiple old grease stains. Several small-size voids < 1" in diam., < ½" in depth, scattered. Spalled concrete around tendon cans 13 and 14 (approximately 4" x 8" x 2"), no rebar exposed. Several small-size bug holes < 2" in diam., < ½" in depth, scattered. Minor surface irregularities, embedded wood in concrete near tendon cans 50 and 51. Acceptable with no further evaluation required.
Zone 2-13A Buttress #5 (DE side), from bottom up	400' – 562'	L1.11	General Visual	Direct	Multiple hairline cracks < 0.04". Multiple old grease stains. Several small-size voids < 1" in diam., < ½" in depth, scattered. Spalled concrete around tendon cans 13 and 14 (approximately 4" x 8" x 2"), no rebar exposed. Several small-size bug holes < 2" in diam., < ½" in depth, scattered. Minor surface irregularities, embedded wood in concrete near tendon cans 50 and 51. Acceptable with no further evaluation required.
Zone 2-14 Buttress #4 (ED side), from ground up	400' – 562'	L1.11	General Visual	Direct	Multiple hairline cracks < 0.04". Multiple old grease stains. Several small-size voids < 1" in diam., < ½" in depth, scattered. Several small-size bug holes < 2" in diam., < ½" in depth, scattered. Minor surface irregularities. Acceptable with no further evaluation required.
Zone 2-14A Buttress #4 (ED side), below grade	374' – 400'	L1.11	General Visual	Direct	Multiple hairline cracks < 0.04". Multiple old grease stains. Several small-size voids < 1" in diam., < ½" in depth, scattered. Several small-size bug holes < 2" in diam., < ½" in depth, scattered. Minor surface irregularities, piece of wood embedded near tendon can #H7. Acceptable with no further evaluation required.
Zone 2-15 Buttress #4 (EF side), from ground up	400' – 562'	L1.11	General Visual	Direct	Multiple hairline cracks < 0.04". Multiple old grease stains. Several small-size voids < 1" in diam., < ½" in depth, scattered. Several small-size bug holes < 2" in diam., < ½" in depth, scattered. Minor surface irregularities. Acceptable with no further evaluation required.

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Description and Assessment

Table 3.7.11-1: Unit 2 Concrete Indications, Spring/Summer 2011

Area of Examination	Elevation	Examination Category	Exam Type	Direct/ Remote	Comments
Zone 2-15A Buttress #4 (EF side), below grade	374' – 400'	L1.11	General Visual	Direct	Multiple hairline cracks < 0.04". Multiple old grease stains. Several small-size voids < 1" in diam., < ½" in depth, scattered. Several small-size bug holes < 2" in diam., < ½" in depth, scattered. Minor surface irregularities. Acceptable with no further evaluation required.
Zone 2-16 Buttress #6 (FE side), from ground up	400' – 562'	L1.11	General Visual	Direct	Multiple hairline cracks < 0.04". Multiple old grease stains. Several small-size voids < 1" in diam., < ½" in depth, scattered. Several spalled/chipped concrete around tendon can plate edges. Non-corrosion stains on wall. Several small-size bug holes < 2" in diam., < ½" in depth, scattered. Minor surface irregularities. Acceptable with no further evaluation required.
Zone 2-16A Buttress #6 (FE side), below grade	374' – 400'	L1.11	General Visual	Remote	Multiple hairline cracks < 0.04". Multiple old grease stains. Several small-size voids < 1" in diam., < ½" in depth, scattered. Several spalled/chipped concrete around tendon can plate edges. Non-corrosion stains on wall. Several small-size bug holes < 2" in diam., < ½" in depth, scattered. Minor surface irregularities, 1st horizontal tendon can from bottom coated, 2nd can from bottom has general surface rust. Acceptable with no further evaluation required.
Zone 2-17 Buttress #6 (FD side), from ground up	400' – 562'	L1.11	General Visual	Direct	Multiple hairline cracks < 0.04". Multiple old grease stains. Several small-size voids < 1" in diam., < ½" in depth, scattered. Several spalled/chipped concrete around tendon can plate edges. Non-corrosion stains on wall. Several small-size bug holes < 2" in diam., < ½" in depth, scattered. Minor surface irregularities. Acceptable with no further evaluation required.
Zone 2-17A Buttress #6 (FD side), below grade	374' – 400'	L1.11	General Visual	Remote	Multiple hairline cracks < 0.04". Multiple old grease stains. Several small-size voids < 1" in diam., < ½" in depth, scattered. Several spalled/chipped concrete around tendon can plate edges. A piece of wood, 12" long, embedded near a joint line. Non-corrosion stains on wall. Several small-size bug holes < 2" in diam., < ½" in depth, scattered. Minor surface irregularities, 1st horizontal tendon can from bottom has general surface rust. Acceptable with no further evaluation required.
Zone 2-18A/B/C/D Upper Vertical Tendon Gallery	Approx. 582'	L1.11	General Visual	Direct	Multiple hairline cracks < 0.04". Multiple old grease stains on floor and on some tendon cans. Several small-size voids < 1" in diam., < ½" in depth, scattered. Several spalled/chipped concrete near V234. Non-corrosion stains on floor. Coating on some vertical tendon cans is fading/degrading. Acceptable with no further evaluation required.

Table 3.7.11-1: Unit 2 Concrete Indications, Spring/Summer 2011					
Area of Examination	Elevation	Examination Category	Exam Type	Direct/ Remote	Comments
Zone 2-19A/B/C/D Lower Vertical Tendon Gallery	Approx. 382'	L1.11	General Visual	Direct	Multiple hairline cracks < 0.04". Multiple locations with fresh grease leakage, specifically at V224, V305, and V326. The amount of grease leakage is well within the 10% of duct volume acceptance criteria. Several small-size voids < 1" in diam., < ½" in depth, scattered. Edges of V322 have active corrosion, very minor, no surface corrosion. Several small-size bug holes < 2" in diam., < ½" in depth, scattered. Minor evidence of efflorescence at several locations. Efflorescence is negligible and there is no significant change since 2006. Acceptable with no further evaluation required.
Zone 2-20 Containment Dome	Varies above 582'	L1.11	General Visual	Direct	Multiple hairline cracks < 0.04". Coating thickness is not uniform, some color variation exists, previous recoating in good condition. Acceptable with no further evaluation required.
Zone 2-21A Dome Tendon Gallery, between Azimuth 180 and 360	562' – 579'	L1.11	General Visual	Direct	Multiple hairline cracks < 0.04". Non-structural rebar exposed at D5-1B. Multiple old grease stains, especially at D5-32B (no change since previous inspection). Several small-size voids < 1" in diam., < ½" in depth, scattered. Several spalled/chipped concrete around tendon can boxed edges. Non-corrosion stains on wall. Several small-size bug holes < 2" in diam., < ½" in depth, scattered. Minor surface irregularities. Acceptable with no further evaluation required.
Zone 2-21B Dome Tendon Gallery, between Azimuth 180 and 0	562' – 579'	L1.11	General Visual	Direct	Multiple hairline cracks < 0.04". Multiple old grease stains. Several small-size voids < 1" in diam., < ½" in depth, scattered. Several spalled/chipped concrete around tendon can boxed edges. Non-corrosion stains on wall. Several small-size bug holes < 2" in diam., < ½" in depth, scattered. Minor surface irregularities. Acceptable with no further evaluation required.
Zone 2-22A Containment wall, between Buttresses D & E	478' – 562'	L1.11	General Visual	Remote	Several hairline cracks < 0.04", scattered. A rebar projecting outward near Elev. 478'. Multiple old grease stains on the wall. Several patched areas, some have minor surface wear. Several small-size voids < 1" in diam., < ½" in depth, scattered. Several spalls, especially around few tie holes < 8" long, no rebar exposed. Old stains from steel framing above. Several small-size bug holes < 2" in diam., < ½" in depth, scattered. Rough surface texture on many areas, a piece of wood embedded in concrete near the top between Azimuths 109 and 90. Acceptable with no further evaluation required.
Zone 2-22B Containment wall, between Buttresses D & E	415' – 478'	L1.11	General Visual	Remote	Several hairline cracks < 0.04", scattered. Multiple old grease stains on the wall. Several small-size voids < 1" in diam., < ½" in depth, scattered. Several spalls, especially around few tie holes < 8" long, no rebar exposed. Old stains from steel framing above. Several small-size bug holes < 2" in diam., < ½" in depth, scattered. Rough surface texture on many areas, surface irregularities. Acceptable with no further evaluation required.

Table 3.7.11-1: Unit 2 Concrete Indications, Spring/Summer 2011					
Area of Examination	**Elevation**	**Examination Category**	**Exam Type**	**Direct/ Remote**	**Comments**
Zone 2-23 Containment wall, between Buttresses D & F	400' – 562'	L1.11	General Visual	Remote	Several hairline cracks < 0.04", scattered. Multiple old grease stains on the wall. Several patched areas, some have minor surface wear. Several small-size voids < 1" in diam., < ½" in depth, scattered. Several spalls, especially around few tie holes < 8" long, no rebar exposed. Some joint edges contain minor degradation. Old stains from steel framing above, orange stain near the ground. Several small-size bug holes < 2" in diam., < ½" in depth, scattered. Rough surface texture on many areas, tie bars at several locations. Acceptable with no further evaluation required.
Zone 2-24 Containment wall, between Buttresses F & E	400' – 562'	L1.11	General Visual	Remote	Several hairline cracks < 0.04", scattered. Multiple old grease stains on the wall. Several patched areas, some have minor surface wear. Several small-size voids < 1" in diam., < ½" in depth, scattered. Several spalls, especially around few tie holes (max 10" long), no rebar exposed. Some joint edges contain minor degradation. Old stains from steel framing above, orange stain near the ground. Several small-size bug holes < 2" in diam., < ½" in depth, scattered. Rough surface texture on many areas, tie bars at several locations. Acceptable with no further evaluation required.

3.7.12 Units 1 and 2 IWL Examinations, Spring 2016

BYR completed the Fourth (4th) Five-Year ASME Class CC examinations for the Units 1 and 2 Containment concrete surfaces during 2016. These examinations took place during the Third (3rd) Period of BYR's Second (2nd) Containment Inservice Inspection (CISI) Interval. The examinations were performed in accordance with ASME Section XI, Subsection IWL, 2001 Edition through 2003 Addenda and additional criterion as specified in 10 CFR 50.55a, Codes and Standards, (b)(2)(viii)(E) through (b)(2)(viii)(G).

BYR Units 1 and 2 Containment Structures are Post Tensioned Concrete designs. Each Containment Structure was divided into 35 accessible Zones. The accessible Zones were inspected per requirements of ASME Section XI, Subsection IWL, Sub-articles IWL-2310 and IWL-2510.

Evaluation of Examination Results – ASME Section XI IWL Acceptance Standards

As specified in ASME Section XI, IWL-3300 (Evaluation), items that do not meet the acceptance standards of IWL-3100 or IWL-3200 shall be evaluated by the Owner. The Owner shall be responsible for preparation of an Engineering Evaluation Report stating the following:

a. The cause of the condition that does not meet the acceptance standards;
b. The applicability of the condition to any other plants at the same site;
c. The acceptability of the concrete containment without repair of the item;
d. Whether or not repair/replacement activity is required and, if required, the extent, method, and completion date for the repair/replacement activity;
e. Extent, nature, and frequency of additional examinations.

See Tables 3.7.12-1 and 3.7.12-2, for documentation/discussion of above items (a) through (e), corresponding to each Suspect Area.

Evaluation of Acceptability of Inaccessible Areas – 10 CFR 50.55a Requirements

As specified in NRC Code of Federal Regulations, 10 CFR 50.55(a), applicants or licensees applying Subsection IWL, 2001 Edition through the 2004 Edition, up to and including the 2006 Addenda, shall apply paragraphs (b)(2)(viii)(E) through (b)(2)(viii)(G) of this section.

At BYR, there are two inaccessible areas at each Unit: area in Zone 10 and area concealed by backfill (below grade). These two inaccessible areas are exempt per IWL-1220(b) and are discussed/evaluated as follows:

- Zone 10 (1-10 in U1 & 2-10 in U2) is deemed inaccessible because the surface is not visible by normal means and access to this location around the hatch is difficult. This Zone is a very small area of the Containment wall (< 50 ft) around the Emergency Hatch at Elevation 402'-3" (the four corners between the 10'-2" diameter hatch and the concrete tunnel). This small area meets IWL-1220(b) for exemption (i.e., it is obstructed by adjacent structures, components, parts, or appurtenances).

- Areas concealed by backfill are the Containment wall areas between the buttresses and/or tunnels which are below grade Elevation 400' and the Containment mat foundation. These areas meet IWL-1220(b) for exemption (i.e., they are covered by backfill). These areas will be discussed in the subsequent sections.

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The Zones surrounding Zone 10 are Zones 8, 17A, 17, and 23, which are all accessible. Zone 8 is the SVR tunnel on one side of Zone 10. Zones 17 and 17A are the buttress areas on the other side of Zone 10, above and below grade, respectively. Zone 23 is the wall directly above Zone 10.

The RIs for two of the four Zones surrounding Zone 10 met the owner-defined acceptance criteria while the other two Zones had Suspect Areas. As discussed in Tables 3.7.12-1 and 3.7.12- 2 of this report, the SAs in the surrounding Zones were all inconsequential spalls or voids created during original construction or by mechanical damage without any sign of degradation or propagation to the adjacent inaccessible Zone 10 (i.e., no conditions exist in accessible areas that could indicate the presence of or result in degradation to such inaccessible areas). Therefore, the very small inaccessible area (Zone 10) is found to be acceptable without a need for further inspection, evaluation, or corrective action.

For the accessible areas of the wall, the type of degradation is: evidence of grease leakage through the concrete surface, moisture and efflorescence in the concrete surface, and cracking. The specific inaccessible area of concern is the containment wall surfaces located below grade level (< 400' Elevation). Although undesirable, the identified degradation does not adversely affect the structural integrity of the containment buildings. The conditions that led to the degradation included normal cracking of concrete since original construction, water intrusion through minor cracks and voids in the concrete and aging of previous patches. The primary concern is water infiltration/accumulation into the tendon ducts and tendon cans with the potential for this water to create a corrosive environment. Free water was collected and analyzed from the few dome and horizontal tendon cans that contained water during the 30th Year Post-Tensioning Surveillance in 2014. Refer to the BYR Engineering Evaluation Report for the full discussion on the free water collected from the post-tensioning systems. The estimated extent of degradation in the inaccessible area is negligible, if any exists at all.

The RIs for two of four Zones surrounding Zone 10 met the owner-defined acceptance criteria while the other two Zones had Suspect Areas. As discussed in Tables 3.7.12-1 and 3.7.12-2 of this report, the SAs in the surrounding Zones were all inconsequential spalls or voids created during original construction or by mechanical damage without any sign of degradation or propagation to the adjacent inaccessible Zone 10 (i.e., no conditions exist in accessible areas that could indicate the presence of or result in degradation to such inaccessible areas). Therefore, the very small inaccessible area (Zone 10) is found to be acceptable without a need for further inspection, evaluation, or corrective action.

Although the results of examinations performed on accessible areas revealed the previously acknowledged degradation (evidence of grease leakage through the concrete surface, moisture and efflorescence in the concrete surface, and cracking), it does not result in any challenge to the structural integrity of the containment building or the post-tensioning systems. The degradation is cosmetic in nature with no structural impact. The degradation identified in accessible areas does not warrant further investigation or inspection of any identified inaccessible areas.

No evidence of degradation affecting the structural integrity of the containment building was identified in the accessible areas during visual examination. The recognized degradation is categorized as cosmetic. All grease leakage was minimal and did not approach 10% loss to tendon duct grease volume. This same result was concluded in the most recent tendon post-tensioning surveillance as the net difference between the quantities of grease removed versus that replaced did not exceed 10% by volume for any tendon. Additionally, the presence of free water in the few tendon cans is not resulting in degradation of the post-tensioning systems. Further evaluation of free water in the tendons is included in the BYR Engineering Evaluation Report.

As previously discussed, the degradation identified in accessible areas does not warrant further actions, investigation, inspection or corrective action of any inaccessible areas. Refer to Tables 3.7.12-1 and 3.7.12-2 of this report for actions associated with degradation identified in the accessible areas.

<u>Conclusion</u>

The majority of RIs met the owner-defined acceptance criteria for BYR. RIs that met the owner-defined acceptance criteria are not discussed in this report.

The RIs not meeting the owner-defined acceptance criteria are considered as Suspect Areas and are discussed in this report. SAs in each Zone are described for that zone and the SAs are entered into the Corrective Action Program (CAP). The Suspect Areas are evaluated per the requirements of IWL-3310 and are documented in Tables 3.7.12-1 and 3.7.12-2. All SAs evaluated in this report revealed no degradation that adversely affects the structural integrity of the containment structures. The conditions/indications are primarily cosmetic in nature and were found to be acceptable with no required repair/replacement activities per IWL-4000 (next scheduled CISI is in 5 years, in 2021). One examination Zone (Zone 1-20) warrants increased monitoring until scheduled repairs are completed. This repair is exempt from IWL-4000 as it meets the exemption requirements of IWL-4110(4).

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Table 3.7.12-1: Unit 1 Evaluation of Suspect Areas (SA) per IWL-3310						
Zone (Suspect Area No.)	**Description of Condition/ Indication**	**IWL–3310(a)** *The cause of the condition that does not meet the acceptance standards.*	**IWL-3310(b)** *The applicability of the condition to any other plants at the same site.*	**IWL-3310(c)** *The acceptability of the concrete containment without repair of the item.*	**IWL-3310(d)** *Whether or not repair/replacement activity is required and if required, the extent, method, and completion date for the repair/ replacement activity.*	**IWL-3310(e)** *Extent, nature, and frequency of additional examinations.*
1-1 (SA 1)	Spall at penetration P-94 measuring 3.0" length x 2.0" height x 2.0" depth {identified in 2011 (by mistake under Zone 2-1 instead of Zone 1-1), 2006, and 2001; indication is measured to be larger when compared to 2006 and 2001 exams}.	There is a very small distance between bottom of the pipe and the horizontal V- shape groove in the wall (where the pour forms meet). The very thin strip of concrete was broken off during removal of the forms or the concrete pour never reached that thin area. See Note 1 for explanation of difference in size measurements.	Yes, this condition is applicable to Unit 2, but similar condition has not been observed in Unit 2. U2 appears to have been patched at P-94.	Concrete containment is ACCEPTABLE without repair of the item since the indication does not adversely affect the structural integrity of the concrete containment.	Repair/Replacement activity is NOT required.	NO additional examinations required outside the required CISI frequency.
1-4 (SA 1)	One spall measured at 1.5" deep and 3.0" in diameter above penetration E-19 {identified in 2011 and 2006; no change from previous exams}.	Conical popout. Most probably from original construction. Popouts can result from internal surface pressure due to a swelling of a porous aggregate that absorbs moisture or freezes.	Yes, this condition is applicable to Unit 2 and similar conditions have been observed in Unit 2 (see Table 3.7.11-2).	Concrete containment is ACCEPTABLE without repair of the item since the indication does not adversely affect the structural integrity of the concrete containment.	Repair/Replacement activity is NOT required.	NO additional examinations required outside the required CISI frequency.
1-12 (SA 1)	Spall at H47-BA, length (horizontal) = 1.8" x height (vertical) = 1.5" x depth = 1.0".	Most probable cause is improper construction at the joint.	Yes, this condition is applicable to Unit 2 and similar conditions have been observed in Unit 2 (see Table 3.7.11-2).	Concrete containment is ACCEPTABLE without repair of the item since the indication does not adversely affect the structural integrity of the concrete containment.	Repair/Replacement activity is NOT required.	NO additional examinations required outside the required CISI frequency.

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Table 3.7.12-1: Unit 1 Evaluation of Suspect Areas (SA) per IWL-3310						
Zone (Suspect Area No.)	**Description of Condition/ Indication**	**IWL–3310(a)** *The cause of the condition that does not meet the acceptance standards.*	**IWL-3310(b)** *The applicability of the condition to any other plants at the same site.*	**IWL-3310(c)** *The acceptability of the concrete containment without repair of the item.*	**IWL-3310(d)** *Whether or not repair/replacement activity is required and if required, the extent, method, and completion date for the repair/ replacement activity.*	**IWL-3310(e)** *Extent, nature, and frequency of additional examinations.*
1-12 (SA 2)	Second spall at H47-BA, length (horizontal) = 2.8" x height (vertical) = 1.8" x depth = 2.0".	Most probable cause is improper construction at the joint.	Yes, this condition is applicable to Unit 2 and similar conditions have been observed in Unit 2 (see Table 3.7.11-2).	Concrete containment is ACCEPTABLE without repair of the item since the indication does not adversely affect the structural integrity of the concrete containment.	Repair/Replacement activity is NOT required.	NO additional examinations required outside the required CISI frequency.
1-12 (SA 3)	Spall at H65-BA, length (horizontal) = 6.0" x height (vertical) = 1.3" x depth = 2.0".	Most probable cause is improper construction at the joint.	Yes, this condition is applicable to Unit 2 and similar conditions have been observed in Unit 2 (see Table 3.7.11-2).	Concrete containment is ACCEPTABLE without repair of the item since the indication does not adversely affect the structural integrity of the concrete containment.	Repair/Replacement activity is NOT required.	NO additional examinations required outside the required CISI frequency.
1-13 (SA 1)	Spall at H26-AC, length (horizontal) = 2.3" x height (vertical) = 3.5" x depth = 0.9".	Most probable cause is improper construction at the joint.	Yes, this condition is applicable to Unit 2 and similar conditions have been observed in Unit 2 (see Table 3.7.11-2).	Concrete containment is ACCEPTABLE without repair of the item since the indication does not adversely affect the structural integrity of the concrete containment.	Repair/Replacement activity is NOT required.	NO additional examinations required outside the required CISI frequency.
1-13 (SA 2)	Spall at H37-AC, length (horizontal) = 4.5" x height (vertical) = 2.0" x depth = 2.5"	Most probable cause is improper construction at the joint.	Yes, this condition is applicable to Unit 2 and similar conditions have been observed in Unit 2 (see Table 3.7.11-2).	Concrete containment is ACCEPTABLE without repair of the item since the indication does not adversely affect the structural integrity of the concrete containment.	Repair/Replacement activity is NOT required.	NO additional examinations required outside the required CISI frequency.

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Table 3.7.12-1: Unit 1 Evaluation of Suspect Areas (SA) per IWL-3310						
Zone (Suspect Area No.)	**Description of Condition/ Indication**	**IWL–3310(a)** *The cause of the condition that does not meet the acceptance standards.*	**IWL-3310(b)** *The applicability of the condition to any other plants at the same site.*	**IWL-3310(c)** *The acceptability of the concrete containment without repair of the item.*	**IWL-3310(d)** *Whether or not repair/replacement activity is required and if required, the extent, method, and completion date for the repair/ replacement activity.*	**IWL-3310(e)** *Extent, nature, and frequency of additional examinations.*
1-13A (SA 1)	Spall at H3-AC, length (horizontal) = 5.5" x height (vertical) = 2.0" x depth = 2.5" {identified in 2011, 2006, and 2001; no change from previous exams}.	Most probable cause is improper construction at the joint.	Yes, this condition is applicable to Unit 2 and similar conditions have been observed in Unit 2 (see Table 3.7.11-2).	Concrete containment is ACCEPTABLE without repair of the item since the indication does not adversely affect the structural integrity of the concrete containment.	Repair/Replacement activity is NOT required.	NO additional examinations required outside the required CISI frequency.
1-14 (SA 1)	Spall at H67-BC, length (horizontal) = 9.0" x height (vertical) = 6.0" x depth = 0.3".	Most probable cause is improper construction along the edge and/or mechanical damage from original construction and/or impact from equipment during tendon surveillances.	Yes, this condition is applicable to Unit 2 and similar conditions have been observed in Unit 2 (see Table 3.7.11-2).	Concrete containment is ACCEPTABLE without repair of the item since the indication does not adversely affect the structural integrity of the concrete containment.	Repair/Replacement activity is NOT required.	NO additional examinations required outside the required CISI frequency.
1-15 (SA 1)	Spall at H32-BA, length (horizontal) = 5.5" x height (vertical) = 2.5" x depth = 2.4" {identified in 2001; no change from previous exams}.	Most probable cause is improper construction at the joint.	Yes, this condition is applicable to Unit 2 and similar conditions have been observed in Unit 2 (see Table 3.7.11-2).	Concrete containment is ACCEPTABLE without repair of the item since the indication does not adversely affect the structural integrity of the concrete containment.	Repair/Replacement activity is NOT required.	NO additional examinations required outside the required CISI frequency.
1-16 (SA 1)	Spall at H32-AC, length (horizontal) = 2.8" x height (vertical) = 24.0" x depth = 1.8".	Most probable cause is improper construction at the joint and/or mechanical damage from original construction and/or impact from equipment during tendon surveillances.	Yes, this condition is applicable to Unit 2 and similar conditions have been observed in Unit 2 (see Table 3.7.11-2).	Concrete containment is ACCEPTABLE without repair of the item since the indication does not adversely affect the structural integrity of the concrete containment.	Repair/Replacement activity is NOT required.	NO additional examinations required outside the required CISI frequency.

Table 3.7.12-1: Unit 1 Evaluation of Suspect Areas (SA) per IWL-3310

Zone (Suspect Area No.)	Description of Condition/ Indication	IWL–3310(a) *The cause of the condition that does not meet the acceptance standards.*	IWL-3310(b) *The applicability of the condition to any other plants at the same site.*	IWL-3310(c) *The acceptability of the concrete containment without repair of the item.*	IWL-3310(d) *Whether or not repair/replacement activity is required and if required, the extent, method, and completion date for the repair/ replacement activity.*	IWL-3310(e) *Extent, nature, and frequency of additional examinations.*
1-16 (SA 2)	Spall at H43-AC, length (horizontal) = 20.0" x height (vertical) = 1.9" x depth= 1.4".	Most probable cause is improper construction at the joint.	Yes, this condition is applicable to Unit 2 and similar conditions have been observed in Unit 2 (see Table 3.7.11-2).	Concrete containment is ACCEPTABLE without repair of the item since the indication does not adversely affect the structural integrity of the concrete containment.	Repair/Replacement activity is NOT required.	NO additional examinations required outside the required CISI frequency.
1-17 (SA 1)	Spall at H12-CB, length (horizontal) = 1.0" x height (vertical) = 6.0" x depth= 1.3".	Most probable cause is improper construction along the edge and/or mechanical damage from original construction and/or impact from equipment during tendon surveillances.	Yes, this condition is applicable to Unit 2 and similar conditions have been observed in Unit 2 (see Table 3.7.11-2).	Concrete containment is ACCEPTABLE without repair of the item since the indication does not adversely affect the structural integrity of the concrete containment.	Repair/Replacement activity is NOT required.	NO additional examinations required outside the required CISI frequency.
1-17 (SA 2)	Spall at H40-CB, length (horizontal) = 5.5" x height (vertical) = 1.8" x depth= 2.5".	Most probable cause is improper construction at the joint.	Yes, this condition is applicable to Unit 2 and similar conditions have been observed in Unit 2 (see Table 3.7.11-2).	Concrete containment is ACCEPTABLE without repair of the item since the indication does not adversely affect the structural integrity of the concrete containment.	Repair/Replacement activity is NOT required.	NO additional examinations required outside the required CISI frequency.
1-17 (SA 3)	Spall at H51-CB, length (horizontal) = 5.5" x height (vertical) = 1.0" x depth = 1.3" {identified in 2011 and 2006; no change from previous exams}.	Most probable cause is improper construction at the joint.	Yes, this condition is applicable to Unit 2 and similar conditions have been observed in Unit 2 (see Table 3.7.11-2).	Concrete containment is ACCEPTABLE without repair of the item since the indication does not adversely affect the structural integrity of the concrete containment.	Repair/Replacement activity is NOT required.	NO additional examinations required outside the required CISI frequency.

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Table 3.7.12-1: Unit 1 Evaluation of Suspect Areas (SA) per IWL-3310

Zone (Suspect Area No.)	**Description of Condition/ Indication**	**IWL–3310(a)** *The cause of the condition that does not meet the acceptance standards.*	**IWL-3310(b)** *The applicability of the condition to any other plants at the same site.*	**IWL-3310(c)** *The acceptability of the concrete containment without repair of the item.*	**IWL-3310(d)** *Whether or not repair/replacement activity is required and if required, the extent, method, and completion date for the repair/ replacement activity.*	**IWL-3310(e)** *Extent, nature, and frequency of additional examinations.*
1-17 (SA 4)	Popout by H34-CB, length = 4.3" x height = 2.0" x depth = 0.9".	Most probable cause is from original construction. Popouts can result from internal surface pressure due to a swelling of a porous aggregate that absorbs moisture or freezes and/or mechanical damage.	Yes, this condition is applicable to Unit 2 and similar conditions have been observed in Unit 2 (see Table 3.7.11-2).	Concrete containment is ACCEPTABLE without repair of the item since the indication does not adversely affect the structural integrity of the concrete containment.	Repair/Replacement activity is NOT required.	NO additional examinations required outside the required CISI frequency.
1-17 (SA 5)	Popout by H12-CB, length = 2.3" x height= 1.0" x depth= 1.0".	Most probable cause is improper construction at the joint and/or mechanical damage from original construction and/or impact from equipment during tendon surveillances.	Yes, this condition is applicable to Unit 2 and similar conditions have been observed in Unit 2 (see Table 3.7.11-2).	Concrete containment is ACCEPTABLE without repair of the item since the indication does not adversely affect the structural integrity of the concrete containment.	Repair/Replacement activity is NOT required.	NO additional examinations required outside the required CISI frequency.
1-18A/B/C/D (SA 1)	Corner spall/chip at V-13, length (horizontal) = 5.0" x height (vertical) = 2.3" x depth = 1.5" {identified in 2011, 2006, and 2001; quantitative information was not fully detailed in any of previous reports for comparison}.	Most probable cause is mechanical damage. Although, it may have occurred during removal of the pour form (small corner area may have been adhered to the form).	Yes, this condition is applicable to Unit 2 and similar conditions have been observed in Unit 2 (see Table 3.7.11-2).	Concrete containment is ACCEPTABLE without repair of the item since the indication does not adversely affect the structural integrity of the concrete containment.	Repair/Replacement activity is NOT required.	NO additional examinations required outside the required CISI frequency.

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Table 3.7.12-1: Unit 1 Evaluation of Suspect Areas (SA) per IWL-3310						
Zone (Suspect Area No.)	**Description of Condition/ Indication**	**IWL–3310(a)** *The cause of the condition that does not meet the acceptance standards.*	**IWL-3310(b)** *The applicability of the condition to any other plants at the same site.*	**IWL-3310(c)** *The acceptability of the concrete containment without repair of the item.*	**IWL-3310(d)** *Whether or not repair/replacement activity is required and if required, the extent, method, and completion date for the repair/ replacement activity.*	**IWL-3310(e)** *Extent, nature, and frequency of additional examinations.*
1-18A/B/C/D (SA 2)	Corner spall/chip at V-51, length (horizontal) = 6.0" x height (vertical) = 6.0" x depth = 1.3" {identified in 2011, 2006, and 2001; quantitative information was not fully detailed in any of previous reports for comparison}.	Most probable cause is mechanical damage. Although, it may have occurred during removal of the pour form (small corner area may have been adhered to the form).	Yes, this condition is applicable to Unit 2 and similar conditions have been observed in Unit 2 (see Table 3.7.11-2).	Concrete containment is ACCEPTABLE without repair of the item since the indication does not adversely affect the structural integrity of the concrete containment.	Repair/Replacement activity is NOT required.	NO additional examinations required outside the required CISI frequency.
1-18A/B/C/D (SA 3)	Corner spall/chip at V-80, length (horizontal) = 30.0" x height (vertical) = 6.0" x depth = 3.8" {identified in 2011, 2006, and 2001; quantitative information was not fully detailed in any of previous reports for comparison}.	Most probable cause is mechanical damage. Although, it may have occurred during removal of the pour form (small corner area may have been adhered to the form).	Yes, this condition is applicable to Unit 2 and similar conditions have been observed in Unit 2 (see Table 3.7.11-2).	Concrete containment is ACCEPTABLE without repair of the item since the indication does not adversely affect the structural integrity of the concrete containment.	Repair/Replacement activity is NOT required.	NO additional examinations required outside the required CISI frequency.
1-20 (SA 1)	Scaling by drain (azimuth 140), depth = 1.3".	This area was chipped and repaired during original construction due to the drainpipe reroute. Cause is most probably due to the improper construction of the repaired area.	Yes, this condition is applicable to Unit 2, but similar condition has not been observed in Unit 2.	Concrete containment is ACCEPTABLE without repair of the item since the indication does not adversely affect the structural integrity of the concrete containment.	Repair/Replacement activity is NOT required.	NO additional examinations required outside the required CISI frequency.

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Table 3.7.12-1: Unit 1 Evaluation of Suspect Areas (SA) per IWL-3310

Zone (Suspect Area No.)	**Description of Condition/ Indication**	**IWL–3310(a)** *The cause of the condition that does not meet the acceptance standards.*	**IWL-3310(b)** *The applicability of the condition to any other plants at the same site.*	**IWL-3310(c)** *The acceptability of the concrete containment without repair of the item.*	**IWL-3310(d)** *Whether or not repair/replacement activity is required and if required, the extent, method, and completion date for the repair/ replacement activity.*	**IWL-3310(e)** *Extent, nature, and frequency of additional examinations.*
1-20 (SA 2)	Scaling by drain (azimuth 260), depth = 1.3".	This area was chipped and repaired during original construction due to the drainpipe reroute. Cause is most probably due to the improper construction of the repaired area.	Yes, this condition is applicable to Unit 2, but similar condition has not been observed in Unit 2.	Concrete containment is ACCEPTABLE without repair of the item since the indication does not adversely affect the structural integrity of the concrete containment.	Repair/Replacement activity is NOT required.	NO additional examinations required outside the required CISI frequency.
1-20 (SA 3)	Partially exposed rebar with minor surface rust (an evaluation was performed for this issue to address operability and create actions for further monitoring and recommended repair).	This area was chipped and repaired during original construction due to the drainpipe reroute. Cause is most probably due to the improper construction of the repaired area.	Yes, this condition is applicable to Unit 2, but similar condition has not been observed in Unit 2.	Concrete containment is ACCEPTABLE without repair of the item since the indication does not adversely affect the structural integrity of the concrete containment. See evaluation for justification/acceptability. However, it shall be monitored until recommended repair is completed.	Repair/Replacement activity is NOT required but is recommended. The subject area is scheduled to be repaired in 2017 (note that this area was also repaired during original construction). Annual monitoring will be performed until completion of the recommended repair.	Annual monitoring of the exposed rebar will be performed per IWL-2510 for further pitting, monitor the concrete in the area for further breakoff and exposure of other rebar. Monitoring may stop once the repair has been completed.

Table 3.7.12-1: Unit 1 Evaluation of Suspect Areas (SA) per IWL-3310						
Zone (Suspect Area No.)	**Description of Condition/ Indication**	**IWL–3310(a)** *The cause of the condition that does not meet the acceptance standards.*	**IWL-3310(b)** *The applicability of the condition to any other plants at the same site.*	**IWL-3310(c)** *The acceptability of the concrete containment without repair of the item.*	**IWL-3310(d)** *Whether or not repair/replacement activity is required and if required, the extent, method, and completion date for the repair/ replacement activity.*	**IWL-3310(e)** *Extent, nature, and frequency of additional examinations.*
1-21A (SA 1)	Spall/chip at D1-1T, length (horizontal) = 5.0" x height (vertical) = 8.3" x depth = 0.8" {identified in 2006 and 2001 (as (12) on VT report); quantitative information was not fully detailed since 2001 report; indication is measured to be larger when compared to 2001 exam}.	Most probable cause is mechanical damage from original construction and/or impact from equipment during tendon surveillances. See Note 1 for explanation of difference in size measurements.	Yes, this condition is applicable to Unit 2 and similar conditions have been observed in Unit 2 (see Table 3.7.11-2).	Concrete containment is ACCEPTABLE without repair of the item since the indication does not adversely affect the structural integrity of the concrete containment.	Repair/Replacement activity is NOT required.	NO additional examinations required outside the required CISI frequency.
1-21A (SA 2)	Spall/chip at D1-2T, length (horizontal) = 2.5" x height (vertical) = 6.5" x depth = 0.8".	Most probable cause is mechanical damage from original construction and/or impact from equipment during tendon surveillances.	Yes, this condition is applicable to Unit 2 and similar conditions have been observed in Unit 2 (see Table 3.7.11-2).	Concrete containment is ACCEPTABLE without repair of the item since the indication does not adversely affect the structural integrity of the concrete containment.	Repair/Replacement activity is NOT required.	NO additional examinations required outside the required CISI frequency.

Table 3.7.12-1: Unit 1 Evaluation of Suspect Areas (SA) per IWL-3310						
Zone (Suspect Area No.)	**Description of Condition/ Indication**	**IWL–3310(a)** *The cause of the condition that does not meet the acceptance standards.*	**IWL-3310(b)** *The applicability of the condition to any other plants at the same site.*	**IWL-3310(c)** *The acceptability of the concrete containment without repair of the item.*	**IWL-3310(d)** *Whether or not repair/replacement activity is required and if required, the extent, method, and completion date for the repair/ replacement activity.*	**IWL-3310(e)** *Extent, nature, and frequency of additional examinations.*
1-21A (SA 3)	Spall/chip at D2-40T, length (horizontal) = 10.0" x height (vertical) = 22.0" x depth = 2.0" {identified in 2006 and 2001 (as (3) on VT report; quantitative information was not fully detailed since 2001 report; no adverse change from previous exams}.	Most probable cause is mechanical damage from original construction and/or impact from equipment during tendon surveillances.	Yes, this condition is applicable to Unit 2 and similar conditions have been observed in Unit 2 (see Table 3.7.11-2).	Concrete containment is ACCEPTABLE without repair of the item since the indication does not adversely affect the structural integrity of the concrete containment.	Repair/Replacement activity is NOT required.	NO additional examinations required outside the required CISI frequency.
1-21A (SA 4)	Spall/chip at D3-1B, length (horizontal) = 8.3" x height (vertical) = 21.0" x depth = 3.0" {identified in 2006 and 2001 (as (7) on VT report); quantitative information was not fully detailed since 2001 report; no adverse change from previous exams}.	Most probable cause is mechanical damage from original construction and/or impact from equipment during tendon surveillances.	Yes, this condition is applicable to Unit 2 and similar conditions have been observed in Unit 2 (see Table 3.7.11-2).	Concrete containment is ACCEPTABLE without repair of the item since the indication does not adversely affect the structural integrity of the concrete containment.	Repair/Replacement activity is NOT required.	NO additional examinations required outside the required CISI frequency.

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Table 3.7.12-1: Unit 1 Evaluation of Suspect Areas (SA) per IWL-3310						
Zone (Suspect Area No.)	**Description of Condition/ Indication**	**IWL–3310(a)** *The cause of the condition that does not meet the acceptance standards.*	**IWL-3310(b)** *The applicability of the condition to any other plants at the same site.*	**IWL-3310(c)** *The acceptability of the concrete containment without repair of the item.*	**IWL-3310(d)** *Whether or not repair/replacement activity is required and if required, the extent, method, and completion date for the repair/ replacement activity.*	**IWL-3310(e)** *Extent, nature, and frequency of additional examinations.*
1-21A (SA 5)	Spall/chip at D3-2B, length (horizontal) = 7.5" x height (vertical) = 20.8" x depth = 3.0" {identified in 2006 and 2001 (as (8) on VT report); quantitative information was not fully detailed since 2001 report; no adverse change from previous exams}.	Most probable cause is mechanical damage from original construction and/or impact from equipment during tendon surveillances.	Yes, this condition is applicable to Unit 2 and similar conditions have been observed in Unit 2 (see Table 3.7.11-2).	Concrete containment is ACCEPTABLE without repair of the item since the indication does not adversely affect the structural integrity of the concrete containment.	Repair/Replacement activity is NOT required.	NO additional examinations required outside the required CISI frequency.
1-21A (SA 6)	Spall/chip at D1-1B, length (horizontal) = 9.5" x height (vertical) = 22.0" x depth = 4.0" {identified in 2006 and 2001 (as (6) on VT report); quantitative information was not fully detailed since 2001 report; no adverse change from previous exams}.	Most probable cause is mechanical damage from original construction and/or impact from equipment during tendon surveillances.	Yes, this condition is applicable to Unit 2 and similar conditions have been observed in Unit 2 (see Table 3.7.11-2).	Concrete containment is ACCEPTABLE without repair of the item since the indication does not adversely affect the structural integrity of the concrete containment.	Repair/Replacement activity is NOT required.	NO additional examinations required outside the required CISI frequency.

Table 3.7.12-1: Unit 1 Evaluation of Suspect Areas (SA) per IWL-3310						
Zone (Suspect Area No.)	**Description of Condition/ Indication**	**IWL–3310(a)** *The cause of the condition that does not meet the acceptance standards.*	**IWL-3310(b)** *The applicability of the condition to any other plants at the same site.*	**IWL-3310(c)** *The acceptability of the concrete containment without repair of the item.*	**IWL-3310(d)** *Whether or not repair/replacement activity is required and if required, the extent, method, and completion date for the repair/ replacement activity.*	**IWL-3310(e)** *Extent, nature, and frequency of additional examinations.*
1-21A (SA 7)	Spall/chip at D1-2B, length (horizontal) = 6.0" x height (vertical) = 8.0" x depth = 0.8".	Most probable cause is mechanical damage from original construction and/or impact from equipment during tendon surveillances.	Yes, this condition is applicable to Unit 2 and similar conditions have been observed in Unit 2 (see Table 3.7.11-2).	Concrete containment is ACCEPTABLE without repair of the item since the indication does not adversely affect the structural integrity of the concrete containment.	Repair/Replacement activity is NOT required.	NO additional examinations required outside the required CISI frequency.
1-21A (SA 8)	Spall/chip at D2-1T, length (horizontal) = 5.0" x height (vertical) = 10.0" x depth = 0.9" {identified in 2006 and 2001 (as (1) on VT report); quantitative information was not fully detailed since 2001 report; indication is measured to be larger when compared to 2001 exam}.	Most probable cause is mechanical damage from original construction and/or impact from equipment during tendon surveillances. See Note 1 for explanation of difference in size measurements.	Yes, this condition is applicable to Unit 2 and similar conditions have been observed in Unit 2 (see Table 3.7.11-2).	Concrete containment is ACCEPTABLE without repair of the item since the indication does not adversely affect the structural integrity of the concrete containment.	Repair/Replacement activity is NOT required.	NO additional examinations required outside the required CISI frequency.

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Table 3.7.12-1: Unit 1 Evaluation of Suspect Areas (SA) per IWL-3310

Zone (Suspect Area No.)	**Description of Condition/ Indication**	**IWL–3310(a)** *The cause of the condition that does not meet the acceptance standards.*	**IWL-3310(b)** *The applicability of the condition to any other plants at the same site.*	**IWL-3310(c)** *The acceptability of the concrete containment without repair of the item.*	**IWL-3310(d)** *Whether or not repair/replacement activity is required and if required, the extent, method, and completion date for the repair/ replacement activity.*	**IWL-3310(e)** *Extent, nature, and frequency of additional examinations.*
1-21A (SA 9)	Spall/chip at D3-1B, length (horizontal) = 6.0" x height (vertical) = 19.0" x depth = 4.0" {identified in 2006 and 2001 (as (5) on VT report); quantitative information was not fully detailed since 2001 report; no adverse change from previous exams}.	Most probable cause is mechanical damage from original construction and/or impact from equipment during tendon surveillances.	Yes, this condition is applicable to Unit 2 and similar conditions have been observed in Unit 2 (see Table 3.7.11-2).	Concrete containment is ACCEPTABLE without repair of the item since the indication does not adversely affect the structural integrity of the concrete containment.	Repair/Replacement activity is NOT required.	NO additional examinations required outside the required CISI frequency.
1-21A (SA 10)	Spall/chip at D3-2B, length (horizontal) = 6.0" x height (vertical) = 14.0" x depth = 2.0" {identified in 2006 and 2001 (as (4) on VT report); quantitative information was not fully detailed since 2001 report; no adverse change from previous exams}.	Most probable cause is mechanical damage from original construction and/or impact from equipment during tendon surveillances.	Yes, this condition is applicable to Unit 2 and similar conditions have been observed in Unit 2 (see Table 3.7.11-2).	Concrete containment is ACCEPTABLE without repair of the item since the indication does not adversely affect the structural integrity of the concrete containment.	Repair/Replacement activity is NOT required.	NO additional examinations required outside the required CISI frequency.

Table 3.7.12-1: Unit 1 Evaluation of Suspect Areas (SA) per IWL-3310						
Zone (Suspect Area No.)	**Description of Condition/ Indication**	**IWL–3310(a)** *The cause of the condition that does not meet the acceptance standards.*	**IWL-3310(b)** *The applicability of the condition to any other plants at the same site.*	**IWL-3310(c)** *The acceptability of the concrete containment without repair of the item.*	**IWL-3310(d)** *Whether or not repair/replacement activity is required and if required, the extent, method, and completion date for the repair/ replacement activity.*	**IWL-3310(e)** *Extent, nature, and frequency of additional examinations.*
1-21B (SA 1)	Spall/chip at D3-40B, length (horizontal) = 7.5" x height (vertical) = 17.0" x depth = 2.0" {identified in 2006 and 2001 (as (1) on VT report); quantitative information was not fully detailed since 2001 report; no adverse change from previous exams}.	Most probable cause is mechanical damage from original construction and/or impact from equipment during tendon surveillances.	Yes, this condition is applicable to Unit 2 and similar conditions have been observed in Unit 2 (see Table 3.7.11-2).	Concrete containment is ACCEPTABLE without repair of the item since the indication does not adversely affect the structural integrity of the concrete containment.	Repair/Replacement activity is NOT required.	NO additional examinations required outside the required CISI frequency.
1-21B (SA 2)	Spall/chip at D1-40B, length (horizontal) = 10.0" x height (vertical) = 14.0" x depth = 2.0" {identified in 2006 and 2001 (as (2) on VT report); quantitative information was not fully detailed since 2001 report; no adverse change from previous exams}.	Most probable cause is mechanical damage from original construction and/or impact from equipment during tendon surveillances.	Yes, this condition is applicable to Unit 2 and similar conditions have been observed in Unit 2 (see Table 3.7.11-2).	Concrete containment is ACCEPTABLE without repair of the item since the indication does not adversely affect the structural integrity of the concrete containment.	Repair/Replacement activity is NOT required.	NO additional examinations required outside the required CISI frequency.

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Table 3.7.12-1: Unit 1 Evaluation of Suspect Areas (SA) per IWL-3310						
Zone (Suspect Area No.)	**Description of Condition/ Indication**	**IWL–3310(a)** *The cause of the condition that does not meet the acceptance standards.*	**IWL-3310(b)** *The applicability of the condition to any other plants at the same site.*	**IWL-3310(c)** *The acceptability of the concrete containment without repair of the item.*	**IWL-3310(d)** *Whether or not repair/replacement activity is required and if required, the extent, method, and completion date for the repair/ replacement activity.*	**IWL-3310(e)** *Extent, nature, and frequency of additional examinations.*
1-21B (SA 3)	Spall/chip at D1-39B, length (horizontal) = 9.5" x height (vertical) = 13.0" x depth = 2.0" {identified in 2006 and 2001 (as (3) on VT report); quantitative information was not fully detailed since 2001 report; no adverse change from previous exams}.	Most probable cause is mechanical damage from original construction and/or impact from equipment during tendon surveillances.	Yes, this condition is applicable to Unit 2 and similar conditions have been observed in Unit 2 (see Table 3.7.11-2).	Concrete containment is ACCEPTABLE without repair of the item since the indication does not adversely affect the structural integrity of the concrete containment.	Repair/Replacement activity is NOT required.	NO additional examinations required outside the required CISI frequency.
1-21B (SA 4)	Spall/chip at D3-40B, length (horizontal) = 9.3" x height (vertical) = 20.5" x depth = 4.0" {identified in 2006 and 2001 (as (4) on VT report); quantitative information was not fully detailed since 2001 report; no adverse change from previous exams}.	Most probable cause is mechanical damage from original construction and/or impact from equipment during tendon surveillances.	Yes, this condition is applicable to Unit 2 and similar conditions have been observed in Unit 2 (see Table 3.7.11-2).	Concrete containment is ACCEPTABLE without repair of the item since the indication does not adversely affect the structural integrity of the concrete containment.	Repair/Replacement activity is NOT required.	NO additional examinations required outside the required CISI frequency.

Table 3.7.12-1: Unit 1 Evaluation of Suspect Areas (SA) per IWL-3310						
Zone (Suspect Area No.)	**Description of Condition/ Indication**	**IWL–3310(a)** *The cause of the condition that does not meet the acceptance standards.*	**IWL-3310(b)** *The applicability of the condition to any other plants at the same site.*	**IWL-3310(c)** *The acceptability of the concrete containment without repair of the item.*	**IWL-3310(d)** *Whether or not repair/replacement activity is required and if required, the extent, method, and completion date for the repair/ replacement activity.*	**IWL-3310(e)** *Extent, nature, and frequency of additional examinations.*
1-21B (SA 5)	Spall/chip at D3-39B, length (horizontal) = 9.0" x height (vertical) = 13.0" x depth = 1.8" {identified in 2006 and 2001 (as (5) on VT report); quantitative information was not fully detailed since 2001 report; no adverse change from previous exams}.	Most probable cause is mechanical damage from original construction and/or impact from equipment during tendon surveillances.	Yes, this condition is applicable to Unit 2 and similar conditions have been observed in Unit 2 (see Table 3.7.11-2).	Concrete containment is ACCEPTABLE without repair of the item since the indication does not adversely affect the structural integrity of the concrete containment.	Repair/Replacement activity is NOT required.	NO additional examinations required outside the required CISI frequency.
1-21B (SA 6)	Spall/chip at D2-40T, length (horizontal) = 10.5" x height (vertical) = 19.0" x depth = 2.0" {identified in 2006 and 2001 (as (6) on VT report); quantitative information was not fully detailed since 2001 report; no adverse change from previous exams}.	Most probable cause is mechanical damage from original construction and/or impact from equipment during tendon surveillances.	Yes, this condition is applicable to Unit 2 and similar conditions have been observed in Unit 2 (see Table 3.7.11-2).	Concrete containment is ACCEPTABLE without repair of the item since the indication does not adversely affect the structural integrity of the concrete containment.	Repair/Replacement activity is NOT required.	NO additional examinations required outside the required CISI frequency.

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Table 3.7.12-1: Unit 1 Evaluation of Suspect Areas (SA) per IWL-3310

Zone (Suspect Area No.)	**Description of Condition/ Indication**	**IWL–3310(a)** *The cause of the condition that does not meet the acceptance standards.*	**IWL-3310(b)** *The applicability of the condition to any other plants at the same site.*	**IWL-3310(c)** *The acceptability of the concrete containment without repair of the item.*	**IWL-3310(d)** *Whether or not repair/replacement activity is required and if required, the extent, method, and completion date for the repair/ replacement activity.*	**IWL-3310(e)** *Extent, nature, and frequency of additional examinations.*
1-21B (SA 7)	Spall/chip at D2-1T, length (horizontal) = 10.0" x height (vertical) = 12.0" x depth = 1.0" {identified in 2006 and 2001 (as (7) on VT report); quantitative information was not fully detailed since 2001 report; no adverse change from previous exams}.	Most probable cause is mechanical damage from original construction and/or impact from equipment during tendon surveillances.	Yes, this condition is applicable to Unit 2 and similar conditions have been observed in Unit 2 (see Table 3.7.11-2).	Concrete containment is ACCEPTABLE without repair of the item since the indication does not adversely affect the structural integrity of the concrete containment.	Repair/Replacement activity is NOT required.	NO additional examinations required outside the required CISI frequency.
1-21B (SA 8)	Spall/chip at D3-24C, length (horizontal) = 8.0" x height (vertical) = 5.0" x depth = 3.0" {identified in 2001 as (4) on VT report. More directly above D3-24C, not D3-26C. Quantitative information was not fully detailed since 2001 report; no adverse change from previous exams}.	Most probable cause is improper construction practice.	Yes, this condition is applicable to Unit 2 and similar conditions have been observed in Unit 2 (see Table 3.7.11-2).	Concrete containment is ACCEPTABLE without repair of the item since the indication does not adversely affect the structural integrity of the concrete containment.	Repair/Replacement activity is NOT required.	NO additional examinations required outside the required CISI frequency.

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Table 3.7.12-1: Unit 1 Evaluation of Suspect Areas (SA) per IWL-3310						
Zone (Suspect Area No.)	**Description of Condition/ Indication**	**IWL–3310(a)** *The cause of the condition that does not meet the acceptance standards.*	**IWL-3310(b)** *The applicability of the condition to any other plants at the same site.*	**IWL-3310(c)** *The acceptability of the concrete containment without repair of the item.*	**IWL-3310(d)** *Whether or not repair/replacement activity is required and if required, the extent, method, and completion date for the repair/ replacement activity.*	**IWL-3310(e)** *Extent, nature, and frequency of additional examinations.*
1-21B (SA 9)	Spall/chip at embed plate above D2-1T (Buttress A), length (horizontal) = 9.0" x height (vertical) = 6.0" x depth = 1.0" {identified in 2001 as (5) on VT report. Quantitative information was not fully detailed since 2001 report; no adverse change from previous exams}.	Most probable cause is corrosion from the embedded plate.	Yes, this condition is applicable to Unit 2 and similar conditions have been observed in Unit 2 (see Table 3.7.11-2).	Concrete containment is ACCEPTABLE without repair of the item since the indication does not adversely affect the structural integrity of the concrete containment.	Repair/Replacement activity is NOT required.	NO additional examinations required outside the required CISI frequency.
1-22A (SA 1)	Spall, length (horizontal) = 2.0" x height (vertical) = 12.0" x depth = 0.5" {identified in 2001 as (7) on VT report; no change from previous exams}.	Most probable cause is improper construction practice.	Yes, this condition is applicable to Unit 2 and similar conditions have been observed in Unit 2 (see Table 3.7.11-2).	Concrete containment is ACCEPTABLE without repair of the item since the indication does not adversely affect the structural integrity of the concrete containment.	Repair/Replacement activity is NOT required.	NO additional examinations required outside the required CISI frequency.
1-22A (SA 2)	Spall, diameter = 8.0" x depth = 0.5" {identified in 2001 as (8) on VT report; no change from previous exams}.	Most probable cause is improper construction practice during form removal (spall around tie bar).	Yes, this condition is applicable to Unit 2 and similar conditions have been observed in Unit 2 (see Table 3.7.11-2).	Concrete containment is ACCEPTABLE without repair of the item since the indication does not adversely affect the structural integrity of the concrete containment.	Repair/Replacement activity is NOT required.	NO additional examinations required outside the required CISI frequency.

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Table 3.7.12-1: Unit 1 Evaluation of Suspect Areas (SA) per IWL-3310						
Zone (Suspect Area No.)	**Description of Condition/ Indication**	**IWL–3310(a)** *The cause of the condition that does not meet the acceptance standards.*	**IWL-3310(b)** *The applicability of the condition to any other plants at the same site.*	**IWL-3310(c)** *The acceptability of the concrete containment without repair of the item.*	**IWL-3310(d)** *Whether or not repair/replacement activity is required and if required, the extent, method, and completion date for the repair/ replacement activity.*	**IWL-3310(e)** *Extent, nature, and frequency of additional examinations.*
1-22B (SA 1)	Spalling (peeling), length (horizontal) = 20.0" x height (vertical) = 1.8" x depth = 0.2".	Most probable cause is improper construction at the joint.	Yes, this condition is applicable to Unit 2 and similar conditions have been observed in Unit 2 (see Table 3.7.11-2).	Concrete containment is ACCEPTABLE without repair of the item since the indication does not adversely affect the structural integrity of the concrete containment.	Repair/Replacement activity is NOT required.	NO additional examinations required outside the required CISI frequency.
1-23 (SA 1)	Void in degraded joint, length = 10.5" x height = 1.5" x depth = 1.0" {identified in 2001 as (9) on VT report; no adverse change from previous exams}.	Most probable cause is improper construction at the joint.	Yes, this condition is applicable to Unit 2 and similar conditions have been observed in Unit 2 (see Table 3.7.11-2).	Concrete containment is ACCEPTABLE without repair of the item since the indication does not adversely affect the structural integrity of the concrete containment.	Repair/Replacement activity is NOT required.	NO additional examinations required outside the required CISI frequency.
1-23 (SA 2)	Void in same degraded joint, length = 5.5" x height = 1.5" x depth = 0.8" {identified in 2001 as (9) on VT report; no adverse change from previous exams}.	Most probable cause is improper construction at the joint.	Yes, this condition is applicable to Unit 2 and similar conditions have been observed in Unit 2 (see Table 3.7.11-2).	Concrete containment is ACCEPTABLE without repair of the item since the indication does not adversely affect the structural integrity of the concrete containment.	Repair/Replacement activity is NOT required.	NO additional examinations required outside the required CISI frequency.
1-24 (SA 1)	Spalling around form tie hole, length = 9.5" x height = 11.5" x depth = 1.5".	Most probable cause is improper construction practice during form removal (spall around tie bar).	Yes, this condition is applicable to Unit 2 and similar conditions have been observed in Unit 2 (see Table 3.7.11-2).	Concrete containment is ACCEPTABLE without repair of the item since the indication does not adversely affect the structural integrity of the concrete containment.	Repair/Replacement activity is NOT required.	NO additional examinations required outside the required CISI frequency.

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Table 3.7.12-1: Unit 1 Evaluation of Suspect Areas (SA) per IWL-3310						
Zone (Suspect Area No.)	**Description of Condition/ Indication**	**IWL–3310(a)** *The cause of the condition that does not meet the acceptance standards.*	**IWL-3310(b)** *The applicability of the condition to any other plants at the same site.*	**IWL-3310(c)** *The acceptability of the concrete containment without repair of the item.*	**IWL-3310(d)** *Whether or not repair/replacement activity is required and if required, the extent, method, and completion date for the repair/ replacement activity.*	**IWL-3310(e)** *Extent, nature, and frequency of additional examinations.*
1-24 (SA 2)	Spall below patch, length = 12.0" x height = 6.0" x depth = 0.8".	Most probable cause is mechanical damage when installing patch directly above this spall.	Yes, this condition is applicable to Unit 2 and similar conditions have been observed in Unit 2 (see Table 3.7.11-2).	Concrete containment is ACCEPTABLE without repair of the item since the indication does not adversely affect the structural integrity of the concrete containment.	Repair/Replacement activity is NOT required.	NO additional examinations required outside the required CISI frequency.
1-24 (SA 3)	Spall, length = 6.0" x height = 1.0" x depth = 1.0" {Spall is within a degraded joint previously identified in 2001 as (4) on VT report}.	Most probable cause is improper construction at the joint.	Yes, this condition is applicable to Unit 2 and similar conditions have been observed in Unit 2 (see Table 3.7.11-2).	Concrete containment is ACCEPTABLE without repair of the item since the indication does not adversely affect the structural integrity of the concrete containment.	Repair/Replacement activity is NOT required.	NO additional examinations required outside the required CISI frequency.
1-24 (SA 4)	Popout, length = 5.0" x height = 2.0" x depth = 1.0" {identified in 2001 as (26) on VT report; no change from previous exams}.	Most probably from original construction. Popouts can result from internal surface pressure due to a swelling of a porous aggregate that absorbs moisture or freezes.	Yes, this condition is applicable to Unit 2 and similar conditions have been observed in Unit 2 (see Table 3.7.11-2).	Concrete containment is ACCEPTABLE without repair of the item since the indication does not adversely affect the structural integrity of the concrete containment.	Repair/Replacement activity is NOT required.	NO additional examinations required outside the required CISI frequency.

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Table 3.7.12-1: Unit 1 Evaluation of Suspect Areas (SA) per IWL-3310						
Zone (Suspect Area No.)	**Description of Condition/ Indication**	**IWL–3310(a)** *The cause of the condition that does not meet the acceptance standards.*	**IWL-3310(b)** *The applicability of the condition to any other plants at the same site.*	**IWL-3310(c)** *The acceptability of the concrete containment without repair of the item.*	**IWL-3310(d)** *Whether or not repair/replacement activity is required and if required, the extent, method, and completion date for the repair/ replacement activity.*	**IWL-3310(e)** *Extent, nature, and frequency of additional examinations.*
1-C (SA 1)	Multiple voids within 2' x 2' area, largest void length = 4.0" x height = 1.2" x depth = 1.0" {identified in 2006 (as (1) on VT report) and in 2001 (as (1) on VT report); no change from previous exams}.	Most probable cause for small voids is entrapment of air bubbles at the form surface during placement. Most probable cause for bigger voids is usually from internal surface pressure due to a swelling of a porous aggregate that absorbs moisture or freezes.	Yes, this condition is applicable to Unit 2 and similar conditions have been observed in Unit 2 (see Table 3.7.11-2).	Concrete containment is ACCEPTABLE without repair of the item since the indication does not adversely affect the structural integrity of the concrete containment.	Repair/Replacement activity is NOT required.	NO additional examinations required outside the required CISI frequency.

Note 1: The Recorded Indications (RI) identified in the 2016 CISI (Inservice Inspection) that did not meet the 2nd Tier acceptance criteria (Suspect Areas) were compared to the corresponding RIs identified in previous CISIs performed in 2001, 2006, and 2011 for the same Zone. There were some differences noticed among the RIs from 2016 CISI and those of previous CISIs. These differences were found to be acceptable and determined not to be due to physical changes or time dependent degradations, rather they were as a result of the following:

- RIs are documented in more detail in the 2016 report and in accordance with newly issued EGC procedure.
- The forms used for documenting the 2011 and 2016 CISIs are more detailed than the forms used in the 2001 and 2006 CISIs.
- The difference in size measurements in comparison to the ones from the previous CISIs is attributed to an irregular shape spall, void, pop-out, etc. being measured by different inspectors using different tools, rather than time-dependent degradation.

Table 3.7.12-2: Unit 2 Evaluation of Suspect Areas (SA) per IWL-3310						
Zone (Suspect Area No.)	**Description of Condition/ Indication**	**IWL–3310(a)** *The cause of the condition that does not meet the acceptance standards.*	**IWL-3310(b)** *The applicability of the condition to any other plants at the same site.*	**IWL-3310(c)** *The acceptability of the concrete containment without repair of the item.*	**IWL-3310(d)** *Whether or not repair/replacement activity is required and if required, the extent, method, and completion date for the repair/ replacement activity.*	**IWL-3310(e)** *Extent, nature, and frequency of additional examinations.*
2-2 (SA 1)	Void, length= 1.4" x height= 0.3" x depth= 1.3".	Most probable cause is; improper construction at the joint (void is in the V-shape groove).	Yes, this condition is applicable to Unit 1 and similar conditions have been observed in Unit 1 (see Table 3.7.11-1).	Concrete containment is ACCEPTABLE without repair of the item since the indication does not adversely affect the structural integrity of the concrete containment.	Repair/Replacement activity is NOT required.	NO additional examinations required outside the required CISI frequency.
2-3 (SA 1)	One thin layer of spalled concrete, below E-13 and above I-3, length = 3.0" x height = 10.0" x depth = 0.2" {identified in 2011, 2006, and 2001; no change from previous exams}.	Most probable cause is; surface delamination due to trapped air and/or water during construction.	Yes, this condition is applicable to Unit 1 and similar conditions have been observed in Unit 1 (see Table 3.7.11-1).	Concrete containment is ACCEPTABLE without repair of the item since the indication does not adversely affect the structural integrity of the concrete containment.	Repair/Replacement activity is NOT required.	NO additional examinations required outside the required CISI frequency.
2-4 (SA 1)	Spall above penetration E-20 measured at 5.0" length x 2.0" height x 1.0" depth {identified in 2011 and 2006; no adverse changes from previous exams}.	Most probable cause is; improper construction at the joint.	Yes, this condition is applicable to Unit 1 and similar conditions have been observed in Unit 1 (see Table 3.7.11-1).	Concrete containment is ACCEPTABLE without repair of the item since the indication does not adversely affect the structural integrity of the concrete containment.	Repair/Replacement activity is NOT required.	NO additional examinations required outside the required CISI frequency.
2-4A (SA 1)	Void, diameter = 2.0" and 1.8" deep {identified in 2001; no change from previous exams}.	Most probably from original construction. Voids can result from internal surface pressure due to a swelling of a porous aggregate that absorbs moisture or freezes.	Yes, this condition is applicable to Unit 1 and similar conditions have been observed in Unit 1 (see Table 3.7.11-1).	Concrete containment is ACCEPTABLE without repair of the item since the indication does not adversely affect the structural integrity of the concrete containment.	Repair/Replacement activity is NOT required.	NO additional examinations required outside the required CISI frequency.

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Table 3.7.12-2: Unit 2 Evaluation of Suspect Areas (SA) per IWL-3310						
Zone (Suspect Area No.)	**Description of Condition/ Indication**	**IWL–3310(a)** *The cause of the condition that does not meet the acceptance standards.*	**IWL-3310(b)** *The applicability of the condition to any other plants at the same site.*	**IWL-3310(c)** *The acceptability of the concrete containment without repair of the item.*	**IWL-3310(d)** *Whether or not repair/replacement activity is required and if required, the extent, method, and completion date for the repair/ replacement activity.*	**IWL-3310(e)** *Extent, nature, and frequency of additional examinations.*
2-4A (SA 2)	Spall, length = 3.5" x height = 3.0" x depth = 0.8" {identified in 2001; no adverse change from previous exams}.	Most probable cause is; improper construction practice during form removal (spall around tie bar).	Yes, this condition is applicable to Unit 1 and similar conditions have been observed in Unit 1 (see Table 3.7.11-1).	Concrete containment is ACCEPTABLE without repair of the item since the indication does not adversely affect the structural integrity of the concrete containment.	Repair/Replacement activity is NOT required.	NO additional examinations required outside the required CISI frequency.
2-7 (SA 1)	One form tie hole close to P-73 with spalling, diameter = 3.0" and 1.0" deep {identified in 2001; no change from previous exams}.	Most probable cause is; improper construction practice during form removal (spall around tie bar). Also, spall may be due to pressure from corroded tie bar.	Yes, this condition is applicable to Unit 1 and similar conditions have been observed in Unit 1 (see Table 3.7.11-1).	Concrete containment is ACCEPTABLE without repair of the item since the indication does not adversely affect the structural integrity of the concrete containment.	Repair/Replacement activity is NOT required.	NO additional examinations required outside the required CISI frequency.
2-12 (SA 1)	Spall at H14-DF, length (horizontal) = 3.0" x height (vertical) = 7.5" x depth = 2.4" {identified in 2011, 2006, and 2001; no change from previous exams}.	Most probable cause is; mechanical damage. Also, spall may be due to pressure from corroded adjacent embed plate. Spall is not in the load-bearing zone of the tendon.	Yes, this condition is applicable to Unit 1 and similar conditions have been observed in Unit 1 (see Table 3.7.11-1).	Concrete containment is ACCEPTABLE without repair of the item since the indication does not adversely affect the structural integrity of the concrete containment.	Repair/Replacement activity is NOT required.	NO additional examinations required outside the required CISI frequency.
2-12 (SA 2)	Spall at H25-DF, length (horizontal) = 6.0" x height (vertical) = 2.5" x depth= 2.4".	Most probable cause is; mechanical damage. Also, spall may be due to pressure from corroded adjacent embed plate. Spall is not in the load-bearing zone of the tendon.	Yes, this condition is applicable to Unit 1 and similar conditions have been observed in Unit 1 (see Table 3.7.11-1).	Concrete containment is ACCEPTABLE without repair of the item since the indication does not adversely affect the structural integrity of the concrete containment.	Repair/Replacement activity is NOT required.	NO additional examinations required outside the required CISI frequency.

Table 3.7.12-2: Unit 2 Evaluation of Suspect Areas (SA) per IWL-3310						
Zone (Suspect Area No.)	**Description of Condition/ Indication**	**IWL–3310(a)** *The cause of the condition that does not meet the acceptance standards.*	**IWL-3310(b)** *The applicability of the condition to any other plants at the same site.*	**IWL-3310(c)** *The acceptability of the concrete containment without repair of the item.*	**IWL-3310(d)** *Whether or not repair/replacement activity is required and if required, the extent, method, and completion date for the repair/ replacement activity.*	**IWL-3310(e)** *Extent, nature, and frequency of additional examinations.*
2-12 (SA 3)	Spall at H61-DF, length (horizontal) = 3.5" x height (vertical) = 3.0" x depth= 2.4".	Most probable cause is; mechanical damage from original construction and/or impact from equipment during tendon surveillances.	Yes, this condition is applicable to Unit 1 and similar conditions have been observed in Unit 1 (see Table 3.7.11-1).	Concrete containment is ACCEPTABLE without repair of the item since the indication does not adversely affect the structural integrity of the concrete containment.	Repair/Replacement activity is NOT required.	NO additional examinations required outside the required CISI frequency.
2-12A (SA 1)	Spall at H3-DF, length (horizontal) = 8.0" x height (vertical) = 1.0" x depth = 4.5".	Most probable cause is; improper construction practice and/or mechanical damage from original construction and/or impact from equipment during tendon surveillances.	Yes, this condition is applicable to Unit 1 and similar conditions have been observed in Unit 1 (see Table 3.7.11-1).	Concrete containment is ACCEPTABLE without repair of the item since the indication does not adversely affect the structural integrity of the concrete containment.	Repair/Replacement activity is NOT required.	NO additional examinations required outside the required CISI frequency.
2-12A (SA 2)	Another spall at H3-DF, length (horizontal) = 2.5" x height (vertical) = 0.8" x depth = 2.0".	Most probable cause is; improper construction practice and/or mechanical damage from original construction and/or impact from equipment during tendon surveillances.	Yes, this condition is applicable to Unit 1 and similar conditions have been observed in Unit 1 (see Table 3.7.11-1).	Concrete containment is ACCEPTABLE without repair of the item since the indication does not adversely affect the structural integrity of the concrete containment.	Repair/Replacement activity is NOT required.	NO additional examinations required outside the required CISI frequency.
2-12A (SA 3)	Spall at H6-DF, length (horizontal) = 4.2" x height (vertical) = 1.5" x depth = 1.0".	Most probable cause is; improper construction practice and/or mechanical damage from original construction and/or impact from equipment during tendon surveillances.	Yes, this condition is applicable to Unit 1 and similar conditions have been observed in Unit 1 (see Table 3.7.11-1).	Concrete containment is ACCEPTABLE without repair of the item since the indication does not adversely affect the structural integrity of the concrete containment.	Repair/Replacement activity is NOT required.	NO additional examinations required outside the required CISI frequency.

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Table 3.7.12-2: Unit 2 Evaluation of Suspect Areas (SA) per IWL-3310						
Zone (Suspect Area No.)	**Description of Condition/ Indication**	**IWL–3310(a)** *The cause of the condition that does not meet the acceptance standards.*	**IWL-3310(b)** *The applicability of the condition to any other plants at the same site.*	**IWL-3310(c)** *The acceptability of the concrete containment without repair of the item.*	**IWL-3310(d)** *Whether or not repair/replacement activity is required and if required, the extent, method, and completion date for the repair/ replacement activity.*	**IWL-3310(e)** *Extent, nature, and frequency of additional examinations.*
2-13 (SA 1)	Void (directly above spall at H14-ED), length = 6.0" x height = 2.0" x depth = 5.0" deep {identified in 2011, 2006, and 2001; no change from previous exams}.	Most probable cause is; improper construction practice and not time dependent degradation. Also, void may be due to pressure from corroded adjacent embed plate. Void is not in the load bearing zone of the tendon.	Yes, this condition is applicable to Unit 1 and similar conditions have been observed in Unit 1 (see Table 3.7.11-1).	Concrete containment is ACCEPTABLE without repair of the item since the indication does not adversely affect the structural integrity of the concrete containment.	Repair/Replacement activity is NOT required, but recommended.	NO additional examinations required outside the required CISI frequency.
2-13 (SA 2)	Spall at H14-ED, length (horizontal) = 4.8" x height (vertical) = 6.0" x depth = 1.5" {identified in 2011, 2006, and 2001; no change from previous exams as spall and void were previously documented as one indication}.	Most probable cause is; improper construction practice and not time dependent degradation. Also, spall may be due to pressure from corroded adjacent embed plate. Spall is not in the load-bearing zone of the tendon.	Yes, this condition is applicable to Unit 1 and similar conditions have been observed in Unit 1 (see Table 3.7.11-1).	Concrete containment is ACCEPTABLE without repair of the item since the indication does not adversely affect the structural integrity of the concrete containment.	Repair/Replacement activity is NOT required, but it was recommended.	NO additional examinations required outside the required CISI frequency.
2-13 (SA 3)	Spall at H29-ED, length (horizontal) = 2.8" x height (vertical) = 0.2" x depth= 2.0".	Most probable cause is; improper construction practice (not forming around plate during original pour).	Yes, this condition is applicable to Unit 1 and similar conditions have been observed in Unit 1 (see Table 3.7.11-1).	Concrete containment is ACCEPTABLE without repair of the item since the indication does not adversely affect the structural integrity of the concrete containment.	Repair/Replacement activity is NOT required.	NO additional examinations required outside the required CISI frequency.

Table 3.7.12-2: Unit 2 Evaluation of Suspect Areas (SA) per IWL-3310

Zone (Suspect Area No.)	**Description of Condition/ Indication**	**IWL–3310(a)** *The cause of the condition that does not meet the acceptance standards.*	**IWL-3310(b)** *The applicability of the condition to any other plants at the same site.*	**IWL-3310(c)** *The acceptability of the concrete containment without repair of the item.*	**IWL-3310(d)** *Whether or not repair/replacement activity is required and if required, the extent, method, and completion date for the repair/ replacement activity.*	**IWL-3310(e)** *Extent, nature, and frequency of additional examinations.*
2-13 (SA 4)	Spall at H51-ED, length (horizontal) = 2.0" x height (vertical) = 0.3" x depth= 0.8".	Most probable cause is; improper construction practice and/or mechanical damage from original construction and/or impact from equipment during tendon surveillances.	Yes, this condition is applicable to Unit 1 and similar conditions have been observed in Unit 1 (see Table 3.7.11-1).	Concrete containment is ACCEPTABLE without repair of the item since the indication does not adversely affect the structural integrity of the concrete containment.	Repair/Replacement activity is NOT required.	NO additional examinations required outside the required CISI frequency.
2-13 (SA 5)	Second spall at H51-ED, length (horizontal) = 1.0" x height (vertical) = 0.3" x depth = 0.8".	Most probable cause is; improper construction practice and/or mechanical damage from original construction and/or impact from equipment during tendon surveillances.	Yes, this condition is applicable to Unit 1 and similar conditions have been observed in Unit 1 (see Table 3.7.11-1).	Concrete containment is ACCEPTABLE without repair of the item since the indication does not adversely affect the structural integrity of the concrete containment.	Repair/Replacement activity is NOT required.	NO additional examinations required outside the required CISI frequency.
2-14 (SA 1)	Spall at H51-DE, length (horizontal) = 2.3" x height (vertical) = 1.6" x depth= 2.0".	Most probable cause is; improper construction at the joint.	Yes, this condition is applicable to Unit 1 and similar conditions have been observed in Unit 1 (see Table 3.7.11-1).	Concrete containment is ACCEPTABLE without repair of the item since the indication does not adversely affect the structural integrity of the concrete containment.	Repair/Replacement activity is NOT required.	NO additional examinations required outside the required CISI frequency.
2-15 (SA 1)	Spall at H41-EF, length (horizontal) = 2.5" x height (vertical) = 5.0" x depth= 0.8".	Most probable cause is; mechanical damage from original construction and/or impact from equipment during tendon surveillances.	Yes, this condition is applicable to Unit 1 and similar conditions have been observed in Unit 1 (see Table 3.7.11-1).	Concrete containment is ACCEPTABLE without repair of the item since the indication does not adversely affect the structural integrity of the concrete containment.	Repair/Replacement activity is NOT required.	NO additional examinations required outside the required CISI frequency.

Table 3.7.12-2: Unit 2 Evaluation of Suspect Areas (SA) per IWL-3310						
Zone (Suspect Area No.)	**Description of Condition/ Indication**	**IWL–3310(a)** *The cause of the condition that does not meet the acceptance standards.*	**IWL-3310(b)** *The applicability of the condition to any other plants at the same site.*	**IWL-3310(c)** *The acceptability of the concrete containment without repair of the item.*	**IWL-3310(d)** *Whether or not repair/replacement activity is required and if required, the extent, method, and completion date for the repair/ replacement activity.*	**IWL-3310(e)** *Extent, nature, and frequency of additional examinations.*
2-15 (SA 2)	Spall at H66-EF, length (horizontal) = 2.5" x height (vertical) = 4.0" x depth= 1.0".	Most probable cause is; improper construction at the joint and/or mechanical damage from original construction and/or impact from equipment during tendon surveillances.	Yes, this condition is applicable to Unit 1 and similar conditions have been observed in Unit 1 (see Table 3.7.11-1).	Concrete containment is ACCEPTABLE without repair of the item since the indication does not adversely affect the structural integrity of the concrete containment.	Repair/Replacement activity is NOT required.	NO additional examinations required outside the required CISI frequency.
2-16 (SA 1)	Spall at H36-FE, length (horizontal) = 2.8" x height (vertical) = 2.0" x depth= 2.0".	Most probable cause is; improper construction at the joint.	Yes, this condition is applicable to Unit 1 and similar conditions have been observed in Unit 1 (see Table 3.7.11-1).	Concrete containment is ACCEPTABLE without repair of the item since the indication does not adversely affect the structural integrity of the concrete containment.	Repair/Replacement activity is NOT required.	NO additional examinations required outside the required CISI frequency.
2-16 (SA 2)	Spall at H42-FE, length (horizontal) = 1.4" x height (vertical) = 2.0" x depth= 0.9".	Most probable cause is; improper construction practice and/or mechanical damage from original construction and/or impact from equipment during tendon surveillances.	Yes, this condition is applicable to Unit 1 and similar conditions have been observed in Unit 1 (see Table 3.7.11-1).	Concrete containment is ACCEPTABLE without repair of the item since the indication does not adversely affect the structural integrity of the concrete containment.	Repair/Replacement activity is NOT required.	NO additional examinations required outside the required CISI frequency.
2-16 (SA 3)	Spall at H51-FE, length (horizontal) = 5.3" x height (vertical) = 1.3" x depth = 1.0".	Most probable cause is; improper construction at the joint.	Yes, this condition is applicable to Unit 1 and similar conditions have been observed in Unit 1 (see Table 3.7.11-1).	Concrete containment is ACCEPTABLE without repair of the item since the indication does not adversely affect the structural integrity of the concrete containment.	Repair/Replacement activity is NOT required.	NO additional examinations required outside the required CISI frequency.

Table 3.7.12-2: Unit 2 Evaluation of Suspect Areas (SA) per IWL-3310						
Zone (Suspect Area No.)	**Description of Condition/ Indication**	**IWL–3310(a)** *The cause of the condition that does not meet the acceptance standards.*	**IWL-3310(b)** *The applicability of the condition to any other plants at the same site.*	**IWL-3310(c)** *The acceptability of the concrete containment without repair of the item.*	**IWL-3310(d)** *Whether or not repair/replacement activity is required and if required, the extent, method, and completion date for the repair/ replacement activity.*	**IWL-3310(e)** *Extent, nature, and frequency of additional examinations.*
2-16A (SA 1)	Spall at H3-FE, length (horizontal) = 3.0" x height (vertical) = 4.2" x depth= 1.5".	Most probable cause is; improper construction practice.	Yes, this condition is applicable to Unit 1 and similar conditions have been observed in Unit 1 (see Table 3.7.11-1).	Concrete containment is ACCEPTABLE without repair of the item since the indication does not adversely affect the structural integrity of the concrete containment.	Repair/Replacement activity is NOT required.	NO additional examinations required outside the required CISI frequency.
2-16A (SA 2)	Second spall at H3-FE, length (horizontal) = 2.0" x height (vertical) = 0.5" x depth= 1.0".	Most probable cause is; improper construction practice.	Yes, this condition is applicable to Unit 1 and similar conditions have been observed in Unit 1 (see Table 3.7.11-1).	Concrete containment is ACCEPTABLE without repair of the item since the indication does not adversely affect the structural integrity of the concrete containment.	Repair/Replacement activity is NOT required.	NO additional examinations required outside the required CISI frequency.
2-16A (SA 3)	Spall at H7-FE, length (horizontal) = 1.5" x height (vertical) = 0.3" x depth = 1.4".	Most probable cause is; improper construction practice.	Yes, this condition is applicable to Unit 1 and similar conditions have been observed in Unit 1 (see Table 3.7.11-1).	Concrete containment is ACCEPTABLE without repair of the item since the indication does not adversely affect the structural integrity of the concrete containment.	Repair/Replacement activity is NOT required.	NO additional examinations required outside the required CISI frequency.
2-16A (SA 4)	Spall around form tie hole, length (horizontal) = 4.4" x height (vertical) = 5.8" x depth= 1.0".	Most probable cause is; improper construction practice during form removal (spall around tie bar). Also, spall may be due to pressure from corroded tie bar.	Yes, this condition is applicable to Unit 1 and similar conditions have been observed in Unit 1 (see Table 3.7.11-1).	Concrete containment is ACCEPTABLE without repair of the item since the indication does not adversely affect the structural integrity of the concrete containment.	Repair/Replacement activity is NOT required.	NO additional examinations required outside the required CISI frequency.

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Table 3.7.12-2: Unit 2 Evaluation of Suspect Areas (SA) per IWL-3310						
Zone (Suspect Area No.)	**Description of Condition/ Indication**	**IWL–3310(a)** *The cause of the condition that does not meet the acceptance standards.*	**IWL-3310(b)** *The applicability of the condition to any other plants at the same site.*	**IWL-3310(c)** *The acceptability of the concrete containment without repair of the item.*	**IWL-3310(d)** *Whether or not repair/replacement activity is required and if required, the extent, method, and completion date for the repair/ replacement activity.*	**IWL-3310(e)** *Extent, nature, and frequency of additional examinations.*
2-16A (SA 5)	Observed corrosion on tendon cans H1 - H7 and associated exposed metals (washer, bolts, and plates).	Most probable cause is; flooding of the buttress due to missing drain line since construction.	Yes, this condition is applicable to Unit 1 and similar conditions have been observed in Unit 1 (see Table 3.7.11-1).	Concrete containment is ACCEPTABLE without repair of the item since the indication does not adversely affect the structural integrity of the concrete containment.	Repair/Replacement activity is NOT required.	NO additional examinations required outside the required CISI frequency.
2-17 (SA 1)	Spall at H14-FD, length (horizontal)= 3.0" x height (vertical)= 1.4" x depth= 0.9".	Most probable cause is; improper construction at the joint.	Yes, this condition is applicable to Unit 1 and similar conditions have been observed in Unit 1 (see Table 3.7.11-1).	Concrete containment is ACCEPTABLE without repair of the item since the indication does not adversely affect the structural integrity of the concrete containment.	Repair/Replacement activity is NOT required.	NO additional examinations required outside the required CISI frequency.
2-17 (SA 2)	Spall at H24-FD, length (horizontal) = 2.4" x height (vertical) = 6.5" x depth= 1.0" {identified in 2001; indication is measured to be larger when compared to 2001 exam}.	Most probable cause is; improper construction at the joint. See Note 1 for explanation of difference in size measurements.	Yes, this condition is applicable to Unit 1 and similar conditions have been observed in Unit 1 (see Table 3.7.11-1).	Concrete containment is ACCEPTABLE without repair of the item since the indication does not adversely affect the structural integrity of the concrete containment.	Repair/Replacement activity is NOT required.	NO additional examinations required outside the required CISI frequency.
2-17 (SA 3)	Spall at H61-FD, length (horizontal) = 5.5" x height (vertical) = 2.5" x depth = 0.9".	Most probable cause is; improper construction at the joint.	Yes, this condition is applicable to Unit 1 and similar conditions have been observed in Unit 1 (see Table 3.7.11-1).	Concrete containment is ACCEPTABLE without repair of the item since the indication does not adversely affect the structural integrity of the concrete containment.	Repair/Replacement activity is NOT required.	NO additional examinations required outside the required CISI frequency.

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Table 3.7.12-2: Unit 2 Evaluation of Suspect Areas (SA) per IWL-3310						
Zone (Suspect Area No.)	**Description of Condition/ Indication**	**IWL–3310(a)** *The cause of the condition that does not meet the acceptance standards.*	**IWL-3310(b)** *The applicability of the condition to any other plants at the same site.*	**IWL-3310(c)** *The acceptability of the concrete containment without repair of the item.*	**IWL-3310(d)** *Whether or not repair/replacement activity is required and if required, the extent, method, and completion date for the repair/ replacement activity.*	**IWL-3310(e)** *Extent, nature, and frequency of additional examinations.*
2-17A (SA 1)	Spall, length (horizontal) = 8.5" x height (vertical) = 6.9" x depth = 2.0" {identified in 2006; no change from previous exams}.	Most probable cause is; improper construction practice.	Yes, this condition is applicable to Unit 1 and similar conditions have been observed in Unit 1 (see Table 3.7.11-1).	Concrete containment is ACCEPTABLE without repair of the item since the indication does not adversely affect the structural integrity of the concrete containment.	Repair/Replacement activity is NOT required.	NO additional examinations required outside the required CISI frequency.
2-17A (SA 2)	Spall next to H1-FD, length (horizontal) = 1.3" x height (vertical) = 3.0" x depth= 1.3".	Most probable cause is; improper construction practice.	Yes, this condition is applicable to Unit 1 and similar conditions have been observed in Unit 1 (see Table 3.7.11-1).	Concrete containment is ACCEPTABLE without repair of the item since the indication does not adversely affect the structural integrity of the concrete containment.	Repair/Replacement activity is NOT required.	NO additional examinations required outside the required CISI frequency.
2-17A (SA 3)	Observed corrosion on tendon cans H1 - H3 and associated exposed metals (washer, bolts, and plates).	Most probable cause is; flooding of the buttress due to missing drain line since construction.	Yes, this condition is applicable to Unit 1 and similar conditions have been observed in Unit 1 (see Table 3.7.11-1).	Concrete containment is ACCEPTABLE without repair of the item since the indication does not adversely affect the structural integrity of the concrete containment.	Repair/Replacement activity is NOT required.	NO additional examinations required outside the required CISI frequency.

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Table 3.7.12-2: Unit 2 Evaluation of Suspect Areas (SA) per IWL-3310						
Zone (Suspect Area No.)	**Description of Condition/ Indication**	**IWL–3310(a)** *The cause of the condition that does not meet the acceptance standards.*	**IWL-3310(b)** *The applicability of the condition to any other plants at the same site.*	**IWL-3310(c)** *The acceptability of the concrete containment without repair of the item.*	**IWL-3310(d)** *Whether or not repair/replacement activity is required and if required, the extent, method, and completion date for the repair/ replacement activity.*	**IWL-3310(e)** *Extent, nature, and frequency of additional examinations.*
2-18A/B/C/D (SA 1)	Corner spall/chip at V-236, length (horizontal) = 4.5" x height (vertical) = 2.5" x depth = 1.0" {identified in 2011, 2006, and 2001; quantitative information was not fully detailed since 2001 report; indication is measured to be larger when compared to 2001 exam}.	Most probable cause is; mechanical damage. Although, it may have occurred during removal of the pour form (small corner area may have been adhered to the form). See Note 1 for explanation of difference in size measurements.	Yes, this condition is applicable to Unit 1 and similar conditions have been observed in Unit 1 (see Table 3.7.11-1).	Concrete containment is ACCEPTABLE without repair of the item since the indication does not adversely affect the structural integrity of the concrete containment.	Repair/Replacement activity is NOT required.	NO additional examinations required outside the required CISI frequency.
2-19A/B/C/D (SA 1)	Void in patch, length = 3.0" x height = 0.5" x depth= 0.8".	Most probable cause is; improper construction practice. Patch was not properly applied.	Yes, this condition is applicable to Unit 1 and similar conditions have been observed in Unit 1 (see Table 3.7.11-1).	Concrete containment is ACCEPTABLE without repair of the item since the indication does not adversely affect the structural integrity of the concrete containment.	Repair/Replacement activity is NOT required.	NO additional examinations required outside the required CISI frequency.
2-19A/B/C/D (SA 2)	Observed corrosion on tendon can V-322 and bearing plate.	Most probable cause is; water intrusion into the tendon tunnel. Moisture/Humidity levels are very high in the tendon tunnels.	Yes, this condition is applicable to Unit 1 and similar conditions have been observed in Unit 1 (see Table 3.7.11-1).	Concrete containment is ACCEPTABLE without repair of the item since the indication does not adversely affect the structural integrity of the concrete containment.	Repair/Replacement activity is NOT required.	NO additional examinations required outside the required CISI frequency.

Table 3.7.12-2: Unit 2 Evaluation of Suspect Areas (SA) per IWL-3310						
Zone (Suspect Area No.)	**Description of Condition/ Indication**	**IWL–3310(a)** *The cause of the condition that does not meet the acceptance standards.*	**IWL-3310(b)** *The applicability of the condition to any other plants at the same site.*	**IWL-3310(c)** *The acceptability of the concrete containment without repair of the item.*	**IWL-3310(d)** *Whether or not repair/replacement activity is required and if required, the extent, method, and completion date for the repair/ replacement activity.*	**IWL-3310(e)** *Extent, nature, and frequency of additional examinations.*
2-21A (SA 1)	Spall/chip at D5-2B, length (horizontal) = 8.5" x height (vertical) = 19.0" x depth = 3.0" {identified in 2006 and 2001 (as (5) on VT report); quantitative information was not fully detailed since 2001 report; no adverse change from previous exams}.	Most probable cause is; mechanical damage from original construction and/or impact from equipment during tendon surveillances.	Yes, this condition is applicable to Unit 1 and similar conditions have been observed in Unit 1 (see Table 3.7.11-1).	Concrete containment is ACCEPTABLE without repair of the item since the indication does not adversely affect the structural integrity of the concrete containment.	Repair/Replacement activity is NOT required.	NO additional examinations required outside the required CISI frequency.
2-21A (SA 2)	Spall/chip at D5-1B, length (horizontal) = 10.3" x height (vertical) = 20.0" x depth = 2.5" {identified in 2006 and 2001 (as (7) on VT report); quantitative information was not fully detailed since 2001 report; no adverse change from previous exams}.	Most probable cause is; mechanical damage from original construction and/or impact from equipment during tendon surveillances.	Yes, this condition is applicable to Unit 1 and similar conditions have been observed in Unit 1 (see Table 3.7.11-1).	Concrete containment is ACCEPTABLE without repair of the item since the indication does not adversely affect the structural integrity of the concrete containment.	Repair/Replacement activity is NOT required.	NO additional examinations required outside the required CISI frequency.

Table 3.7.12-2: Unit 2 Evaluation of Suspect Areas (SA) per IWL-3310						
Zone (Suspect Area No.)	**Description of Condition/ Indication**	**IWL–3310(a)** *The cause of the condition that does not meet the acceptance standards.*	**IWL-3310(b)** *The applicability of the condition to any other plants at the same site.*	**IWL-3310(c)** *The acceptability of the concrete containment without repair of the item.*	**IWL-3310(d)** *Whether or not repair/replacement activity is required and if required, the extent, method, and completion date for the repair/ replacement activity.*	**IWL-3310(e)** *Extent, nature, and frequency of additional examinations.*
2-21A (SA 3)	Spall/chip at D5-2B, length (horizontal) = 20.0" x height (vertical) = 5.0" x depth = 1.5" {identified in 2006 and 2001 (as (11) on VT report); quantitative information was not fully detailed since 2001 report; no adverse change from previous exams}.	Most probable cause is; mechanical damage from original construction and/or impact from equipment during tendon surveillances.	Yes, this condition is applicable to Unit 1 and similar conditions have been observed in Unit 1 (see Table 3.7.11-1).	Concrete containment is ACCEPTABLE without repair of the item since the indication does not adversely affect the structural integrity of the concrete containment.	Repair/Replacement activity is NOT required.	NO additional examinations required outside the required CISI frequency.
2-21A (SA 4)	Spall/chip at D6-1T, length (horizontal) = 8.3" x height (vertical) = 19.5" x depth= 2.3".	Most probable cause is; mechanical damage from original construction and/or impact from equipment during tendon surveillances.	Yes, this condition is applicable to Unit 1 and similar conditions have been observed in Unit 1 (see Table 3.7.11-1).	Concrete containment is ACCEPTABLE without repair of the item since the indication does not adversely affect the structural integrity of the concrete containment.	Repair/Replacement activity is NOT required.	NO additional examinations required outside the required CISI frequency.
2-21A (SA 5)	Spall/chip at D4-14B, length (horizontal) = 2.0" x height (vertical) = 6.0" x depth= 2.0".	Most probable cause is; mechanical damage from original construction and/or impact from equipment during tendon surveillances.	Yes, this condition is applicable to Unit 1 and similar conditions have been observed in Unit 1 (see Table 3.7.11-1).	Concrete containment is ACCEPTABLE without repair of the item since the indication does not adversely affect the structural integrity of the concrete containment.	Repair/Replacement activity is NOT required.	NO additional examinations required outside the required CISI frequency.

Table 3.7.12-2: Unit 2 Evaluation of Suspect Areas (SA) per IWL-3310						
Zone (Suspect Area No.)	**Description of Condition/ Indication**	**IWL–3310(a)** *The cause of the condition that does not meet the acceptance standards.*	**IWL-3310(b)** *The applicability of the condition to any other plants at the same site.*	**IWL-3310(c)** *The acceptability of the concrete containment without repair of the item.*	**IWL-3310(d)** *Whether or not repair/replacement activity is required and if required, the extent, method, and completion date for the repair/ replacement activity.*	**IWL-3310(e)** *Extent, nature, and frequency of additional examinations.*
2-21A (SA 6)	Spall/chip at D4-1B, length (horizontal) = 8.3" x height (vertical) = 18.0" x depth= 3.5" {identified in 2006 and 2001 (as (1) on VT report); quantitative information was not fully detailed since 2001 report; no adverse change from previous exams}.	Most probable cause is; mechanical damage from original construction and/or impact from equipment during tendon surveillances.	Yes, this condition is applicable to Unit 1 and similar conditions have been observed in Unit 1 (see Table 3.7.11-1).	Concrete containment is ACCEPTABLE without repair of the item since the indication does not adversely affect the structural integrity of the concrete containment.	Repair/Replacement activity is NOT required.	NO additional examinations required outside the required CISI frequency.
2-21A (SA 7)	Spall/chip at D4-2B, length (horizontal) = 7.5" x height (vertical) = 19.0" x depth= 3.0" {identified in 2006 and 2001 (as (2) on VT report); quantitative information was not fully detailed since 2001 report; no adverse change from previous exams}.	Most probable cause is; mechanical damage from original construction and/or impact from equipment during tendon surveillances.	Yes, this condition is applicable to Unit 1 and similar conditions have been observed in Unit 1 (see Table 3.7.11-1).	Concrete containment is ACCEPTABLE without repair of the item since the indication does not adversely affect the structural integrity of the concrete containment.	Repair/Replacement activity is NOT required.	NO additional examinations required outside the required CISI frequency.

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Table 3.7.12-2: Unit 2 Evaluation of Suspect Areas (SA) per IWL-3310						
Zone (Suspect Area No.)	**Description of Condition/ Indication**	**IWL–3310(a)** *The cause of the condition that does not meet the acceptance standards.*	**IWL-3310(b)** *The applicability of the condition to any other plants at the same site.*	**IWL-3310(c)** *The acceptability of the concrete containment without repair of the item.*	**IWL-3310(d)** *Whether or not repair/replacement activity is required and if required, the extent, method, and completion date for the repair/ replacement activity.*	**IWL-3310(e)** *Extent, nature, and frequency of additional examinations.*
2-21A (SA 8)	Spall/chip at D5-1B, length (horizontal) = 9.0" x height (vertical) = 20.0" x depth = 2.8" {identified in 2006 and 2001 (as (4) on VT report; quantitative information was not fully detailed since 2001 report; no adverse change from previous exams}.	Most probable cause is; mechanical damage from original construction and/or impact from equipment during tendon surveillances.	Yes, this condition is applicable to Unit 1 and similar conditions have been observed in Unit 1 (see Table 3.7.11-1).	Concrete containment is ACCEPTABLE without repair of the item since the indication does not adversely affect the structural integrity of the concrete containment.	Repair/Replacement activity is NOT required.	NO additional examinations required outside the required CISI frequency.
2-21A (SA 9)	Spall/chip at D5-2B, length (horizontal) = 6.0" x height (vertical) = 19.0" x depth= 1.5".	Most probable cause is; mechanical damage from original construction and/or impact from equipment during tendon surveillances.	Yes, this condition is applicable to Unit 1 and similar conditions have been observed in Unit 1 (see Table 3.7.11-1).	Concrete containment is ACCEPTABLE without repair of the item since the indication does not adversely affect the structural integrity of the concrete containment.	Repair/Replacement activity is NOT required.	NO additional examinations required outside the required CISI frequency.
2-21A (SA 10)	Spall/chip at D5-3B, length (horizontal) = 5.5" x height (vertical) = 20.5" x depth = 1.8" {identified in 2006 and 2001 (as (6) on VT report); quantitative information was not fully detailed since 2001 report; no adverse change from previous exams}.	Most probable cause is; mechanical damage from original construction and/or impact from equipment during tendon surveillances.	Yes, this condition is applicable to Unit 1 and similar conditions have been observed in Unit 1 (see Table 3.7.11-1).	Concrete containment is ACCEPTABLE without repair of the item since the indication does not adversely affect the structural integrity of the concrete containment.	Repair/Replacement activity is NOT required.	NO additional examinations required outside the required CISI frequency.

Table 3.7.12-2: Unit 2 Evaluation of Suspect Areas (SA) per IWL-3310						
Zone (Suspect Area No.)	**Description of Condition/ Indication**	**IWL–3310(a)** *The cause of the condition that does not meet the acceptance standards.*	**IWL-3310(b)** *The applicability of the condition to any other plants at the same site.*	**IWL-3310(c)** *The acceptability of the concrete containment without repair of the item.*	**IWL-3310(d)** *Whether or not repair/replacement activity is required and if required, the extent, method, and completion date for the repair/ replacement activity.*	**IWL-3310(e)** *Extent, nature, and frequency of additional examinations.*
2-21A (SA 11)	Spall/chip at D6-40T, length (horizontal) = 8.5" x height (vertical) = 18.0" x depth = 3.0" {identified in 2006 and 2001 (as (10) on VT report); quantitative information was not fully detailed since 2001 report; no adverse change from previous exams}.	Most probable cause is; mechanical damage from original construction and/or impact from equipment during tendon surveillances.	Yes, this condition is applicable to Unit 1 and similar conditions have been observed in Unit 1 (see Table 3.7.11-1).	Concrete containment is ACCEPTABLE without repair of the item since the indication does not adversely affect the structural integrity of the concrete containment.	Repair/Replacement activity is NOT required.	NO additional examinations required outside the required CISI frequency.
2-21A (SA 12)	Spall/chip at D5-18C, length (horizontal) = 2.3" x height (vertical) = 6.0" x depth= 2.5".	Most probable cause is; mechanical damage from original construction and/or impact from equipment during tendon surveillances.	Yes, this condition is applicable to Unit 1 and similar conditions have been observed in Unit 1 (see Table 3.7.11-1).	Concrete containment is ACCEPTABLE without repair of the item since the indication does not adversely affect the structural integrity of the concrete containment.	Repair/Replacement activity is NOT required.	NO additional examinations required outside the required CISI frequency.

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Table 3.7.12-2: Unit 2 Evaluation of Suspect Areas (SA) per IWL-3310

Zone (Suspect Area No.)	**Description of Condition/ Indication**	**IWL–3310(a)** *The cause of the condition that does not meet the acceptance standards.*	**IWL-3310(b)** *The applicability of the condition to any other plants at the same site.*	**IWL-3310(c)** *The acceptability of the concrete containment without repair of the item.*	**IWL-3310(d)** *Whether or not repair/replacement activity is required and if required, the extent, method, and completion date for the repair/ replacement activity.*	**IWL-3310(e)** *Extent, nature, and frequency of additional examinations.*
2-21A (SA 13)	Spall/chip at D4-1T, length (horizontal) = 5.3" x height (vertical) = 16.0" x depth = 3.0" {identified in 2006 and 2001 (as (8) on VT report); quantitative information was not fully detailed since 2001 report; no adverse change from previous exams}.	Most probable cause is; mechanical damage from original construction and/or impact from equipment during tendon surveillances.	Yes, this condition is applicable to Unit 1 and similar conditions have been observed in Unit 1 (see Table 3.7.11-1).	Concrete containment is ACCEPTABLE without repair of the item since the indication does not adversely affect the structural integrity of the concrete containment.	Repair/Replacement activity is NOT required.	NO additional examinations required outside the required CISI frequency.
2-21A (SA 14)	Spall at drain line, length (horizontal) = 5.5" x height (vertical) = 2.0" x depth = 1.5".	Cause is spall due to pressure from rusted rebar passing thru the drain (poor design). This is not in scope of containment CISI and has no impact on the concrete containment.	Yes, this condition is applicable to Unit 1, but similar condition has not been observed in Unit 1.	Concrete containment is ACCEPTABLE without repair of the item since the indication is not in scope of containment CISI and does not adversely affect the structural integrity of the concrete containment.	Repair/Replacement activity is NOT required.	NO additional examinations required outside the required CISI frequency.
2-21B (SA 1)	Spall/chip at D4-40T, length (horizontal) = 6.5" x height (vertical) = 17.0" x depth = 3.5".	Most probable cause is; mechanical damage from original construction and/or impact from equipment during tendon surveillances.	Yes, this condition is applicable to Unit 1 and similar conditions have been observed in Unit 1 (see Table 3.7.11-1).	Concrete containment is ACCEPTABLE without repair of the item since the indication does not adversely affect the structural integrity of the concrete containment.	Repair/Replacement activity is NOT required.	NO additional examinations required outside the required CISI frequency.

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Table 3.7.12-2: Unit 2 Evaluation of Suspect Areas (SA) per IWL-3310						
Zone (Suspect Area No.)	**Description of Condition/ Indication**	**IWL–3310(a)** *The cause of the condition that does not meet the acceptance standards.*	**IWL-3310(b)** *The applicability of the condition to any other plants at the same site.*	**IWL-3310(c)** *The acceptability of the concrete containment without repair of the item.*	**IWL-3310(d)** *Whether or not repair/replacement activity is required and if required, the extent, method, and completion date for the repair/ replacement activity.*	**IWL-3310(e)** *Extent, nature, and frequency of additional examinations.*
2-21B (SA 2)	Spall/chip at D6-1T, length (horizontal) = 10.3" x height (vertical) = 20.3" x depth= 4.5" {identified in 2006 and 2001 (as (5) on VT report); quantitative information was not fully detailed since 2001 report; no adverse change from previous exams}.	Most probable cause is; mechanical damage from original construction and/or impact from equipment during tendon surveillances.	Yes, this condition is applicable to Unit 1 and similar conditions have been observed in Unit 1 (see Table 3.7.11-1).	Concrete containment is ACCEPTABLE without repair of the item since the indication does not adversely affect the structural integrity of the concrete containment.	Repair/Replacement activity is NOT required.	NO additional examinations required outside the required CISI frequency.
2-21B (SA 3)	Spall/chip at D6-2T, length (horizontal) = 5.0" x height (vertical) = 19.0" x depth= 2.5" {identified in 2006 and 2001 (as (5) on VT report); quantitative information was not fully detailed since 2001 report; no adverse change from previous exams}.	Most probable cause is; mechanical damage from original construction and/or impact from equipment during tendon surveillances.	Yes, this condition is applicable to Unit 1 and similar conditions have been observed in Unit 1 (see Table 3.7.11-1).	Concrete containment is ACCEPTABLE without repair of the item since the indication does not adversely affect the structural integrity of the concrete containment.	Repair/Replacement activity is NOT required.	NO additional examinations required outside the required CISI frequency.

Table 3.7.12-2: Unit 2 Evaluation of Suspect Areas (SA) per IWL-3310						
Zone (Suspect Area No.)	**Description of Condition/ Indication**	**IWL–3310(a)** *The cause of the condition that does not meet the acceptance standards.*	**IWL-3310(b)** *The applicability of the condition to any other plants at the same site.*	**IWL-3310(c)** *The acceptability of the concrete containment without repair of the item.*	**IWL-3310(d)** *Whether or not repair/replacement activity is required and if required, the extent, method, and completion date for the repair/ replacement activity.*	**IWL-3310(e)** *Extent, nature, and frequency of additional examinations.*
2-21B (SA 4)	Spall/chip at D5-39B, length (horizontal) = 8.3" x height (vertical) = 18.3" x depth = 3.0" {identified in 2006 and 2001 (as (4) on VT report); quantitative information was not fully detailed since 2001 report; no adverse change from previous exams}.	Most probable cause is; mechanical damage from original construction and/or impact from equipment during tendon surveillances.	Yes, this condition is applicable to Unit 1 and similar conditions have been observed in Unit 1 (see Table 3.7.11-1).	Concrete containment is ACCEPTABLE without repair of the item since the indication does not adversely affect the structural integrity of the concrete containment.	Repair/Replacement activity is NOT required.	NO additional examinations required outside the required CISI frequency.
2-21B (SA 5)	Spall/chip at D5-40B, length (horizontal) = 9.8" x height (vertical) = 18.8" x depth = 2.5" {identified in 2006 and 2001 (as (4) on VT report); quantitative information was not fully detailed since 2001 report; no adverse change from previous exams}.	Most probable cause is; mechanical damage from original construction and/or impact from equipment during tendon surveillances.	Yes, this condition is applicable to Unit 1 and similar conditions have been observed in Unit 1 (see Table 3.7.11-1).	Concrete containment is ACCEPTABLE without repair of the item since the indication does not adversely affect the structural integrity of the concrete containment.	Repair/Replacement activity is NOT required.	NO additional examinations required outside the required CISI frequency.

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Table 3.7.12-2: Unit 2 Evaluation of Suspect Areas (SA) per IWL-3310

Zone (Suspect Area No.)	**Description of Condition/ Indication**	**IWL–3310(a)** *The cause of the condition that does not meet the acceptance standards.*	**IWL-3310(b)** *The applicability of the condition to any other plants at the same site.*	**IWL-3310(c)** *The acceptability of the concrete containment without repair of the item.*	**IWL-3310(d)** *Whether or not repair/replacement activity is required and if required, the extent, method, and completion date for the repair/ replacement activity.*	**IWL-3310(e)** *Extent, nature, and frequency of additional examinations.*
2-21B (SA 6)	Spall/chip at D4-40B, length (horizontal) = 7.0" x height (vertical) = 21.3" x depth= 2.5" {identified in 2006 and 2001 (as (3) on VT report); quantitative information was not fully detailed since 2001 report; no adverse change from previous exams}.	Most probable cause is; mechanical damage from original construction and/or impact from equipment during tendon surveillances.	Yes, this condition is applicable to Unit 1 and similar conditions have been observed in Unit 1 (see Table 3.7.11-1).	Concrete containment is ACCEPTABLE without repair of the item since the indication does not adversely affect the structural integrity of the concrete containment.	Repair/Replacement activity is NOT required.	NO additional examinations required outside the required CISI frequency.
2-21B (SA 7)	Spall/chip at D4-39B, length (horizontal) = 10.3" x height (vertical) = 20.5" x depth = 2.5" {identified in 2006 and 2001 (as (3) on VT report); quantitative information was not fully detailed since 2001 report; no adverse change from previous exams}.	Most probable cause is; mechanical damage from original construction and/or impact from equipment during tendon surveillances.	Yes, this condition is applicable to Unit 1 and similar conditions have been observed in Unit 1 (see Table 3.7.11-1).	Concrete containment is ACCEPTABLE without repair of the item since the indication does not adversely affect the structural integrity of the concrete containment.	Repair/Replacement activity is NOT required.	NO additional examinations required outside the required CISI frequency.

Table 3.7.12-2: Unit 2 Evaluation of Suspect Areas (SA) per IWL-3310						
Zone (Suspect Area No.)	**Description of Condition/ Indication**	**IWL–3310(a)** *The cause of the condition that does not meet the acceptance standards.*	**IWL-3310(b)** *The applicability of the condition to any other plants at the same site.*	**IWL-3310(c)** *The acceptability of the concrete containment without repair of the item.*	**IWL-3310(d)** *Whether or not repair/replacement activity is required and if required, the extent, method, and completion date for the repair/ replacement activity.*	**IWL-3310(e)** *Extent, nature, and frequency of additional examinations.*
2-21B (SA 8)	Spall/chip at D4-38B, length (horizontal) = 7.3" x height (vertical) = 19.0" x depth= 2.0" {identified in 2006 and 2001 (as (3) on VT report); quantitative information was not fully detailed since 2001 report; no adverse change from previous exams}.	Most probable cause is; mechanical damage from original construction and/or impact from equipment during tendon surveillances.	Yes, this condition is applicable to Unit 1 and similar conditions have been observed in Unit 1 (see Table 3.7.11-1).	Concrete containment is ACCEPTABLE without repair of the item since the indication does not adversely affect the structural integrity of the concrete containment.	Repair/Replacement activity is NOT required.	NO additional examinations required outside the required CISI frequency.
2-21B (SA 9)	Spall/chip at D6-40T, length (horizontal) = 9.8" x height (vertical) = 19.5" x depth = 2.8" {identified in 2006 and 2001 (as (1) on VT report); quantitative information was not fully detailed since 2001 report; no adverse change from previous exams}.	Most probable cause is; mechanical damage from original construction and/or impact from equipment during tendon surveillances.	Yes, this condition is applicable to Unit 1 and similar conditions have been observed in Unit 1 (see Table 3.7.11-1).	Concrete containment is ACCEPTABLE without repair of the item since the indication does not adversely affect the structural integrity of the concrete containment.	Repair/Replacement activity is NOT required.	NO additional examinations required outside the required CISI frequency.

Table 3.7.12-2: Unit 2 Evaluation of Suspect Areas (SA) per IWL-3310						
Zone (Suspect Area No.)	**Description of Condition/ Indication**	**IWL–3310(a)** *The cause of the condition that does not meet the acceptance standards.*	**IWL-3310(b)** *The applicability of the condition to any other plants at the same site.*	**IWL-3310(c)** *The acceptability of the concrete containment without repair of the item.*	**IWL-3310(d)** *Whether or not repair/replacement activity is required and if required, the extent, method, and completion date for the repair/ replacement activity.*	**IWL-3310(e)** *Extent, nature, and frequency of additional examinations.*
2-21B (SA 10)	Spall/chip at D5-40B, length (horizontal) = 9.5" x height (vertical) = 21.5" x depth= 3.0" {identified in 2006 and 2001 (as (2) on VT report); quantitative information was not fully detailed since 2001 report; no adverse change from previous exams}.	Most probable cause is; mechanical damage from original construction and/or impact from equipment during tendon surveillances.	Yes, this condition is applicable to Unit 1 and similar conditions have been observed in Unit 1 (see Table 3.7.11-1).	Concrete containment is ACCEPTABLE without repair of the item since the indication does not adversely affect the structural integrity of the concrete containment.	Repair/Replacement activity is NOT required.	NO additional examinations required outside the required CISI frequency.
2-21B (SA 11)	Spall/chip at D5-39B, length (horizontal) = 6.5" x height (vertical) = 16.8" x depth= 1.5" {identified in 2006 and 2001 as (2) on VT report); quantitative information was not fully detailed since 2001 report; no adverse change from previous exams}.	Most probable cause is; mechanical damage from original construction and/or impact from equipment during tendon surveillances.	Yes, this condition is applicable to Unit 1 and similar conditions have been observed in Unit 1 (see Table 3.7.11-1).	Concrete containment is ACCEPTABLE without repair of the item since the indication does not adversely affect the structural integrity of the concrete containment.	Repair/Replacement activity is NOT required.	NO additional examinations required outside the required CISI frequency.
2-22A (SA 1)	Spall at previously repaired section, length (horizontal) = 36.0" x height (vertical) = 2.0" x depth= 1.5".	Most probable cause is; improper construction at the joint and poor previous repair.	Yes, this condition is applicable to Unit 1 and similar conditions have been observed in Unit 1 (see Table 3.7.11-1).	Concrete containment is ACCEPTABLE without repair of the item since the indication does not adversely affect the structural integrity of the concrete containment.	Repair/Replacement activity is NOT required.	NO additional examinations required outside the required CISI frequency.

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Table 3.7.12-2: Unit 2 Evaluation of Suspect Areas (SA) per IWL-3310						
Zone (Suspect Area No.)	**Description of Condition/ Indication**	**IWL–3310(a)** *The cause of the condition that does not meet the acceptance standards.*	**IWL-3310(b)** *The applicability of the condition to any other plants at the same site.*	**IWL-3310(c)** *The acceptability of the concrete containment without repair of the item.*	**IWL-3310(d)** *Whether or not repair/replacement activity is required and if required, the extent, method, and completion date for the repair/ replacement activity.*	**IWL-3310(e)** *Extent, nature, and frequency of additional examinations.*
2-22A (SA 2)	Popout, length = 2.0" x height = 1.8" x depth= 0.5" {identified in 2001 as (18) on VT report. Quantitative information was not fully detailed since 2001 report; no change from previous exams}.	Most probably from original construction. Popouts can result from internal surface pressure due to a swelling of a porous aggregate that absorbs moisture or freezes.	Yes, this condition is applicable to Unit 1 and similar conditions have been observed in Unit 1 (see Table 3.7.11-1).	Concrete containment is ACCEPTABLE without repair of the item since the indication does not adversely affect the structural integrity of the concrete containment.	Repair/Replacement activity is NOT required.	NO additional examinations required outside the required CISI frequency.
2-24 (SA 1)	Spall, length = 24.0" x height = 2.5" x depth = 1.0".	Most probable cause is; improper construction at the joint.	Yes, this condition is applicable to Unit 1 and similar conditions have been observed in Unit 1 (see Table 3.7.11-1).	Concrete containment is ACCEPTABLE without repair of the item since the indication does not adversely affect the structural integrity of the concrete containment.	Repair/Replacement activity is NOT required.	NO additional examinations required outside the required CISI frequency.
2-24 (SA 2)	Localized section of popouts, diameter = 1.5" - 2.8" and depth = 0.3" - 0.5".	Most probably from original construction. Popouts can result from internal surface pressure due to a swelling of a porous aggregate that absorbs moisture or freezes.	Yes, this condition is applicable to Unit 1 and similar conditions have been observed in Unit 1 (see Table 3.7.11-1).	Concrete containment is ACCEPTABLE without repair of the item since the indication does not adversely affect the structural integrity of the concrete containment.	Repair/Replacement activity is NOT required.	NO additional examinations required outside the required CISI frequency.

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Table 3.7.12-2: Unit 2 Evaluation of Suspect Areas (SA) per IWL-3310

Zone (Suspect Area No.)	**Description of Condition/ Indication**	**IWL–3310(a)** *The cause of the condition that does not meet the acceptance standards.*	**IWL-3310(b)** *The applicability of the condition to any other plants at the same site.*	**IWL-3310(c)** *The acceptability of the concrete containment without repair of the item.*	**IWL-3310(d)** *Whether or not repair/replacement activity is required and if required, the extent, method, and completion date for the repair/ replacement activity.*	**IWL-3310(e)** *Extent, nature, and frequency of additional examinations.*
2-D (SA 1)	Void, length = 4.0" x height= 1.5" x depth = 2.0" {identified in 2006 as (2) on VT report; documented dimensions show small change from previous exams}.	Most probable cause is; improper construction at the joint. See Note 1 for explanation of difference in size measurements.	Yes, this condition is applicable to Unit 1 and similar conditions have been observed in Unit 1 (see Table 3.7.11-1).	Concrete containment is ACCEPTABLE without repair of the item since the indication does not adversely affect the structural integrity of the concrete containment.	Repair/Replacement activity is NOT required.	NO additional examinations required outside the required CISI frequency.
2-D (SA 2)	Spall, length = 16.0" x height= 0.8" x depth = 0.5".	Most probable cause is; improper construction at the joint.	Yes, this condition is applicable to Unit 1 and similar conditions have been observed in Unit 1 (see Table 3.7.11-1).	Concrete containment is ACCEPTABLE without repair of the item since the indication does not adversely affect the structural integrity of the concrete containment.	Repair/Replacement activity is NOT required.	NO additional examinations required outside the required CISI frequency.
2-F (SA 1)	Void, length= 4.0" x height = 1.0" x depth = 0.3" {identified in 2006 as (5) on VT report; no change from previous exams}.	Most probably from original construction. Voids can result from internal surface pressure due to a swelling of a porous aggregate that absorbs moisture or freezes.	Yes, this condition is applicable to Unit 1 and similar conditions have been observed in Unit 1 (see Table 3.7.11-1).	Concrete containment is ACCEPTABLE without repair of the item since the indication does not adversely affect the structural integrity of the concrete containment.	Repair/Replacement activity is NOT required.	NO additional examinations required outside the required CISI frequency.

Table 3.7.12-2: Unit 2 Evaluation of Suspect Areas (SA) per IWL-3310						
Zone (Suspect Area No.)	**Description of Condition/ Indication**	**IWL–3310(a)** *The cause of the condition that does not meet the acceptance standards.*	**IWL-3310(b)** *The applicability of the condition to any other plants at the same site.*	**IWL-3310(c)** *The acceptability of the concrete containment without repair of the item.*	**IWL-3310(d)** *Whether or not repair/replacement activity is required and if required, the extent, method, and completion date for the repair/ replacement activity.*	**IWL-3310(e)** *Extent, nature, and frequency of additional examinations.*
2-F (SA 2)	Multiple voids within 5' x 5' area, largest void length = 2.0" x height = 3.0" x depth = 1.0" {identified in 2006 (as (2) on VT report) and 2001 (as (2) on VT report); no change from previous exams}.	Most probably from original construction. Most probable cause for small voids; entrapment of air bubbles at the form surface during placement.	Yes, this condition is applicable to Unit 1 and similar conditions have been observed in Unit 1 (see Table 3.7.11-1).	Concrete containment is ACCEPTABLE without repair of the item since the indication does not adversely affect the structural integrity of the concrete containment.	Repair/Replacement activity is NOT required.	NO additional examinations required outside the required CISI frequency.

Note 1: The Recorded Indications (RI) identified in the 2016 CISI (Inservice Inspection) that did not meet the 2nd Tier acceptance criteria (Suspect Areas) were compared to the corresponding RIs identified in previous CISIs performed in 2001, 2006, and 2011, for the same Zone. There were some differences noticed among the RIs from 2016 CISI and those of previous CISIs. These differences were found to be acceptable and determined not to be due to physical changes or time dependent degradations, rather they were as a result of the following:

- RIs are documented in more detail in the 2016 report and in accordance with newly issued EGC procedure.
- The forms used for documenting the 2011 and 2016 CISIs are more detailed than the forms used in the 2001 and 2006 CISIs.
- The difference in size measurements in comparison to the ones from the previous CISIs is attributed to an irregular shape spall, void, pop-out, etc., being measured by different inspectors using different tools, rather than time dependent degradation.

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3.7.13 Tendon Surveillance Assessment, June 2009

This report details the 2009 BYR Unit 1 (Visual) and Unit 2 (Physical) 25th Year containment structure post tensioning systems tendon surveillance. The surveillance program is a systematic means of assessing the quality and structural performance of the post tensioning systems.

The tendon surveillance program consists of a periodic inspection of the condition of a selected group of tendons. This program provides confidence in the condition and functional capability of the system, and an opportunity for timely corrective measures if adverse conditions are detected. This surveillance period consisted of a Physical and Visual Inspection of the post tensioning system on Unit 2 and a Visual Inspection only on Unit 1.

Physical tendon surveillance consists of sheathing filler inspection and testing, thread measurement, anchorage inspection, concrete inspection around tendons, force monitoring, inspection and tensile testing of removed wire samples (for detensioned tendons), retensioning of detensioned tendons and replacement of sheathing filler after completion of all inspections. A visual inspection consists only of sheathing filler inspection and testing, anchorage inspection, concrete inspection around tendons and replacement of sheathing filler after completion of all inspections.

BYR is currently committed to meet the requirements of the ASME, B&PV Code, Section XI, Subsection IWL, 2001 Edition with 2003 Addenda, and the applicable amendments as specified in 10 CFR 50.55a.

Due to accessibility issues, tendon H-5-ED of Unit 2 could not be physically inspected. Tendon H-12-ED was chosen as the replacement physical inspection, and tendon H-5-ED received a visual inspection only.

Summary

The results of this containment structures' post tensioning investigation are summarized as follows:

1. The sheathing filler (grease) samples were tested and found to have acceptable levels of water-soluble ions (Chlorides, Nitrates, and Sulfides). The moisture contents were all below the acceptable limit of 10% water by weight. All neutralization numbers were above the IWL requirement of 0.0 mg KOH/g and acceptable.

2. Water was observed during the removal of three Unit 2 tendons. Horizontal tendons H-1-FE and H-2-FE were observed having less than 8 ounces of water, while tendon D6-08 was observed having ¾ gallons (96 ounces) of water. The conditions were recorded and transmitted to BYR's engineering department. There was no evidence of water in any of the other tendons inspected.

3. Acceptable corrosion levels were found on all inspected tendon ends and no cracks were found on any anchorage components.

4. No tendon was found with additional unreported missing or protruding buttonheads.

5. All thread measurements taken were found acceptable. Thread measurements were taken to ensure that the external threads of a tendon anchorage meet the minimum fit required to develop the necessary stressing loads when coupled with a specific stressing adaptor.

6. The hydraulic jacks used for lift-offs, detensioning and retensioning were calibrated before and after the surveillance and found to be within an acceptable variation of +/- 1.5%.

7. All physical surveillance tendons monitored for forces this inspection period were found to have lift-off forces greater than 95% of their corresponding predicted force.

8. The detensioned tendons were retensioned with acceptable elongations to acceptable force levels. All test wires removed from detensioned tendons were found to have acceptable corrosion levels. All tendon test wire samples had acceptable diameter, yield stress, ultimate stress and elongation results.

9. All tendons were resealed and regreased to acceptable levels.

10. A comparison of "as-found" force levels to the original force levels was made in an effort to detect any evidence of system degradation. The Unit 2 force loss percentages since original installation for each tendon group are reported as 18.94% for the hoop tendons, 16.66% for the vertical tendons, and 16.09% for the dome tendons. No force comparison was made on Unit 1 due to the visual inspection only performed on this unit.

11. A stressing trend (regression) analysis was performed on each group of Unit 2 tendons using the current and all previous lift-off data. The analysis results show all groups' forces staying above the required minimum design force beyond the next surveillance, as well as beyond 60 years of plant life.

Based on the data gathered during the 2009 EGC BYR Unit 1 (Visual) and Unit 2 (Physical) 25th year containment structure post tensioning systems inspection the conclusion is reached that no abnormal degradation of either post tensioning system has occurred.

Conclusion

A review of this surveillance was conducted per IWL-3220, Unbonded Post-Tensioning Systems, and is outlined below:

IWL-3221 Acceptance by Examination

IWL-3221.1 Tendon Force and Elongation. Tendon forces and elongation are acceptable if the following conditions are met:

(a) The average of all measured tendon forces, including those measured in IWL-3221.1(b)(2), for each type of tendon is equal to or greater than the minimum required prestress specified at the anchorage for that type of tendon.

Results: All of the group averages for each group of tendons monitored were above the minimum design force. On Unit 2 Hoop tendons were 4.61% above the required minimum design force (1110 kips), while vertical tendons were 13.0% above (1060 kips) and the dome tendons were 8.76% above minimum design (1110 kips). No physical surveillance was performed on Unit 1 tendons.

b) The measured force in each individual tendon is not less than 95% of the predicted force unless the following conditions are satisfied:

(1) The measured force in not more than one tendon is between 90% and 95% of the predicted force.

(2) The measured forces in two tendons located adjacent to the tendon in IWL-3221.1(b)(1) are not less than 95% of the predicted forces.

(3) For tendons requiring augmented examination in accordance with Table IWL-2521-2, Item L2-10, the measured forces in two like tendons located nearest to but on opposite sides of the tendon described in IWL-3221-1(b)(1) are not less than 95% of the predicted forces.

(4) The measured forces in all the remaining sample tendons are not less than 95% of the predicted force.

Results: All of the tendon lift-offs were above 95% of the Predicted Force and were deemed acceptable.

c) The prestressing forces for each type of tendon measured in IWL-3221.1(a) and (b), and the measurement from the previous examination, indicate a prestress loss such that predicted tendon forces meet the minimum design prestress forces at the next scheduled examination.

Results: Regression analysis for Unit 2 shows force levels remaining above minimum design beyond the next surveillance interval as well as beyond 60 years.

d) The measured tendon elongation varies from the last measurement, adjusted for wires or strands, by less than 10%.

Results: All tendons, which were detensioned exhibited elongations within 10% of their original elongation values when they were restressed and are deemed acceptable.

IWL-3221.2 Tendon Wire or Strand Samples. The condition of wire or strand samples is acceptable if:

(a) Samples are free of physical damage.

Results: All of the tendon wire test samples were free of physical damage.

(b) Sample ultimate tensile strength and elongation are not less than minimum specified values.

Results: All of the tendon test wire samples had acceptable values for ultimate tensile stress (≥ 240 ksi) and elongation at failure (≥ 4%).

IWL-3221.3 Tendon Anchorage Areas. The condition of tendon anchorage areas is acceptable if:

(a) There is no evidence of cracking in anchor heads, shims, or bearing plates;

Results: Detailed inspections did not reveal any cracks in the anchorage components for any inspected tendon end.

(b) There is no evidence of active corrosion;

Results: Detailed inspections did not reveal active corrosion on the anchorage components for any inspected tendon end. All corrosion conditions were level 1 and level 2 (on a scale of 5) and acceptable.

(c) Broken or unseated wires, broken strands, and detached buttonheads were documented and accepted during a preservice examination or during a previous in-service examination;

Results: All missing or protruding buttonheads found had been previously reported and accepted.

(d) Cracks in the concrete adjacent to the bearing plates do not exceed 0.01 in. (0.3 mm) in width;

Results: No cracks exceeding 0.010" were detected in the 24" of concrete adjacent to the bearing plates.

(e) There is no evidence of free water.

Results: Three Unit 2 tendons were found to have water inside the grease cap:

- The shop end of tendons H-1-FE and H2-FE were both find with "Observable Moisture" (less than 8 oz.) after grease cap removal.
- The field end of tendon D6-08 was found with "Significant Moisture" (0.75 gal. of water) after grease cap removal.
- A 1000ml sample was collected for testing from the field end of tendon D6-08.

These findings were recorded and reported to the BYR Engineering Department.

IWL-3221.4 Corrosion Protection Medium. Corrosion protection medium is acceptable when the reserve alkalinity, water content, and soluble ion concentrations of all samples are within the limits specified in Table IWL-2525-1. The absolute difference between the amount removed and the amount replaced shall not exceed 10% of the tendon net duct volume.

Results: All sheathing filler (grease) samples were tested and found to have acceptable levels of water-soluble ions (Chlorides, Nitrates, and Sulfides). All neutralization numbers were above the IWL requirement of 0.0 mg potassium hydroxide/gram (KOH/g) and acceptable. Water content values were below 10% by weight and acceptable for all samples tested. No tendon accepted more than 10% of its net duct volume more than was removed and all refills were acceptable.

Based upon the evaluation of the Inservice Inspection results for the BYR Unit 1 (Visual) and Unit 2 (Physical) 25th Year Containment Building Tendon Surveillance reported herein, the containment structures have experienced no abnormal degradation of their respective post-tensioning systems. The containment post-tensioning systems are performing in accordance with the design requirements and are expected to continue to do so for the life of the units.

3.7.14 Tendon Surveillance Assessment, August 2014

This report details the 30th Year BYR Units 1 and 2 containment structure post-tensioning system IWL Tendon Surveillance. The surveillance program is a systematic means of assessing the quality and structural performance of the post-tensioning system.

The tendon surveillance program consists of a periodic inspection of the condition of a selected group of tendons. This program provides confidence in the condition and functional capability of the system, and an opportunity for timely corrective measures if adverse conditions are detected. This surveillance period consisted of a visual and physical inspection of the three tendon groups (domes, hoops, and verticals). Visual tendon surveillance consists of sheathing filler inspection and testing, inspection for water, anchorage inspection, concrete inspection around tendons, and replacement of grease after completion of all inspections. Physical tendon surveillance consists of a visual inspection, force monitoring, and testing of removed wire samples for detensioned tendons.

BYR TS, 10 CFR 50.55a, and ASME Section XI, Subsection IWL, 2001 Edition with 2003 Addenda define the specific requirements for the selection of the inspection tendons, as well as specific requirements and acceptance criteria for the performance of the inspection.

Fourteen (14) tendons were included in the scope for Unit 1 for physical inspections. Sixteen (16) tendons were included in the scope for Unit 2 for visual inspections. Six (6) additional tendons had grease cap gaskets replaced on Unit 1.

Summary

The results of this containment structures' post tensioning investigation are summarized as follows:

1. Acceptable corrosion levels (1 or 2) were found on all selected tendon ends, and no cracks were found on anchorage components.

2. After removal of the cap, observable moisture was found in Unit 2 on shop ends of tendons H1-FE and H2-FE. Additionally, significant moisture was found on field ends of tendons D6-08 and H1-FE. Water Content Notification Letters were issued for each instance. No moisture or free water was found on any other tendon end.

3. The sheathing filler (grease) samples were sent for chemical analysis to determine levels of chlorides, nitrates, and sulfides, as well as moisture content and neutralization numbers. All samples were found to be within the specified acceptance criteria. The moisture contents for all Units 1 and 2 tendons were found to have values well below the acceptable limit of 10% by water weight. All neutralization numbers were above the IWL requirement of 17.5 mg KOH/g.

4. After removal of grease caps, the inspected tendon ends were found to have no previously unreported missing or protruding buttonheads or wires for any tendon end inspected in this surveillance.

5. A detailed visual inspection was performed within a 24" perimeter of concrete surrounding the bearing plate of each tendon end inspected. No concrete cracks greater than 0.010" wide were found at any surveillance tendon end.

6. No tendons were found to have lift-off force values below the predicted lift-off force.

7. The detensioned tendons were retensioned to acceptable force levels, per IWL-2523.3.

8. All tendon elongation measurements were acceptable during tendon restoration.

9. The first test of the 3rd segment of tendon D1-38 wire resulted in a wire elongation percentage of 3.1, which is smaller than the ASTM A421 specified minimum of 4.0% elongation at sample failure. The second test of the 3rd segment of the wire sample resulted in an elongation percentage of 4.6. This result was documented and submitted to the plant utility through a non-conformance report.

   The first and second tests of the 1st segment of tendon H57-CB wire resulted in elongation percentages of 3.2 and 3.8, respectively – both of which are smaller than the ASTM A431 specified minimum of 4.0% elongation at sample failure. This result was documented and submitted to the plant utility through a non-conformance report.

   Elongation percentage was at or above the ASTM A421 specified minimum of 4.0% for all other wire samples tested.

   All sample test wires were found to have acceptable corrosion levels, diameter, yield strength, and ultimate strength.

10. All inspected tendons were resealed and greased to acceptable levels.

11. The hydraulic jacks used for tendon lift-offs were calibrated before and after the surveillance period and were found to be within an acceptable variation of +/- 1.50%.

12. A comparison of the "as-found" force levels to the original force levels was made in an effort to detect and evidence of system degradation. The force loss percentages since the original installation for each tendon group are reported as 13.76% for the dome tendons, 16.33% for the hoop tendons, and 12.84% for the vertical tendons.

13. Steam Generator Repair (SGR) replacement tendons were considered separately, as the installation force losses for this group of tendons took place over a different time period (1998 to 2014). The average force loss percentages for this tendon group are reported as 5.06% for the SGR hoop tendons and 5.98% for the SGR vertical tendons. Additionally, a regression analysis was done to verify that prestress force losses did not result in values below the design minimum. Both of these analyses indicate that no abnormal average force differences were observed during this surveillance period.

The post-tensioning system for BYR Units 1 and 2 continues to meet the design requirements. No abnormal degradation of the tendons or containment concrete was observed or recorded during this surveillance.

<u>Conclusion</u>

A review of this surveillance was conducted per IWL-3220, Unbonded Post-Tensioning Systems, and is outlined below:

ATTACHMENT 1b
Description and Assessment

IWL-3221 Acceptance by Examination

IWL-3221.1 Tendon Force and Elongation. Tendon forces and elongation are acceptable if the following conditions are met:

(a) The average of all measured tendon forces, including those measured in IWL-3221.1(b)(2), for each type of tendon is equal to or greater than the minimum required prestress specified at the anchorage for that type of tendon.

Results: The average of all measured tendon forces was above the minimum required prestress force:

- Unit 1 Original Scope Dome Tendons had an average lift-off value of 1234.0 kips, which exceeds the Minimum Design value of 1183.4 kips.
- Unit 1 Original Scope Hoop Tendons had an average lift-off value of 1193.4 kips, which exceeds the Minimum Design value of 1152.0 kips.
- Unit 1 Original Scope Vertical Tendons had an average lift-off value of 1242.2 kips, which exceeds the Minimum Design value of 1186.1 kips.

All lift-off forces exceeded their respective Minimum Predicted Forces.

(b) The measured force in each individual tendon is not less than 95% of the predicted force unless the following conditions are satisfied:

(1) The measured force in not more than one tendon is between 90% and 95% of the predicted force.

(2) The measured forces in two tendons located adjacent to the tendon in IWL-3221.1(b)(1) are not less than 95% of the predicted forces.

(3) For tendons requiring augmented examination in accordance with Table IWL-2521-2, Item L2-10, the measured forces in two like tendons located nearest to but on opposite sides of the tendon described in IWL-3221-1(b)(1) are not less than 95% of the predicted forces.

(4) The measured forces in all the remaining sample tendons are not less than 95% of the predicted force.

Results: All of the tendon lift-off forces were found within the acceptable limits.

(c) The prestressing forces for each type of tendon measured in IWL-3221.1(a) and (b), and the measurement from the previous examination, indicate a prestress loss such that predicted tendon forces meet the minimum design prestress forces at the next scheduled examination.

Results: Based upon an evaluation of the regression data for Unit 1, it can be seen that the tendons from all three groups (domes, hoops, and verticals) are expected to remain above the minimum design force

values until the next surveillance interval.

(d) The measured tendon elongation varies from the last measurement, adjusted for wires or strands, by less than 10%.

Results: All tendon elongation measurements were found within the acceptable limits.

IWL-3221.2 Tendon Wire or Strand Samples. The condition of wire or strand samples is acceptable if:

(a) Samples are free of physical damage;

Results: All test wire samples collected for this inspection were found to have acceptable corrosion levels and were free of physical damage.

(b) Sample ultimate tensile strength and elongation are not less than minimum specified values.

Results: The first test of the 3rd segment of tendon D1-38 wire resulted in an elongation percentage of 3.1, which is smaller than the SATM A421 specified minimum elongation of 4.0% elongation at sample failure. The second test of the 3rd segment of the wire sample resulted in an elongation percentage of 4.6. This result was documented and submitted to the plant utility through a non-conformance report.

The first and second tests of the 1st segment of tendon H57-CB wire resulted in elongation percentages of 3.2 and 3.8, respectively – both of which are smaller than the ASTM A421 specified minimum of 4.0% elongation at sample failure. This result was documented and submitted to the plant utility through a non-conformance report.

All other test wire samples had acceptable elongation percentages (≥ 4.0%).

All test wire samples had acceptable results for ultimate tensile stress (≥ 240 ksi) and yield strength (≥ 204 ksi).

IWL-3221.3 Tendon Anchorage Areas. The condition of tendon anchorage areas is acceptable if:

(a) There is no evidence of cracking in anchor heads, shims, or bearing plates;

Results: Detailed inspections did not reveal any cracks in the anchorage components on any inspected tendon end.

(b) There is no evidence of active corrosion;

Results: All tendon end anchorage components, including all bearing plates were found with acceptable corrosion levels.

(c) Broken or unseated wires, broken strands, and detached buttonheads were documented and accepted during a preservice examination or during a previous in-

service examination;

Results: No previously unreported missing or protruding buttonheads were discovered on any tendon end inspected in this surveillance.

(d) Cracks in the concrete adjacent to the bearing plates do not exceed 0.01 in. (0.3 mm) in width;

Results: No cracks exceeding 0.010" were detected in the 24" of concrete adjacent to the bearing plates on any inspected surveillance tendon end.

(e) There is no evidence of free water.

Results: After removal of the cap, observable moisture was found in Unit 2, on shop ends of tendons H1-FE and H2-FE. Additionally, significant moisture was found on field ends of tendons D6-08 and H1-FE. Water Notification Letters were issued in each instance. No water was exhibited inside the grease cap or on any other anchorage component during the inspection of any other tendon end.

IWL-3221.4 Corrosion Protection Medium. Corrosion protection medium is acceptable when the reserve alkalinity, water content, and soluble ion concentrations of all samples are within the limits specified in Table IWL-2525-1. The absolute difference between the amount removed and the amount replaced shall not exceed 10% of the tendon net duct volume.

Results: All sheathing filler (grease) samples were tested and found to have acceptable levels of water-soluble ions (Chlorides, Nitrates, and Sulfides). The moisture contents for all tendon ends were below the acceptable limit of 10% by water weight. All neutralization numbers were above the IWL requirements.

No tendon accepted more than 10% of its net duct volume, and all refills were acceptable.

Based upon the evaluation of the Inservice Inspection results for the BYR Unit 1 (Physical) and Unit 2 (Visual) 30th Year Containment Building Tendon Surveillance reported herein, the containment structures did not reveal abnormal degradation of the post-tensioning systems. The containment structure post-tensioning systems continue to meet the design requirements. The prestress loss trends indicate that the containment structures will continue to meet the design requirements beyond the projected 60-year life of the units.

3.7.15 Containment Modifications

No major containment modifications have been performed since the last ILRTs in 2012 (Unit 1) and 2014 (Unit 2). Steam generator replacement on BYR Unit 1 was completed in 1998 (B1R08). An ILRT was performed after completion of the Unit 1 steam generator replacement during B1R08 to verify containment integrity (Reference Section 3.1.5 of this submittal). The BYR Unit 2 steam generators have not been replaced and there are no plans to replace them. There are no plans to replace the reactor heads on Unit 1 or Unit 2 and there are no other major containment modifications planned that would require the performance of an ILRT or Structural Integrity Test (SIT).

3.8 License Renewal Aging Management

By letter dated May 29, 2013, EGC requested renewal of Operating Licenses NPF-37 and NPF-66 for BYR, Units 1 and 2, respectively, for a period of 20 years beyond the current expiration dates of midnight October 31, 2024, for Unit 1 and November 6, 2026 for Unit 2.

An SE was issued by the NRC on July 6, 2015 (Reference 37), and the Renewed Facility Operating License was issued for BYR, Units 1 and 2 (Operating License Nos. NPF-37 and NPF-66, respectively). The BYR Period of Extended Operation (PEO) is effective from October 31, 2024, through October 31, 2044, for Unit 1, and from November 6, 2026, through November 6, 2046, for Unit 2.

License renewal commitments are currently tracked in a supplement to the BYR UFSAR, Appendix F, as required per 10 CFR 54.21(d), and describe enhancements to the ISI Programs beyond the requirements of ASME Section XI. Credit taken for inspections that satisfy pre-PEO requirements cannot be performed more than 10 years prior to the start of the PEO. The following programs, which are part of the supporting basis of this LAR, are also AMPs at BYR.

3.8.1 Aging Management Programs (AMPs)

Appendix J Program

The 10 CFR 50, Appendix J AMP is an existing performance monitoring program that monitors leakage rates through the containment pressure boundary, including the containment liner, associated welds, penetrations, fittings, and other access openings, in order to detect degradation of the containment pressure boundary. Corrective actions are taken if leakage rates exceed acceptance criteria. The Primary Containment Leakage Rate Testing Program (CLRT) provides for aging management of pressure boundary degradation for electrical penetration assemblies, mechanical penetrations, penetration bellows and sleeves, the containment liner, bolting, personnel airlock, equipment hatch, and seals, gaskets, and MBs, due to aging effects from the loss of material, loss of sealing, loss of leak tightness, loss of preload, or cracking in systems penetrating containment. Consistent with the current licensing basis, the CLRTs are performed in accordance with the regulations and guidance provided in 10 CFR 50, Appendix J, Option B; RG 1.163, "Performance-Based Containment Leak-Test Program;" NEI 94-01, "Industry Guideline for Implementing Performance-Based Option of 10 CFR Part 50, Appendix J;" and ANSI/ANS 56.8, "Containment System Leakage Testing Requirements."

CLRTs are performed to assure that leakage through the containment, and systems and components penetrating primary containment, does not exceed allowable leakage limits specified in the TS. An ILRT is performed during a period of reactor shutdown at a frequency based on the historical performance of the overall containment system. LLRTs are performed on containment isolation valves and containment access penetrations at frequencies that comply with the requirements of 10 CFR 50, Appendix J, Option B.

ASME Section XI, Subsection IWE Program

The ASME Section XI, Subsection IWE AMP is an existing program based on ASME Section XI, Subsection IWE requirements and complies with the provisions of 10 CFR 50.55a. This program is in accordance with ASME Section XI, Subsection IWE, 2007 Edition through the 2008 Addenda.

The program consists of periodic visual and volumetric examination of pressure retaining components of steel and concrete containments for signs of degradation, assessment of damage, and corrective

actions. The program includes aging management of surfaces and components such as bolting for containment closure, containment liner, containment penetrations (electrical, instrumentation, and control assemblies), mechanical penetrations, penetration bellows at the containment boundary, penetration sleeves at the containment boundary, and the personnel airlock and equipment hatch. The MB, which is a sealant between the bottom of the containment liner and the base mat, is included within the scope of the program.

Examination methods include visual and volumetric testing as required by ASME Section XI, Subsection IWE. Observed conditions that have the potential for impacting an intended function are evaluated for acceptability in accordance with ASME requirements and corrected in accordance with corrective action program.

The ASME Section XI, Subsection IWE AMP will be enhanced to:

1. Provide guidance for specification of bolting material, lubricant and sealants, and installation torque or tension to prevent or mitigate degradation and failure of structural bolting.

2. Use the condition of the embedded reinforcing steel at the inner surface of the tendon tunnel as a representative indicator for the potential for corrosion at the exterior surface of the containment liner plate. Use the results of Structures Monitoring (B.2.1.34) AMP, Enhancement 16 activities and results from ongoing examinations of the tendon tunnel performed as part of the ASME Section XI, Subsection IWL (B.2.1.30) and Structures Monitoring (B.2.1.34) AMPs to identify changing conditions. Changing conditions consisting of the identification of significant corrosion of embedded steel in the tendon tunnel structure require an evaluation to determine if augmented examinations in accordance with requirements of IWE-1240, "Surface Areas Requiring Augmented Examination," are required due to the potential for accelerated corrosion at the exterior surface of the containment liner plate.

These enhancements will be implemented prior to the period of extended operation.

<u>ASME Section XI, Subsection IWL Program</u>

The ASME Section XI, Subsection IWL AMP is an existing program that consists of (a) periodic visual inspection of concrete surfaces for reinforced and unbonded, prestressed concrete containments, and (b) periodic visual inspection and sample tendon testing of unbonded post-tensioning systems for prestressed concrete containments for signs of degradation, assessment of damage, and corrective actions, and testing of the tendon corrosion protection medium and free water. Measured tendon lift-off forces are compared to predicted tendon forces calculated in accordance with RG 1.35.1 (Reference 34).

Reinforced concrete surfaces are inspected for material degradation, including loss of material, cracking, increase in porosity and permeability, and loss of bond. A sample of each tendon wire type (vertical, hoop, dome) for the post-tensioning system is tested for loss of prestress. One tendon wire of each type is also examined for loss of material and subject to physical testing to determine yield strength, ultimate tensile strength, and elongation. The end anchorage for the unbonded post-tensioning system is inspected for loss of material.

This program is in accordance with ASME Section XI, Subsection IWL, 2007 Edition through the 2008 addenda, and complies with the provisions of 10 CFR 50.55a.

The ASME Section XI, Subsection IWL AMP will be enhanced to:

1. Include additional augmented examination requirements after post-tensioning system repair/replacement activities in accordance with Table IWL-2521-2.

2. Explicitly require that areas of concrete deterioration and distress be recorded in accordance with the guidance provided in ACI 349.3R. The visual resolution capability of direct and remote examination techniques will be sufficient to detect concrete degradation at the levels described in Chapter 5 of ACI 349.3R. The resolution capability of the optical aids used for remote examinations will be demonstrated as equivalent to direct visual examination.

3. Include quantitative acceptance criteria, based on the "Evaluation Criteria" provided in Chapter 5 of ACI 349.3R, that will be used to augment the qualitative assessment of the Responsible Engineer. In addition, the Responsible Engineer will confirm that the visual resolution capability used for the concrete Containment Structure examinations was sufficient to evaluate the examination results against the quantitative acceptance criteria described in Chapter 5 of ACI 349.3R.

These enhancements will be implemented prior to the period of extended operation.

Protective Coating Monitoring and Maintenance Program

The Protective Coating Monitoring and Maintenance Program is an existing condition monitoring program that provides for aging management of Service Level I coatings inside BYR containments including selection, application, inspection, and maintenance. The program is comparable to RG 1.54, Revision 2. The failure of the Service Level I coatings could adversely affect the operation of the ECCS by clogging the ECCS suction strainers. Proper maintenance of the Service Level I coating ensures that coating degradation will not impact the operability of the ECCS systems. The program includes a visual examination of all reasonably accessible Service Level I coatings inside containment during every refueling outage and includes assessment and repair for any condition that adversely affects the intended function of Service Level I coatings.

Service Level I coatings will prevent or minimize the loss of material due to corrosion, but these coatings are not credited for managing the effects of corrosion for the carbon steel containment liners and components at BYR. This program ensures that the Service Level I coatings maintain adhesion so as to not affect the intended function of the ECCS suction strainers.

The program also provides controls over the amount of unqualified coating which is defined as coating inside the containment that has not passed the required laboratory testing, including irradiation and simulated DBA conditions. Unqualified coating(s) may fail in a way to affect the intended function of the ECCS suction strainers. Therefore, the quantity of unqualified coating is controlled to ensure that the amount of unqualified coating in the containment is kept within acceptable design limits.

The Protective Coating Monitoring and Maintenance Program is an existing program that is consistent with NUREG-1801, Revision 2, AMP XI.S8 (Revision 29), with enhancements as described below:

1. Add recurring work orders requiring Service Level I coating inspections every refuel outage.

2. Require qualification of coating inspectors to ASTM D 5498.

3. Require qualification of personnel in accordance with ASTM D 7108.

4. Incorporate guidance for inspection and maintenance of Service Level I coatings per RG 1.54 and impose ASTM D5163-08 requirements for Service Level I coatings condition assessment, reporting, evaluation, and documentation.

5. Require thorough visual inspections of all coatings near sumps or screens associated with the ECCS by the coatings inspector(s).

6. Specify instruments and equipment that may be needed for Service Level I coatings inspections.

These enhancements will be implemented prior to the period of extended operation.

3.9 NRC SE Limitations and Conditions

3.9.1 Limitations and Conditions Applicable to NEI 94-01, Revision 2-A

The NRC staff found that the use of NEI TR 94-01, Revision 2, was acceptable for referencing by licensees proposing to amend their TS to permanently extend the ILRT surveillance interval to 15 years, provided the following conditions as listed in Table 3.9.1-1 are satisfied:

Table 3.9.1-1: NEI 94-01, Revision 2-A, Limitations and Conditions

Limitation/Condition (from Section 4.0 of SE)	BYR Response
For calculating the Type A leakage rate, the licensee should use the definition in the NEI TR 94-01, Revision 2, in lieu of that in ANSI/ANS-56.8-2002. (Refer to SE Section 3.1.1.1)	BYR will utilize the definition in NEI 94-01 Revision 3-A, Section 5.0. This definition has remained unchanged from Revision 2-A to Revision 3-A of NEI 94-01.
The licensee submits a schedule of containment inspections to be performed prior to and between Type A tests. (Refer to SE Section 3.1.1.3)	Reference Sections 3.5.3 and 3.5.4 of this submittal.
The licensee addresses the areas of the containment structure potentially subjected to degradation. (Refer to SE Section 3.1.3)	Reference Section 3.6.3 of this submittal.
The licensee addresses any tests and inspections performed following major modifications to the containment structure, as applicable. (Refer to SE Section 3.1.4)	No major containment modifications have been performed since the last ILRTs in 2012 (Unit 1) and 2014 (Unit 2). Steam generator replacement on BYR Unit 1 was completed in 1998 (B1R08). An ILRT was performed after completion of the Unit 1 steam generator replacement during B1R08 to verify containment integrity (Reference Section 3.1.5 of this submittal). There are no major modifications planned that would require the performance of a Type A or Structural Integrity Test (SIT). Reference Section 3.7.15 of this submittal.

Table 3.9.1-1: NEI 94-01, Revision 2-A, Limitations and Conditions	
Limitation/Condition (from Section 4.0 of SE)	**BYR Response**
The normal Type A test interval should be less than 15 years. If a licensee has to utilize the provision of Section 9.1 of NEI TR 94-01, Revision 2, related to extending the ILRT interval beyond 15 years, the licensee must demonstrate to the NRC staff that it is an unforeseen emergent condition. (Refer to SE Section 3.1.1.2)	BYR will follow the requirements of NEI 94-01, Revision 3-A, Section 9.1. This requirement has remained unchanged from Revision 2-A to Revision 3-A of NEI 94-01. In accordance with the requirements of NEI 94-01, Revision 2-A, SE Section 3.1.1.2, BYR will also demonstrate to the NRC staff that an unforeseen emergent condition exists in the event an extension beyond the 15-year interval is required.
For plants licensed under 10 CFR 52, applications requesting a permanent extension of the ILRT surveillance interval to 15 years should be deferred until after the construction and testing of containments for that design have been completed and applicants have confirmed the applicability of NEI 94-01, Revision 2, and EPRI Report No. 1009325, Revision 2, including the use of past containment ILRT data.	Not applicable. BYR, Units 1 and 2 were not licensed under 10 CFR 52.

3.9.2 Limitations and Conditions Applicable to NEI 94-01, Revision 3-A

The NRC staff found that the guidance in NEI TR 94-01, Revision 3, was acceptable for referencing by licensees in the implementation for the optional performance-based requirements of Option B to 10 CFR 50, Appendix J. However, the NRC staff identified two conditions on the use of NEI TR 94-01, Revision 3 (Reference NEI 94-01 Revision 3-A, NRC SE 4.0, Limitations and Conditions).

Topical Report Condition 1

NEI TR 94-01, Revision 3, is requesting that the allowable extended interval for Type C LLRTs be increased to 75 months, with a permissible extension (for non-routine emergent conditions) of nine months (84 months total). The staff is allowing the extended interval for Type C LLRTs be increased to 75 months with the requirement that a licensee's post-outage report include the margin between the Type B and Type C leakage rate summation and its regulatory limit. In addition, a corrective action plan shall be developed to restore the margin to an acceptable level. The staff is also allowing the non-routine emergent extension out to 84-months as applied to Type C valves at a site, with some exceptions that must be detailed in NEI 94-01, Revision 3. At no time shall an extension be allowed for Type C valves that are restricted categorically (e.g., BWR MSIVs), and those valves with a history of leakage, or any valves held to either a less than maximum interval or to the base refueling cycle interval. Only non-routine emergent conditions allow an extension to 84 months.

Response to Condition 1:

Condition 1 presents the following three (3) separate issues that are required to be addressed:

- ISSUE 1 – The allowance of an extended interval for Type C LLRTs of 75 months carries the requirement that a licensee's post-outage report include the margin between the Type B and Type C leakage rate summation and its regulatory limit.

- ISSUE 2 – In addition, a corrective action plan shall be developed to restore the margin to an acceptable level.
- ISSUE 3 – Use of the allowed 9-month extension for eligible Type C valves is only authorized for non-routine emergent conditions with exceptions as detailed in NEI 94-01, Revision 3-A, Section 10.1.

Response to Condition 1, ISSUE 1:

The post-outage report shall include the margin between the Types B and Type C Minimum Pathway Leak Rate (MNPLR) summation value, as adjusted to include the estimate of applicable Type C leakage understatement, and its regulatory limit of 0.60 L_a.

Response to Condition 1, ISSUE 2:

When the potential leakage understatement adjusted Types B and C MNPLR total is greater than the BYR administrative leakage summation limit of 0.50 L_a, but less than the regulatory limit of 0.6 L_a, then an analysis and determination of a corrective action plan shall be prepared to restore the leakage summation margin to less than the BYR leakage limit. The corrective action plan shall focus on those components which have contributed the most to the increase in the leakage summation value and the manner of timely corrective action, as deemed appropriate, that best focuses on the prevention of future component leakage performance issues so as to maintain an acceptable level of margin.

Response to Condition 1, ISSUE 3:

BYR will apply the 9-month allowable interval extension period only to eligible Type C components for non-routine emergent conditions. Such occurrences will be documented in the record of tests.

<u>Topical Report Condition 2</u>

The basis for acceptability of extending the ILRT interval out to once per 15 years was the enhanced and robust primary containment inspection program and the local leakage rate testing of penetrations. Most of the primary containment leakage experienced has been attributed to penetration leakage and penetrations are thought to be the most likely location of most containment leakage at any time. The containment leakage condition monitoring regime involves a portion of the penetrations being tested each refueling outage, nearly all LLRTs being performed during plant outages. For the purposes of assessing and monitoring or trending overall containment leakage potential, the as-found minimum pathway leakage rates for the just tested penetrations are summed with the as-left minimum pathway leakage rates for penetrations tested during the previous 1 or 2 or even 3 refueling outages. Type C tests involve valves, which in the aggregate, will show increasing leakage potential due to normal wear and tear, some predictable and some not so predictable. Routine and appropriate maintenance may extend this increasing leakage potential. Allowing for longer intervals between LLRTs means that more leakage rate test results from farther back in time are summed with fewer just tested penetrations and that total is used to assess the current containment leakage potential. This leads to the possibility that the LLRT totals calculated understate the actual leakage potential of the penetrations. Given the required margin included with the performance criterion and the considerable extra margin most plants consistently show with their testing, any understatement of the LLRT total using a 5-year test frequency is thought to be conservatively accounted for. Extending the LLRT intervals beyond 5 years to a 75-month interval should be similarly conservative provided an estimate is made of the potential understatement and its acceptability determined as part of the trending specified in NEI TR 94-01, Revision 3, Section 12.1.

When routinely scheduling any LLRT valve interval beyond 60-months and up to 75-months, the primary containment leakage rate testing program trending or monitoring must include an estimate of the amount of understatement in the Type B and C total leakage and must be included in a licensee's post-outage report. The report must include the reasoning and determination of the acceptability of the extension, demonstrating that the LLRT totals calculated represent the actual leakage potential of the penetrations.

Response to Condition 2:

Condition 2 presents the following two (2) separate issues that are required to be addressed:

- ISSUE 1 - Extending the LLRT intervals beyond 5 years to a 75-month interval should be similarly conservative provided an estimate is made of the potential understatement and its acceptability determined as part of the trending specified in NEI TR 94-01, Revision 3, Section 12.1.

- ISSUE 2 - When routinely scheduling any LLRT valve interval beyond 60 months and up to 75 months, the primary containment leakage rate testing program trending or monitoring must include an estimate of the amount of understatement in the Type B and C total and must be included in a licensee's post-outage report. The report must include the reasoning and determination of the acceptability of the extension, demonstrating that the LLRT totals calculated represent the actual leakage potential of the penetrations.

Response to Condition 2, ISSUE 1:

The change in going from a 60-month extended test interval for Type C tested components to a 75-month interval, as authorized under NEI 94-01, Revision 3-A, represents an increase of 25% in the LLRT periodicity. As such, BYR will conservatively apply a potential leakage understatement adjustment factor of 1.25 to the actual As-Left leak rate, which will increase the As-Left leakage total for each Type C component currently on greater than a 60-month test interval up to the 75-month extended test interval. This will result in a combined conservative Type C total for all 75-month LLRTs being "carried forward" and will be included whenever the total leakage summation is required to be updated (either while on line or following an outage).

When the potential leakage understatement adjusted leak rate total for those Type C components being tested on greater than a 60-month test interval up to the 75-month extended test interval is summed with the non-adjusted total of those Type C components being tested at less than or equal to a 60-month test interval, and the total of the Type B tested components, results in the MNPLR being greater than the BYR administrative leakage summation limit of 0.50 L_a, but less than the regulatory limit of 0.6 L_a, then an analysis and corrective action plan shall be prepared to restore the leakage summation value to less than the BYR leakage limit. The corrective action plan shall focus on those components which have contributed the most to the increase in the leakage summation value and the manner of timely corrective action, as deemed appropriate, that best focuses on the prevention of future component leakage performance issues.

Response to Condition 2, ISSUE 2:

If the potential leakage understatement adjusted leak rate MNPLR is less than the BYR administrative leakage summation limit of 0.50 L_a, then the acceptability of the greater than a 60-month test interval up to the 75-month LLRT extension for all affected Type C components has been adequately demonstrated and the calculated local leak rate total represents the actual leakage potential of the penetrations.

In addition to Condition 1, ISSUES 1 and 2, which deal with the MNPLR Types B and C summation margin, NEI 94-01, Revision 3-A, also has a margin related requirement as contained in Section 12.1, "Report Requirements."

> A post-outage report shall be prepared presenting results of the previous cycle's Type B and Type C tests, and Type A, Type B and Type C tests, if performed during that outage. The technical contents of the report are generally described in ANSI/ANS-56.8-2002 and shall be available on-site for NRC review. The report shall show that the applicable performance criteria are met and serve as a record that continuing performance is acceptable. The report shall also include the combined Type B and Type C leakage summation, and the margin between the Type B and Type C leakage rate summation and its regulatory limit. Adverse trends in the Type B and Type C leakage rate summation shall be identified in the report and a corrective action plan developed to restore the margin to an acceptable level.

At BYR, in the event an adverse trend in the aforementioned potential leakage understatement adjusted Types B and C summation is identified, then an analysis and determination of a corrective action plan shall be prepared to restore the trend and associated margin to an acceptable level. The corrective action plan shall focus on those components which have contributed the most to the adverse trend in the leakage summation value and the manner of timely corrective action, as deemed appropriate, that best focuses on the prevention of future component leakage performance issues.

At BYR, an adverse trend is defined as three (3) consecutive increases in the final pre-mode change Types B and C MNPLR leakage summation values, as adjusted to include the estimate of applicable Type C leakage understatement, as expressed in terms of L_a.

3.10 Conclusion

<u>Adoption of NEI 94-01 Revision 3-A</u>

NEI 94-01, Revision 3-A, dated July 2012, and the conditions and limitations specified in NEI 94-01, Revision 2-A, dated October 2008, describe an NRC-accepted approach for implementing the performance-based requirements of 10 CFR 50, Appendix J, Option B. It incorporates the regulatory positions stated in RG 1.163 and includes provisions for extending Type A intervals to 15 years and Type C test intervals to 75 months. NEI 94-01, Revision 3-A delineates a performance-based approach for determining Type A, Type B, and Type C containment leakage rate surveillance test frequencies. BYR is adopting the guidance of NEI 94-01, Revision 3-A, and the conditions and limitations specified in NEI 94-01, Revision 2-A, for the BYR 10 CFR 50, Appendix J testing program plan.

Based on the previous ILRTs conducted at BYR, EGC concludes that the permanent extension of the containment ILRT interval from 10 to 15 years represents minimal risk to increased leakage. The risk is minimized by continued Type B and Type C testing performed in accordance with Option B of 10 CFR 50, Appendix J and the overlapping inspection activities performed as part of the following BYR inspection programs:

- ASME Section XI, IWE Examinations
- ASME Section XI, IWL Examinations
- Tendon Surveillance Program (TS 5.5.6)
- Maintenance Rule Structures Monitoring Program
- Protective Coatings Monitoring and Maintenance Program

This experience is supplemented by risk analysis studies, including the BYR risk analysis provided in Attachment 3b of this submittal. The risk assessment concludes that increasing the ILRT interval on a permanent basis to a one-in-fifteen-year frequency is not considered to be significant since it represents only a small change in the BYR risk profile.

4.0 REGULATORY EVALUATION

4.1 Applicable Regulatory Requirements/Criteria

The proposed change has been evaluated to determine whether applicable regulations and requirements continue to be met.

10 CFR 50.54(o) requires primary reactor containments for water-cooled power reactors to be subject to the requirements of Appendix J to 10 CFR 50, "Primary Reactor Containment Leakage Rate Testing for Water-Cooled Power Reactors" (Reference 7). Appendix J specifies containment leakage testing requirements, including the types required to ensure the leak-tight integrity of the primary reactor containment and systems and components which penetrate the containment. In addition, Appendix J discusses leakage rate acceptance criteria, test methodology, frequency of testing and reporting requirements for each type of test.

The adoption of the Option B performance-based containment leakage rate testing for Type A, Type B and Type C testing did not alter the basic method by which Appendix J leakage rate testing is performed; however, it did alter the frequency at which Type A, Type B, and Type C containment leakage tests must be performed. Under the performance-based option of 10 CFR 50, Appendix J, the test frequency is based upon an evaluation that reviewed "as-found" leakage history to determine the frequency for leakage testing which provides assurance that leakage limits will be maintained. The change to the Type A test frequency did not directly result in an increase in containment leakage. Similarly, the proposed change to the Type C test frequencies will not directly result in an increase in containment leakage.

EPRI TR-1009325, Revision 2-A (Reference 13), provided a risk impact assessment for optimized ILRT intervals up to 15 years, utilizing current industry performance data and risk informed guidance. NEI 94-01, Revision 3-A, Section 9.2.3.1 states that Type A ILRT intervals of up to 15 years are allowed by this guideline. The Risk Impact Assessment of Extended Integrated Leak Rate Testing Intervals, EPRI Report 1018243 (formerly TR-1009325, Revision 2-A) indicates that, in general, the risk impact associated with ILRT interval extensions for intervals up to 15 years is small. However, plant-specific confirmatory analyses are required.

The NRC staff reviewed NEI TR 94-01, Revision 2 (Reference 2), and EPRI Report No. 1009325, Revision 2-A. For NEI TR 94-01, Revision 2, the NRC staff determined that it described an acceptable approach for implementing the optional performance-based requirements of Option B to 10 CFR 50, Appendix J. This guidance includes provisions for extending Type A ILRT intervals up to 15 years and incorporates the regulatory positions stated in RG 1.163 (Reference 4). The NRC staff finds that the Type A testing methodology as described in ANSI/ANS-56.8-2002 (Reference 3), and

the modified testing frequencies recommended by NEI TR 94-01, Revision 2 (Reference 2), serve to ensure continued leakage integrity of the containment structure. Type B and Type C testing ensures that individual penetrations are essentially leak tight. In addition, aggregate Type B and Type C leakage rates support the leakage tightness of primary containment by minimizing potential leakage paths.

For EPRI Report No. 1009325, Revision 2-A, a risk-informed methodology using plant-specific risk insights and industry ILRT performance data to revise ILRT surveillance frequencies, the NRC staff finds that the proposed methodology satisfies the key principles of risk-informed decision-making applied to changes to TS as delineated in RG 1.177, "An Approach to Plant-Specific, Risk-Informed Decision Making: Technical Specifications" (Reference 30) and RG 1.174, Revision 3 (Reference 5). The NRC staff, therefore, found that this guidance was acceptable for referencing by licensees proposing to amend their TS in regards to containment leakage rate testing, subject to the limitations and conditions noted in Section 4.2 of the SE (Reference 11).

The NRC staff reviewed NEI TR 94-01, Revision 3 (Reference 1), and determined that it described an acceptable approach for implementing the optional performance-based requirements of Option B to 10 CFR 50, Appendix J, as modified by the conditions and limitations summarized in Section 4.0 of the associated SE. This guidance included provisions for extending Type C LLRT intervals up to 75 months. Type C testing ensures that individual CIVs are essentially leak tight. In addition, aggregate Type C leakage rates support the leakage tightness of primary containment by minimizing potential leakage paths. The NRC staff, therefore, found that this guidance, as modified to include two limitations and conditions, was acceptable for referencing by licensees proposing to amend their TS in regards to containment leakage rate testing. Any applicant may reference NEI TR 94-01, Revision 3, as modified by the associated SE and approved by the NRC, and the conditions and limitations specified in NEI 94-01, Revision 2-A, dated October 2008, in a licensing action to satisfy the requirements of Option B to 10 CFR 50, Appendix J.

4.2 Precedent

This LAR is similar in nature to the following license amendments for extending the Type A test frequency to 15 years and the Type C test frequency to 75 months as previously authorized by the NRC in the associated referenced SEs:

- Beaver Valley Power Station, Unit Nos. 1 and 2, issued April 8, 2015 (Reference 31 - ML15078A058)

- Comanche Peak Nuclear Power Plant, Units 1 and 2, issued December 30, 2015 (Reference 32 - ML15309A073)

- Vogtle Electric Generating Plant, Units 1 and 2, issued October 29, 2018 (Reference 33 - ML18263A039)

4.3 No Significant Hazards Consideration

Exelon Generation Company, LLC (EGC) proposes to amend the Technical Specifications (TS) for Byron Station (BYR), Units 1 and 2, to allow extension of the Type A and Type C test intervals. The extension is based on the adoption of the Nuclear Energy Institute (NEI) 94-01, Industry Guideline for Implementing Performance-Based Option of 10 CFR Part 50, Appendix J, Revision 3-A, and conditions and limitations set forth in Revision 2-A.

Specifically, the proposed change revises BYR TS 5.5.16, "Containment Leakage Rate Testing Program," by replacing the reference to Regulatory Guide (RG) 1.163, "Performance-Based Containment Leak-Test Program," with a reference to NEI 94-01, "Industry Guideline for Implementing Performance-Based Option of 10 CFR 50, Appendix J," Revision 3-A, and the conditions and limitations specified in NEI 94-01, Revision 2-A.

EGC has evaluated whether or not a significant hazards consideration is involved with the proposed amendment by focusing on the three standards set forth in 10 CFR 50.92, "Issuance of amendment," as discussed below:

1. **Does the proposed amendment involve a significant increase in the probability or consequences of an accident previously evaluated?**

Response: No.

The proposed activity involves the revision of the Byron Station (BYR) Units 1 and 2 Technical Specifications (TS) 5.5.16, "Containment Leakage Rate Testing Program," to allow the extension of the Type A integrated leakage rate test (ILRT) containment test interval to 15 years, and the extension of the Type C local leakage rate test (LLRT) interval to 75 months. Per the guidance provided in Nuclear Energy Institute (NEI) 94-01, "Industry Guideline for Implementing Performance-Based Option of 10 CFR 50, Appendix J," Revision 3-A, the current Type A test interval of 120 months (10 years) would be extended on a permanent basis to no longer than 15 years from the last Type A test. The current Type C test interval of 60 months for selected components would be extended on a performance basis to no longer than 75 months. Extensions of up to nine months for Types A, B and C tests are permissible only for non-routine emergent conditions.

The proposed interval extensions do not involve either a physical change to the plant or a change in the manner in which the plant is operated or controlled. The containment is designed to provide an essentially leak tight barrier against the uncontrolled release of radioactivity to the environment for postulated accidents. As such, the containment and the testing requirements invoked to periodically demonstrate the integrity of the containment exist to ensure the plant's ability to mitigate the consequences of an accident and do not involve the prevention or identification of any precursors of an accident.

The change in Type A test frequency to once-per-fifteen-years, measured as an increase to the total integrated plant risk for those accident sequences influenced by Type A testing, based on the probabilistic risk assessment (PRA) is 0.080 person-rem/year for Unit 1 and 0.071 person-rem/year for Unit 2. Electric Power Research Institute (EPRI) Report No. 1009325, Revision 2-A states that a small population dose is defined as an increase of less than 1.0 person-rem per year, or less than 1 percent of the total population dose, whichever is less restrictive for the risk impact assessment of the extended ILRT intervals. The results of this calculation meet these criteria. Moreover, the risk impact for the ILRT extension when compared to other severe accident risks is negligible.

In addition, as documented in NUREG-1493, "Performance-Based Containment Leak-Test Program," dated September 1995, Types B and C tests have identified a very large percentage of containment leakage paths, and the percentage of containment leakage paths that are detected only by Type A testing is very small. The BYR Units 1 and 2 Type A test history supports this conclusion.

The integrity of the containment is subject to two types of failure mechanisms that can be categorized as: (1) activity based, and (2) time based. Activity based failure mechanisms are defined as degradation due to system and/or component modifications or maintenance. LLRT requirements and administrative controls such as configuration management and procedural requirements for system restoration ensure that containment integrity is not degraded by plant modifications or maintenance activities. The design and construction requirements of the containment combined with the containment inspections performed in accordance with American Society of Mechanical Engineers (ASME) Boiler and Pressure Vessel (B&PV) Code, Section XI, "Rules for Inservice Inspection of Nuclear Power Plant Components," Containment Maintenance Rule Inspections, Containment Coatings Program, and TS requirements serve to provide a high degree of assurance that the containment would not degrade in a manner that is detectable only by a Type A test (ILRT). Based on the above, the proposed test interval extensions do not significantly increase the consequences of an accident previously evaluated.

Therefore, the proposed changes do not involve a significant increase in the probability or consequences of an accident previously evaluated.

2. **Does the proposed change create the possibility of a new or different kind of accident from any accident previously evaluated?**

Response: No.

The proposed amendment to the BYR, Units 1 and 2 TS 5.5.16, "Containment Leakage Rate Testing Program," involves the extension of the BYR, Units 1 and 2 Type A containment test interval to 15 years and the extension of the Type C test interval to 75 months. The containment and the testing requirements to periodically demonstrate the integrity of the containment exist to ensure the plant's ability to mitigate the consequences of an accident.

The proposed change does not involve a physical modification to the plant (i.e., no new or different type of equipment will be installed) nor does it alter the design, configuration, or change the manner in which the plant is operated or controlled beyond the standard functional capabilities of the equipment.

Therefore, the proposed change does not create the possibility of a new or different kind of accident from any previously evaluated.

3. **Does the proposed change involve a significant reduction in a margin of safety?**

Response: No.

The proposed amendment to the BYR Units 1 and 2 TS 5.5.16 involves the extension of the BYR Type A containment test interval to 15 years and the extension of the Type C test interval to 75 months for selected components. This amendment does not alter the manner in which safety limits, limiting safety system set points, or limiting conditions for operation are determined. The specific requirements and conditions of the TS Containment Leak Rate Testing Program exist to ensure that the degree of containment structural integrity and leak-tightness that is considered in the plant safety analysis is maintained. The overall containment leak rate limit specified by TS is maintained.

The proposed change involves the extension of the interval between Type A containment leak rate tests and Type C tests for BYR, Units 1 and 2. The proposed surveillance interval extension is bounded by the 15-year ILRT interval and the 75-month Type C test interval

currently authorized within NEI 94-01, Revision 3-A. Industry experience supports the conclusion that Types B and C testing detects a large percentage of containment leakage paths and that the percentage of containment leakage paths that are detected only by Type A testing is small. The containment inspections performed in accordance with 10 CFR 50, Appendix J, Option B, and the overlapping inspection activities performed as part of ASME Section XI, and the TS, serve to provide a high degree of assurance that the containment would not degrade in a manner that is detectable only by Type A testing. The combination of these factors ensures that the margin of safety in the plant safety analysis is maintained. The design, operation, testing methods, and acceptance criteria for Types A, B, and C containment leakage tests specified in applicable codes and standards would continue to be met, with the acceptance of this proposed change, since these are not affected by changes to the Type A and Type C test intervals.

Therefore, the proposed changes do not involve a significant reduction in a margin of safety.

Based on the above, EGC concludes that the proposed amendment does not involve a significant hazards consideration under the standards set forth in 10 CFR 50.92(c), and, accordingly, a finding of no significant hazards consideration is justified.

4.4 Conclusion

In conclusion, based on the considerations discussed above, (1) there is reasonable assurance that the health and safety of the public will not be endangered by operation in the proposed manner, (2) such activities will be conducted in compliance with the Commission's regulations, and (3) the issuance of the amendment will not be inimical to the common defense and security or to the health and safety of the public.

5.0 ENVIRONMENTAL CONSIDERATION

A review has determined that the proposed amendment would change a requirement with respect to installation or use of a facility component located within the restricted area, as defined in 10 CFR 20, or would change an inspection or surveillance requirement. However, the proposed amendment does not involve: (i) a significant hazards consideration, (ii) a significant change in the types or significant increase in the amounts of any effluent that may be released offsite, or (iii) a significant increase in individual or cumulative occupational radiation exposure. Accordingly, the proposed amendment meets the eligibility criterion for categorical exclusion set forth in 10 CFR 51.22(c)(9). Therefore, pursuant to 10 CFR 51.22(b), no environmental impact statement or environmental assessment need be prepared in connection with the proposed amendment.

6.0 REFERENCES

1. NEI 94-01, Revision 3-A, "Industry Guideline for Implementing Performance-Based Option of 10 CFR Part 50, Appendix J," dated July 2012

2. NEI 94-01, Revision 2-A, "Industry Guideline for Implementing Performance-Based Option of 10 CFR Part 50, Appendix J," dated October 2008

3. ANSI/ANS-56.8-2002, "Containment System Leakage Testing Requirements," dated November 27, 2002

4. Regulatory Guide 1.163, Revision 0, "Performance-Based Containment Leak-Test Program," dated September 1995

5. Regulatory Guide 1.174, Revision 3, "An Approach for Using Probabilistic Risk Assessment in Risk-Informed Decisions on Plant-Specific Changes to the Licensing Basis," dated January 2018

6. Regulatory Guide 1.200, Revision 2, "An Approach for Determining the Technical Adequacy of Probabilistic Risk Assessment Results for Risk-Informed Activities," dated March 2009

7. 10 CFR 50, Appendix J, "Primary Reactor Containment Leakage Testing for Water-Cooled Power Reactors"

8. NEI 94-01, Revision 0, "Industry Guideline for Implementing Performance-Based Option of 10 CFR Part 50, Appendix J," dated July 26, 1995

9. NUREG-1493, "Performance-Based Containment Leak-Test Program," dated September 1995

10. EPRI TR-104285, "Risk Impact Assessment of Revised Containment Leak Rate Test Intervals," dated August 1994

11. Letter from M. J. Maxin (NRC) to J. C. Butler (NEI), "Final Safety Evaluation for Nuclear Energy Institute (NEI) Topical Report (TR) 94-01, Revision 2, 'Industry Guideline for Implementing Performance-Based Option of 10 CFR Part 50, Appendix J' and Electric Power Research Institute (EPRI) Report No. 1009325, Revision 2, August 2007, 'Risk-Impact Assessment of Extended Integrated Leak Rate Testing Intervals' (TAC No. MC9663)," dated June 25, 2008 (ML081140105).

12. Letter from S. Bahadur (NRC) to B. Bradley (NEI), "Final Safety Evaluation of Nuclear Energy Institute (NEI) Report, 94-01, Revision 3, 'Industry Guideline for Implementing Performance-Based Option of 10 CFR Part 50, Appendix J' (TAC No. ME2164)," dated June 8, 2012 (ML121030286).

13. "Risk Impact Assessment of Extended Integrated Leak Rate Testing Intervals," Revision 2-A of 1009325, EPRI, Palo Alto, CA, 1018243, October 2008

14. Letter from R. R. Assa (NRC) to D. L. Farrar (Commonwealth Edison), "Issuance of Amendments (TAC Nos. M94212, M94213, M94214, and M94215)," dated April 4, 1996 (ML020870051)

15. ANSI/ANS-56.8-1994, "Containment System Leakage Testing Requirements," dated August 4, 1994

16. Letter from J. B. Hickman (NRC) to O. D. Kingsley (Commonwealth Edison), "Issuance of Amendments (TAC Nos. MA0763 and MA0764)," dated May 8, 1998 (ML020860669)

17. Letter from G. F. Dick, Jr. (NRC) to O. D. Kingsley (Exelon), "Issuance of Amendments; Increase in Reactor Power, Byron Station, Units 1 and 2, and Braidwood Station, Units 1 and 2 (TAC Nos. MA9428, MA9429, MA9426, and MA9427)," dated May 4, 2001 (ML011420274)

18. Letter from R. F. Kuntz (NRC) to C. M. Crane (Exelon), "Byron Station, Unit Nos. 1 and 2, and Braidwood Station, Unit Nos. 1 and 2 – Issuance of Amendments Re: Alternative Source Term (TAC Nos. MC6221, MC6222, MC6223, and MC6224)," dated September 8, 2006 (ML062340420)

19. Letter from M. M. Thorpe-Kavanaugh (NRC) to C. G. Pardee (Exelon), "Byron Station, Unit Nos. 1 and 2 – Issuance of Amendments Re: Request for Amendment to Technical Specification 5.5.16, 'Containment Leakage Rate Testing Program' (TAC Nos. MD5151 and MD5152)," dated February 12, 2008 (ML080350348 and ML080350396)

20. NEI Document, "Interim Guidance for Performing Risk Impact Assessments in Support of One-Time Extensions for Containment Integrated Leakage Rate Test Surveillance Intervals," dated October 2001 (developed by EPRI and Data Systems & Solutions)

21. Letter from C. H. Cruse (Calvert Cliffs Nuclear Power Plant) to Document Control Desk (NRC), "Response to Request for Additional Information Concerning the License Amendment Request for a One-Time Integrated Leakage Rate Test Extension," dated March 27, 2002 (ML020920100)

22. Letter from NEI to NRC, "Final Revision of Appendix X to NEI 05-04/07-12/12-16, Close-Out of Facts and Observations (F&Os)," dated February 21, 2017 (ML17086A431)

23. Letter from J. Giitter and M. J. Ross-Lee (NRC) to G. Krueger (NEI), "U.S. Nuclear Regulatory Commission Acceptance on Nuclear Energy Institute Appendix X to Guidance 05-04, 07-12, and 12-13, Close-out of Facts and Observations (F&Os)," dated May 3, 2017 (ML17079A427)

24. Report 032299-RPT-05, Revision 2, "Byron Braidwood Nuclear Power Plants; PRA Finding Level Fact and Observation Technical Review," dated May 2018

25. NUREG-2122, "Glossary of Risk-Related Terms in Support of Risk-Informed Decision Making," dated November 2013 (ML13311A353)

26. NRC Revised Review Guidance for Licensee Responses to Generic Letter 2004-02, Enclosure 2, "Coatings Review Guidance," dated March 28, 2008 (ML080230462)

27. 10 CFR 50.55a, "Codes and Standards"

28. Regulatory Guide 1.147, Revision 18, "Inservice Inspection Code Case Acceptability, ASME Section XI, Division 1," dated March 2017

29. NUREG-1801, Revision 2, "Generic Aging Lessons Learned (GALL) Report," dated December 2010

30. Regulatory Guide 1.177, Revision 1, "An Approach for Plant-Specific, Risk-Informed Decision Making: Technical Specifications," dated May 2011

31. Letter from T. A. Lamb (NRC) to E. A. Larson (FirstEnergy), "Beaver Valley Power Station, Unit Nos. 1 and 2 – Issuance of Amendment Re: License Amendment Request to Extend Containment Leakage Rate Test Frequency (TAC Nos. MF3985 and MF3986)," dated April 8, 2015 (ML15078A058)

32. Letter from B. Singal (NRC) to R. Flores (Luminant), "Comanche Peak Nuclear Power Plant, Units 1 and 2 – Issuance of Amendments Re: Technical Specification Change for Extension of the Integrated Leak Rate Test Frequency from 10 to 15 Years (CAC Nos. MF5621 and MF5622)," dated December 30, 2015 (ML15309A073)

33. Letter from M. Orenak (NRC) to C. A. Gayheart (Southern Nuclear), "Vogtle Electric Generating Plant, Units 1 and 2, Issuance of Amendments to Extend the Containment Type A Leak Rate Test Frequency to 15 Years and Type C Leak Rate Test Frequency to 75 Months (CAC Nos. MG0240 and MG0241; EPID L-2017-LLA-0295)," dated October 29, 2018 (ML18263A039)

34. Regulatory Guide 1.35.1, "Determining Prestressing Forces for Inspection of Prestressed Concrete Containments," dated July 1990 (ML003740040)

35. Letter from NRC (J. S. Wiebe) to Exelon Generation Company (B. C. Hanson), "Braidwood Station, Units 1 and 2, and Byron Station, Unit Nos. 1 and 2 – Issuance of Amendments Regarding Request to Delete Obsolete License Conditions and Make Administrative Changes to Technical Specifications (CAC Nos. MF9338, MF9339, MF9340, and MF9341)," dated July 5, 2017 (ML17088A703)

36. Safety Evaluation (SE) for Generic Safety Issue (GSI-191), Containment Sump Blockage, Response to Generic Letter 2004-02, "Pressurized Water Reactor Sump Performance Evaluation Methodology," Revision 0, dated December 6, 2004 (ML043280007)

37. Letter from C. G. Miller (NRC) to M. P. Gallagher (Exelon), "Safety Evaluation Report Related to the License Renewal of Byron Nuclear Station, Units 1 and 2, and Braidwood Nuclear Station, Units 1 and 2 (TAC Nos. MF1879, MF1880, MF1881, MF1882)," dated July 6, 2015 (ML15166A326)

ATTACHMENT 2b
Proposed Technical Specifications Changes for Byron Station, Units 1 and 2

Byron Station, Units 1 and 2

Renewed Facility Operating License Nos. NPF-37 and NPF-66

Mark-up of Technical Specifications Page

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5.5 Programs and Manuals

5.5.15 Safety Function Determination Program (SFDP) (continued)

The SFDP identifies where a loss of safety function exists. If a loss of safety function is determined to exist by this program, the appropriate Conditions and Required Actions of the LCO in which the loss of safety function exists are required to be entered.

Nuclear Energy Institute (NEI) Topical Report (TR)

5.5.16 Containment Leakage Rate Testing Program

A program shall be established to implement the leakage rate testing of the containment as required by 10 CFR 50.54(o) and 10 CFR 50, Appendix J, Option B, as modified by approved exemptions. This program shall be in accordance with the guidelines contained in ~~Regulatory Guide 1.163, September 1995 and~~ NEI 94-01, ~~Revision 0.~~

The ~~peak~~ calculated containment internal pressure for the design basis loss of coolant accident, P_a, is 42.8 psig for Unit 1 and 38.4 psig for Unit 2

The maximum allowable containment leakage rate, L_a, at P_a, shall be 0.20% of containment air weight per day.

Leakage Rate acceptance criteria are:

a. Containment leakage rate acceptance criterion is $\leq 1.0\ L_a$. During the first unit startup following testing in accordance with this program, the leakage rate acceptance criteria are $< 0.60\ L_a$ for the Type B and C tests and $< 0.75\ L_a$ for Type A tests; and

"Industry Guideline for Implementing Performance-Based Option of 10 CFR 50, Appendix J," Revision 3-A, dated July 2012, and the conditions and limitations specified in NEI 94-01, Revision 2-A, dated October 2008.