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10 CFR 50  
10 CFR 51  
10 CFR 54

RS-15-093

April 6, 2015

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

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

Subject: Second 10 CFR 54.21(b) Annual Amendment to the Braidwood Station, Units 1 and 2, and Byron Station, Units 1 and 2, License Renewal Application

- References:
1. Letter from Michael P. Gallagher, Exelon Generation Company LLC (Exelon), to NRC Document Control Desk, dated May 29, 2013, "Application for Renewed Operating Licenses."
  2. Letter from Michael P. Gallagher, Exelon, to NRC Document Control Desk, dated May 5, 2014, "10 CFR 54.21(b) Annual Amendment to the Braidwood Station, Units 1 and 2, and Byron Station, Units 1 and 2, License Renewal Application"
  3. Letter from Patrick R. Simpson, Exelon, to NRC Document Control Desk, dated October 27, 2014, "Dissolution of Exelon Ventures Company, LLC"

In Reference 1, Exelon Generation Company, LLC (Exelon) submitted the License Renewal Application (LRA) for the Byron Station, Units 1 and 2, and Braidwood Station, Units 1 and 2 (BBS). Reference 2 provided the first annual amendment to the LRA, as required by 10 CFR 54.21(b).

Exelon has completed a review to identify any current licensing basis (CLB) changes made since submittal of the Reference 2, which have a material effect on the content of the LRA, including the FSAR Supplement. This amendment identified three (3) changes to the current

licensing basis (CLB) that materially affect the contents of the BBS LRA. Enclosure A contains a description of these CLB changes. Enclosure B contains updates to sections of the LRA affected by the changes.

This submittal satisfies the 10 CFR 54.21(b) annual amendment requirement for 2015.

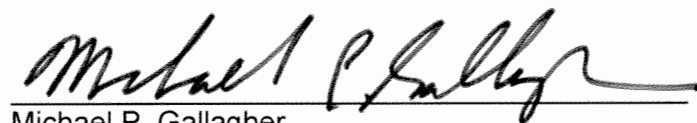
There are no new or revised regulatory commitments contained in this letter.

If you have any questions, please contact Mr. Al Fulvio, Manager, Exelon License Renewal, at 610-765-5936.

I declare under penalty of perjury that the foregoing is true and correct.

Executed on 04-06-2015

Respectfully,

A handwritten signature in black ink, appearing to read "Michael P. Gallagher", is written over a horizontal line.

Michael P. Gallagher  
Vice President - License Renewal Projects  
Exelon Generation Company, LLC

Enclosures: A. Description of CLB Changes that Impact the LRA  
B. LRA Updates Associated with CLB Changes

cc: Regional Administrator – NRC Region III  
NRC Project Manager (Safety Review), NRR-DLR  
NRC Project Manager (Environmental Review), NRR-DLR  
NRC Senior Resident Inspector, Braidwood Station  
NRC Senior Resident Inspector, Byron Station  
NRC Project Manager, NRR-DORL-Braidwood and Byron Stations  
Illinois Emergency Management Agency - Division of Nuclear Safety

## Enclosure A

### Description of CLB Changes that Impact the LRA

1) Change to Ownership Structure for Exelon Generation Company, LLC

In Reference 3, Exelon Generation Company, LLC, notified the NRC that Exelon Ventures Company, LLC was dissolved and that Exelon Generation Company, LLC became a direct wholly-owned subsidiary of Exelon Corporation. This change affected the description of the ownership structure that was contained in LRA Section 1.1.3, "Descriptions of Business or Occupation of Applicant." In addition, it was identified that LRA Section 1.1.3 had inadvertently stated that Exelon Generation Company, LLC is a Delaware company, instead of a Pennsylvania company. LRA Section 1.1.3 is updated as shown in Enclosure B to reflect these changes.

2) Addition of Material for Different Component Type to Component Cooling System

A modification of the Component Cooling System has been performed which installs two carbon steel check valves, a stainless steel restricting orifice, and a copper alloy drain valve to the primary sample cooler assembly at Byron Station, Unit 2. The installation of the carbon steel valve bodies and stainless steel restricting orifice does not materially affect the contents of the license renewal application since the appropriate component type, material, environment, and aging effect combination is included in the Summary of Aging Management table for this system (LRA Table 3.3.2-5). However, the installation of the drain valve constructed of copper alloy with less than 15 percent zinc introduces a new material for the Valve Body component type that was not previously evaluated in the Component Cooling System. Therefore, this material with the corresponding environments and aging management line items are added to the Valve Body component type in LRA Table 3.3.2-5. LRA Table 3.3.2-5 is updated in Enclosure B to reflect these changes.

3) Transition to Revision 7 of the EPRI PWR Primary Water Chemistry Guidelines

NUREG-1801, Revision 2, Section XI.M2, "Water Chemistry" specifies the use of EPRI 1014986, "PWR Primary Water Chemistry Guidelines" Revision 6, for monitoring and control of reactor water chemistry at PWRs. At the time Byron Station, Units 1 and 2, and Braidwood Station, Units 1 and 2 (BBS) License Renewal Application (LRA) was submitted in May 2013, Water Chemistry program procedures implemented Revision 6 of the guideline without exception to NUREG-1801 Revision 2, Section XI.M2, "Water Chemistry". Therefore, LRA section B.2.1.2, Water Chemistry identified no exceptions to the program. However, early in 2015 the Byron and Braidwood Water Chemistry program transitioned to the next revision of this EPRI document, EPRI 3002000505, "PWR Primary Water Chemistry Guidelines", Revision 7, for monitoring and control of reactor water chemistry.

EPRI reports such as "PWR Primary Water Chemistry Guidelines" are industry reports, which are periodically reviewed and revised by industry experts to incorporate recent industry operating experience and best practices. Byron and Braidwood Stations are committed to following and implementing the Nuclear Energy Institute (NEI) industry initiative 97-06, "Steam Generator Program Guidelines," as well as NEI 03-08, "Guideline for

the Management of Materials Issues.” Both of these NEI documents invoke various EPRI chemistry program guidelines, including PWR Primary Water Chemistry Guidelines, as forming a part of the bases of the initiative’s requirements. Updates to the EPRI Guidelines, including “PWR Primary Water Chemistry Guidelines”, are periodically distributed to the industry for expected timely implementation. These guidelines contain “mandatory”, “shall”, and “recommended” requirements. Any deviation from implementing “mandatory” or “shall” requirements must be entered into the corrective action program, technically justified, and notifications made to EPRI, NEI, and the NRC.

Revision 7 does not remove any “mandatory”, “shall”, or “recommended” requirements previously contained in Revision 6. The focus of Revision 7 was on updating the guideline with recent field experience, laboratory results and related investigations, and industry lessons learned. The following table provides a breakdown of major changes from Revision 6 to Revision 7 and the impact, if any, on Byron and Braidwood Water Chemistry aging management program.

<b>Changes to “PWR Primary Water Chemistry Guidelines” (Revision 6 to Revision 7)</b>	<b>Impact of Incorporating EPRI Revision 7 on BBS Water Chemistry Aging Management Program</b>
Volume 1, Chapter 2: Updates to discussions on pH control regimes to provide details and comparisons of the constant, modified, and elevated regimes.	<p>There is no material impact on license renewal aging management activities.</p> <p>The change from Revision 6 to Revision 7 only affects a discussion section, by documenting an improved understanding of pH control to mitigate primary water aging effects.</p>
Volume 1, Chapter 2: Updates documenting recent test results regarding low temperature crack propagation in nickel-base alloys.	<p>There is no material impact on license renewal aging management activities.</p> <p>The change from Revision 6 to Revision 7 only affects a discussion section by documenting an improved understanding of crack propagation in nickel based alloys.</p>
Volume 1, Chapter 2: Updates documenting the industry use of zinc injection to mitigate PWSCC.	<p>There is no material impact on license renewal aging management activities.</p> <p>The change from Revision 6 to Revision 7 only affects a discussion section by documenting an improved understanding of the use of zinc to mitigate PWSCC.</p>
Volume 1, Chapter 2: Updates documenting the influence of primary water chemistry on corrosion of fuel cladding and on core performance.	<p>There is no material impact on license renewal aging management activities.</p> <p>The change from Revision 6 to Revision 7 only affects a discussion section by documenting an improved understanding of mitigation strategies to mitigate corrosion in fuel cladding.</p>
Volume 1, Chapter 2: The addition of a discussion on the effects of pH on shutdown dose rates, including a summary from ongoing trials with elevated lithium concentrations.	<p>There is no material impact on license renewal aging management activities.</p> <p>The change from Revision 6 to Revision 7 only affects a discussion section by documenting an improved understanding for reducing shutdown dose rates.</p>

<b>Changes to “PWR Primary Water Chemistry Guidelines” (Revision 6 to Revision 7)</b>	<b>Impact of Incorporating EPRI Revision 7 on BBS Water Chemistry Aging Management Program</b>
Volume 1, Chapter 2: Calculations regarding the solubility of iron and nickel corrosion products have been updated to reflect the current understanding.	<p>There is no material impact on license renewal aging management activities.</p> <p>The change from Revision 6 to Revision 7 relates to discussion on changes to calculations used in assessing solubility of iron and nickel corrosion products, based on the current understanding of the topic.</p>
Volume 1, Chapter 2: Updates to discussions regarding use of zinc to reduce shutdown dose rates to reflect the continuing encouraging industry results.	<p>There is no material impact on license renewal aging management activities.</p> <p>The change from Revision 6 to Revision 7 only affects a discussion section by documenting additional operating experience for reducing shutdown dose rates.</p>
Volume 1, Chapter 3: A change has been made to Table 3-1, “Generic Principles for Optimization of Primary System pH,” that adds a new principle to assure operating pH is maintained $\geq 7.0$ while at full-power xenon-equilibrium conditions.	<p>Improvement - The change from Revision 6 to Revision 7 results in additional conservatism.</p> <p>This change adds a new requirement to Revision 7 that was not previously contained in Revision 6. Specifically, it documents an improved program principle to operate with pH values as high as achievable, within vendor specified restrictions, for improved mitigation to the susceptibility to PWSCC and to reduce fuel deposits.</p>
Volume 1, Chapter 3: Footnote 2 to Table 3-1, “Generic Principles for Optimization of Primary System pH,” was amended with the statement, “Operating with $\text{pH}_T < 6.5$ requires plant specific evaluation.”	<p>There is no significant impact on aging management effectiveness.</p> <p>This change was added to allow plants the flexibility, subject to a plant specific evaluation, to operate at a <math>\text{pH}_T</math> value of less than 6.5 during the 24 hour window prior to plant shutdown. EPRI’s description of this change states that operating experience indicates there is no plant impact associated with lowering <math>\text{pH}_T</math> to less than 6.5 during this time.</p>
Volume 1, Chapter 3: Principle 7 in Table 3-1, “Generic Principles for Optimization of Primary System pH,” was amended to provide clarification for lithium control following a power transient.	<p>Improvement - The change from Revision 6 to Revision 7 is more prescriptive and results in additional conservatism.</p> <p>Revision 7 now requires actions to be taken if the lithium concentration is not reestablished within the required control band during a 24 hour period. Revision 6 did not contain this requirement.</p>
Volume 1, Chapter 3: Table 3-3, “Reactor Coolant System Power Operation Control Parameters (Reactor Critical)” was revised to include an “Action Level 1” limit for anions (chloride, fluoride, and sulfate).	<p>Improvement - The change from Revision 6 to Revision 7 is more prescriptive and results in additional conservatism.</p> <p>Revision 6 previously allowed for a plant-specific administrative limit to be used as the “Action Level 1” limits for the respective anions. Revision 7 now identifies common specific industry values to be used as the “Action Level 1” limits for anions.</p>

Changes to “PWR Primary Water Chemistry Guidelines” (Revision 6 to Revision 7)	Impact of Incorporating EPRI Revision 7 on BBS Water Chemistry Aging Management Program
Volume 1, Chapter 3: Table 3-3, “Reactor Coolant System Power Operation Control Parameters (Reactor Critical)” was changed to allow for plants to establish a plant-specific “Action Level 1” for hydrogen in the range of 50 to 60 cc/kg H <sub>2</sub> O, incorporating the Interim Guidance SGMP-IG-11-02.	<p>There is no significant impact on aging management effectiveness.</p> <p>The previous Revision 6 upper limit for hydrogen was &gt;50 cc/kg H<sub>2</sub>O. Revision 7 now allows for hydrogen in the range of 50 to 60 cc/kg H<sub>2</sub>O without required action statements, provided that the proper technical basis is established in plant program documents. This change allows plants to more easily operate at the higher end of the recommended range without reaching required action levels, in order to improve aging management, so long as potential adverse effects are fully evaluated.</p>
Volume 1, Chapter 3: Table 3-8, “Reactor Coolant System Startup Control Parameters (Reactor Subcritical and > 250°F (121°C))”, was revised to include an action statement requiring plant cooldown to < 250 °F if Cl, F, SO <sub>4</sub> , or DO <sub>2</sub> limits are exceeded during startup.	<p>Improvement - The change from Revision 6 to Revision 7 results in additional conservatism.</p> <p>The change to Revision 7 involves a new action statement that requires a plant cooldown when identified limits are exceeded during startup. Revision 6 did not contain this requirement.</p>
Volume 1, Chapter 3: Table 3-9, “Reactor Coolant System Startup Chemistry Diagnostic Parameters (From Initiation of Continuous RCP Operation to Reactor Critical),” was modified to add notes relative to start-up lithium control and total suspended solids.	<p>Improvement - The change from Revision 6 to Revision 7 is more prescriptive and results in additional conservatism.</p> <p>The change modified notes in Table 3-9 to provide additional requirements for increased sample frequencies of lithium and cautionary statements related to limits on suspended solids during startup.</p>
Volume 1, Chapter 3: Table 3-10, “Reactor Coolant System Startup and Shutdown Required Parameters for Fuel Integrity Surveillance” was added to address concerns regarding fuel integrity.	<p>Improvement - The change from Revision 6 to Revision 7 results in additional conservatism.</p> <p>A new table of chemistry parameters and frequencies was added to Revision 7. The new table includes sample frequency requirements taken from a previous Revision 6 table, in addition to new parameters. The addition of new monitoring parameters in Revision 7 is considered conservative with respect to Revision 6.</p>
Volume 1, Appendix A was updated to reflect SGMP-IG-09-01, “Interim Guidance Regarding PWR Primary Water Chemistry Guidelines Volume 1, Revision 6, EPRI, Palo Alto, Ca: 2007. TR1014986”.	<p>There is no material impact on license renewal aging management activities.</p> <p>This change updates the guidelines with previously established interim guidance to Revision 6. The change incorporates previous guidance from EPRI on the calculation of pH<sub>T</sub>, and is not materially impactful to the aging management program elements.</p>
Volume 1, Appendix H, “Maintaining and Monitoring the Chemistry Environment in Stagnant Attached RCS Lines and Components” was added.	<p>There is no material impact on license renewal aging management activities.</p> <p>This new appendix provides a discussion section, for information only, of potential corrosion issues related to piping and components filled with fluid in stagnant conditions.</p>

<b>Changes to “PWR Primary Water Chemistry Guidelines” (Revision 6 to Revision 7)</b>	<b>Impact of Incorporating EPRI Revision 7 on BBS Water Chemistry Aging Management Program</b>
Volume 1, Appendix I, “Metal Solubility” was added to document a collection of industry data.	<p>There is no material impact on license renewal aging management activities.</p> <p>This new appendix provides a discussion and basis for previous changes to EPRI chemistry software related to metal solubility calculations. These changes are not materially impactful to the aging management program elements.</p>
Volume 2 of the report was revised with additional discussions and updated industry operating experiences.	<p>There is no material impact on license renewal aging management activities.</p> <p>These new Volume 2 changes are related to discussion sections and operating experience on start-up and shut-down water chemistry.</p>

The above table illustrates that the major changes introduced by Revision 7 are primarily related to updated discussions and operating experience sections. Where changes affect chemistry monitoring parameters and methods, these changes represent improvements to the management of primary water chemistry and aging management effectiveness through incorporation of the latest industry best practices. Therefore, this ensures that the main objectives of the Water Chemistry aging management program, which are to mitigate loss of material due to corrosion, cracking due to stress corrosion cracking (SCC) and related mechanisms, and reduction of heat transfer due to fouling in components exposed to a treated water environment, are maintained. The Water Chemistry aging management program will continue to manage the effects of aging so that the intended function(s) will be maintained consistent with the CLB for the period of extended operation.

As a result of this change, LRA Sections A.2.1.2 and B.2.1.2, Water Chemistry, and B.2.1.10, Steam Generators, have been updated as shown in Enclosure B to document incorporation of the latest EPRI industry guidance on PWR Primary Water Chemistry. Additionally, changes to LRA Tables 3.x.1 (Table 1s) and Tables 3.x.2-y (Table 2s) as a result of the new exception are also described in Enclosure B.

## Enclosure B

### LRA Updates Associated with CLB Changes

- 1) As a result of the CLB change associated with the ownership structure of Exelon Generation Company, LLC, LRA Section 1.1.3, on page 1-1, is revised as shown below. Additions are shown in ***bolded italics*** and deletions are shown with ~~strikethroughs~~.

#### 1.1.3 DESCRIPTIONS OF BUSINESS OR OCCUPATION OF APPLICANT

Exelon Generation Company, LLC is a ~~Delaware~~ ***Pennsylvania*** limited liability company which is wholly owned by ~~Exelon Ventures Company, a Delaware limited liability company, which in turn is wholly owned by~~ Exelon Corporation, a corporation formed under the laws of the Commonwealth of Pennsylvania. Exelon Generation Company, LLC is the licensed operator of Byron and Braidwood Stations, Units 1 and 2, which are the subject of this application. The current Byron and Braidwood Station operating licenses will expire as follows:

- At midnight on October 31, 2024 for Byron Station, Unit 1 (Facility Operating License No. NPF-37)
- At midnight on November 6, 2026 for Byron Station, Unit 2 (Facility Operating License No. NPF-66)
- At midnight on October 17, 2026 for Braidwood Station, Unit 1 (Facility Operating License No. NPF-72)
- At midnight on December 18, 2027 for Braidwood Station, Unit 2 (Facility Operating License No. NPF-77)

Exelon Generation Company, LLC will continue as the licensed operator on the renewed operating licenses.





- 3) As a result of the transition to EPRI document, EPRI 3002000505, "PWR Primary Water Chemistry Guidelines", Revision 7, and the corresponding new exception to the NUREG-1801 XI.M2 program recommendations, various LRA Section 3 Table revisions are required, and are described below.

Aging Management Review Tables 3.x.1 (Table 1s):

As a result of the new exception to the Water Chemistry aging management program, revisions are required to various LRA Table 3.1.1, Table 3.2.1, Table 3.3.1, Table 3.4.1, and Table 3.5.1 Item Numbers. For each Table 1 Item Number (3.x.1-yy), the "Discussion" column in the respective table summarizes the consistency between the aging management programs credited in the BBS LRA and those aging management programs cited in the corresponding NUREG-1800 table and line items. The NUREG-1801 consistency statement at the beginning of the Discussion for each of the Table 1 Item Numbers identified below, is hereby revised (as shown in ***bolded italics*** for inserted text) to state, "Consistent with NUREG-1801 ***with exceptions.***" The following statement is also added to the Discussion column of the Item Number, "***Exceptions apply to the NUREG-1801 recommendations for Water Chemistry (B.2.1.2) program implementation.***"

Applicable Table 1 Item Numbers:

3.1.1-12	3.2.1-5	3.3.1-3	3.4.1-11	3.5.1-78
3.1.1-25	3.2.1-18	3.3.1-17	3.4.1-12	
3.1.1-33	3.2.1-19	3.3.1-20	3.4.1-13	
3.1.1-34	3.2.1-20	3.3.1-28	3.4.1-14	
3.1.1-39	3.2.1-22	3.3.1-29	3.4.1-15	
3.1.1-40		3.3.1-125	3.4.1-16	
3.1.1-40x				
3.1.1-42				
3.1.1-45				
3.1.1-46				
3.1.1-47				
3.1.1-78				
3.1.1-80				
3.1.1-81				
3.1.1-83				
3.1.1-87				
3.1.1-88				

To reflect the Water Chemistry aging management program exception, the additional Table 1 Item Numbers noted below are also revised to include only the following statement in the discussion column, ***“Exceptions apply to the NUREG-1801 recommendations for Water Chemistry (B.2.1.2) program implementation.”***

Applicable Table 1 Item Numbers:

3.1.1-19	3.5.1-84
3.1.1-20	3.5.1-85
3.1.1-23	
3.1.1-53	
3.1.1-69	
3.1.1-70	
3.1.1-71	
3.1.1-72	
3.1.1-74	

Aging Management Review Tables 3.x.2-y (Table 2s):

All aging management review (AMR) line items contain a Standard Note of ‘A’ through ‘J’ to identify the degree of consistency with NUREG-1801 AMR line items. Standard Notes ‘A’ through ‘D’ are defined as follows:

- A Consistent with NUREG-1801 item for component, material, environment, and aging effect. AMP is consistent with NUREG-1801 AMP.
- B Consistent with NUREG-1801 item for component, material, environment, and aging effect. AMP takes some exceptions to NUREG-1801 AMP.
- C Component is different, but consistent with NUREG-1801 item for material, environment, and aging effect. AMP is consistent with NUREG-1801 AMP.
- D Component is different, but consistent with NUREG-1801 item for material, environment, and aging effect. AMP takes some exceptions to NUREG-1801 AMP.

As a result of the new exception to the Water Chemistry (B.2.1.2) aging management program, all AMR lines which credit the Water Chemistry program and cite a Standard Note ‘A’ are hereby revised to cite a Standard Note ‘B’. All AMR lines which credit the Water Chemistry aging management program and cite a Standard Note ‘C’ are hereby revised to cite a Standard Note ‘D’.

The following AMR tables are affected by this change:

Reactor Vessel, Internals, and Reactor Coolant System

Table 3.1.2-1 - Reactor Coolant System

Table 3.1.2-2 - Reactor Vessel

Table 3.1.2-3 - Reactor Vessel Internals

Table 3.1.2-4 - Steam Generators

Engineered Safety Features

Table 3.2.2-2 - Containment Spray System

Table 3.2.2-3 - Residual Heat Removal System

Table 3.2.2-4 - Safety Injection System

Auxiliary Systems

Table 3.3.2-1 - Auxiliary Building Ventilation System

Table 3.3.2-2 - Chemical & Volume Control System

Table 3.3.2-8 - Control Area Ventilation System

Table 3.3.2-10 - Demineralized Water System

Table 3.3.2-14 - Fuel Handling & Fuel Storage System

Table 3.3.2-18 - Radiation Monitoring System

Table 3.3.2-20 - Radwaste System

Table 3.3.2-21 - Sampling System

Table 3.3.2-23 - Spent Fuel Cooling System

Steam and Power Conversion System

Table 3.4.2-1 - Auxiliary Feedwater System

Table 3.4.2-2 - Condensate and Feedwater Auxiliaries System

Table 3.4.2-3 - Main Condensate and Feedwater System

Table 3.4.2-4 - Main Steam System

Table 3.4.2-5 - Main Turbine and Auxiliaries System

Containments, Structures, and Component Supports

Table 3.5.2-3 - Component Supports Commodity Group

Table 3.5.2-4 - Containment Structure

Table 3.5.2-8 - Fuel Handling Building

As a result of the transition to EPRI document, EPRI 3002000505, "PWR Primary Water Chemistry Guidelines", Revision 7, LRA Section A.2.1.2, on pages A-10 and A-11, is revised as shown below. Revisions are indicated with ***bolded italics*** for inserted text and ~~strikethroughs~~ for deleted text

#### **A.2.1.2 Water Chemistry**

The Water Chemistry aging management program is an existing mitigative program whose activities mitigate the loss of material due to corrosion, cracking due to stress corrosion cracking (SCC) and related mechanisms, and reduction of heat transfer due to fouling in components exposed to a reactor coolant, steam, treated borated water, and treated water environment. The program controls water chemistry for impurities (e.g., chloride, fluoride, and sulfate) that accelerate corrosion. Major component types include the reactor vessel, reactor internals, pressurizer vessel, steam generator internals, heat exchangers, tanks, piping, piping elements, and piping components. The primary system portion of this program consists of the reactor coolant system and related interfacing systems containing reactor coolant, treated borated water, and treated water. The secondary system portion of the program consists of the various secondary systems containing steam and treated water. The Byron and Braidwood Water Chemistry aging management program relies on monitoring and control of water chemistry to keep peak levels of various detrimental contaminants below system-specific limits, based on EPRI ***3002000505***~~1014986~~, "PWR Primary Water Chemistry Guidelines," Revision ***76***, and EPRI 1016555, "PWR Secondary Water Chemistry Guidelines," Revision 7.

As a result of the transition to EPRI document, EPRI 3002000505, "PWR Primary Water Chemistry Guidelines", Revision 7, an exception has been added to BBS LRA Section B.2.1.2 on pages B-22 and B-23. This LRA Section is revised as shown below. Revisions are indicated with ***bolded italics*** for inserted text and ~~strikethroughs~~ for deleted text.

## **B.2.1.2 Water Chemistry**

### **Program Description**

The Water Chemistry aging management program is an existing mitigative program whose activities mitigate the loss of material due to corrosion, cracking due to stress corrosion cracking (SCC) and related mechanisms, and reduction of heat transfer due to fouling. The program includes monitoring and control of known detrimental contaminants such as chloride, fluorides, dissolved oxygen, and sulfate concentrations below the levels known to result in loss of material, cracking, or reduction of heat transfer in accordance with EPRI ~~3002000505~~1014986, "PWR Primary Water Chemistry Guidelines," Revision ~~7~~6, and EPRI 1016555, "PWR Secondary Water Chemistry Guidelines," Revision 7.

The Byron and Braidwood (BBS) Water Chemistry aging management program consists of monitoring and controlling the chemical environments of those systems that are exposed to reactor coolant, steam, treated borated water, and treated water, such that aging effects of system components are minimized in accordance with the guidance specified in EPRI ~~3002000505~~1014986, "PWR Primary Water Chemistry Guidelines," Revision ~~7~~6, and the EPRI 1016555, "PWR Secondary Water Chemistry Guidelines," Revision 7. Major component types include the reactor vessel, reactor internals, pressurizer vessels, steam generator internals, heat exchangers, tanks, piping, piping elements, and piping components.

### **Exceptions to NUREG-1801**

~~None.~~

- 1. NUREG-1801, Revision 2 specifies the use of EPRI 1014986, "PWR Primary Water Chemistry Guidelines" Revision 6, for monitoring and control of reactor water chemistry. However, early in 2015 the Byron and Braidwood Station Water Chemistry program transitioned to the next revision of this EPRI document, EPRI 3002000505, "PWR Primary Water Chemistry Guidelines," Revision 7, for monitoring and control of reactor water chemistry. Program Elements Affected: Parameters Monitored/Inspected (Element 3); Detection of Aging Effects (Element 4); Monitoring and Trending (Element 5); Acceptance Criteria (Element 6); Corrective Actions (Element 7)***

### ***Justification of Exception***

***EPRI reports such as "PWR Primary Water Chemistry Guidelines" are industry reports, which are periodically reviewed and revised by industry experts to incorporate recent industry operating experience and best practices. Byron and Braidwood Stations are committed to following and***

*implementing the Nuclear Energy Institute (NEI) industry initiative 97-06, "Steam Generator Program Guidelines," as well as NEI 03-08, "Guideline for the Management of Materials Issues." Both of these NEI documents invoke various EPRI chemistry program guidelines, including PWR Primary Water Chemistry Guidelines, forming a part of the bases of the initiative's requirements. Updates to the EPRI Guidelines, including PWR Primary Water Chemistry Guidelines, are periodically distributed to the industry for expected timely implementation. These guidelines contain "mandatory", "shall", and "recommended" requirements. Any deviation from implementing "mandatory" or "shall" requirements must be entered into the corrective action program, technically justified, and notifications made to EPRI, NEI, and the NRC.*

*Revision 7 does not remove any "mandatory", "shall", or "recommended" requirements previously contained in Revision 6. The focus of Revision 7 was on updating and improving the guideline based on operating experience, laboratory results and related investigations, and lessons learned. Revision 7 major changes include:*

- 1) Updates within the report and in appendices based on industry operating experience, laboratory test results, and improved chemical parameter monitoring and control as follows: improved details related to pH control regimes; recent test results regarding low temperature crack propagation in nickel-based alloys; use of zinc to mitigate PWSCC; the influence of primary water chemistry on corrosion of fuel cladding; the effects of pH parameters on shutdown dose rates; improved calculations regarding the solubility of iron and nickel corrosion; the use of zinc to reduce shutdown dose rates; previous guidance in determination of pH<sub>T</sub>, potential corrosion issues related to stagnant conditions; additional data related to metal solubility, and start-up and shut-down water chemistry.*
- 2) Changes to Table 3-1 that improve pH control to mitigate PWSCC while providing improved guidance related to pH transients prior to plant shutdown, and provide clarification related to required actions for lithium transients.*
- 3) Changes to Table 3-3 which allow for improvements to plant specific criteria for the hydrogen concentration and new required actions for anion concentrations.*
- 4) Changes to Tables 3-8 and 3-9 and the addition of new Table 3-10 that require more conservative action statements for plant cooldown if Cl, F, SO<sub>4</sub>, or DO<sub>2</sub> limits are exceeded during plant startup; and more conservative sample frequencies for lithium, total suspended solids, and corrosion byproducts during plant startups and shutdowns*

*These industry recommended changes improve and clarify implementation of the guidelines and ensure that the main objectives of the Water Chemistry aging management program, which are to mitigate loss of material due to corrosion, cracking due to stress corrosion cracking (SCC) and related*

***mechanisms, and reduction of heat transfer due to fouling in components exposed to a treated water environment, are maintained.***



As a result of the transition to EPRI document, EPRI 3002000505, "PWR Primary Water Chemistry Guidelines", Revision 7, LRA Section B.2.1.10, on page B-73, is revised as shown below. Revisions are indicated with ***bolded italics*** for inserted text and ~~strikethroughs~~ for deleted text.

## B.2.1.10 Steam Generators

### Program Description

The Steam Generators aging management program is an existing preventive, mitigative, condition monitoring, and performance monitoring program that provides for managing aging of the steam generator tubes, plugs, and secondary side components that are contained within the steam generator (i.e., secondary side internals). The program implements NEI 97-06, "Steam Generator Program Guidelines." Aging is managed through assessment of potential degradation mechanisms, inspections, tube integrity assessments, tube plugging and repairs, primary to secondary leakage monitoring, maintenance of secondary side internal component integrity, primary and secondary side water chemistry, and foreign material exclusion. Station procedural guidance implements the performance criteria for steam generator tube integrity, condition monitoring requirements, inspection scope and frequency, acceptance criteria for the plugging or repair of flawed tubes, acceptable tube repair methods, leakage monitoring requirements, operational leakage and accident induced leakage requirements specified in plant technical specifications.

The program reporting requirements, inspection scope and frequency, assessments, tube plugging criteria, primary to secondary leak rate monitoring, and monitoring/controlling primary and secondary side water chemistry are consistent with the requirements of the plant technical specifications, the Maintenance Rule (10 CFR 50.65), ASME Code, and EPRI steam generator guidelines EPRI 1019038, "Steam Generator Integrity Assessment Guidelines", EPRI 1013706, "Steam Generator Examination Guidelines", EPRI 1022832, "PWR Primary-to-Secondary Leak Guidelines", and EPRI 1014983, "Steam Generator In-Situ Pressure Test Guidelines." The EPRI guidelines provide a generic industry program to implement NEI 97-06, "Steam Generator Program Guidelines."

The Steam Generators program includes preventive measures to mitigate age-related degradation through foreign material exclusion as a means to inhibit wear degradation and secondary side maintenance activities, such as sludge lancing, for removing deposits that may contribute to degradation. The Water Chemistry program (B.2.1.2) monitors and controls primary side and secondary side water chemistry for the steam generators consistent with the EPRI guidelines EPRI ~~1014986~~, ***3002000505***, "Pressurized Water Reactor Primary Water Chemistry Guidelines" and EPRI 1016555, "Pressurized Water Reactor Secondary Water Chemistry Guidelines" applicable to primary water chemistry and secondary water chemistry as a preventative measure.