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10 CFR 54

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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: Corrections to the Byron Station, Units 1 and 2, and Braidwood Station, Units 1 and 2, License Renewal Application

Reference: Letter from Michael P. Gallagher, Exelon Generation Company LLC (Exelon) to NRC Document Control Desk, dated May 29, 2013, "Application for Renewed Operating Licenses"

In the Reference letter, 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). Exelon has identified a number of corrections that need to be made to the LRA.

As a supplement to the BBS LRA, Exelon hereby updates the LRA and provides a description of these corrections in the Enclosure to this letter. The changes are explained, and where appropriate to facilitate understanding, portions of the LRA are repeated with changes highlighted by ~~strikethroughs~~ for deleted text and ***bolded italics*** for inserted text.

This submittal has been discussed with the NRC License Renewal Project Manager for the BBS License Renewal project.

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 5-23-2014

Respectfully,



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

Enclosure: Minor Errors or Omissions Related to the LRA

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

### Minor Errors or Omissions Related to the LRA

#### Introduction

This enclosure contains ten (10) changes that correct minor errors or omissions identified subsequent to the submittal of the License Renewal Application (LRA). In addition, an editorial discrepancy in the response to RAI 4.2.5-1/A.4.2.5-1, provided in Exelon Letter RS-14-129, is addressed in this enclosure. For each revision, the affected section and page of the LRA is provided, and the change is described. For clarity, entire sentences or paragraphs from the LRA, as modified by previous RAI responses, are provided with deleted text highlighted by ~~strikethroughs~~ and inserted text highlighted by ***bolded italics***. Revisions to tables are shown by providing excerpts from the affected tables.

**Change #1: Component Cooling System**

**Affected LRA Section: Table 3.3.2-5**

**LRA Page Numbers: 3.3-153, 3.3-165**

**Description of Change:** A discrepancy has been identified related to the NUREG-1801 alignment for the Heat Exchanger - (Component Cooling) Tube Sheet component type in the Component Cooling System. This heat exchanger has a nickel alloy clad carbon steel tube sheet. However, the surface of the tube sheet that is exposed to the Closed Cycle Cooling Water environment is not clad with nickel alloy. Therefore, this line item can be aligned to NUREG-1801 Item number VII.C2.AP-189. The carbon steel side of the tube sheet is exposed to a Closed Cycle Cooling Water (External) environment and is aging managed by the Closed Treated Water Systems (B.2.1.12) aging management program.

**Table 3.3.2-5 Component Cooling System**

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG-1801 Item	Table 1 Item	Notes
Heat Exchanger - (Component Cooling) Tube Sheet	Pressure Boundary	Carbon or Low Alloy Steel with Nickel Alloy Cladding	Closed Cycle Cooling Water (External)	Loss of Material	Closed Treated Water Systems (B.2.1.12)	<b>VII.C2.AP-189</b>	<b>3.3.1-46</b>	<del>G, 4</del> <b>A, 1</b>

**Plant Specific Notes:**

1. Environment not in NUREG-1801 for this component and material. The Closed Treated Water Systems (B.2.1.12) program is used to manage the aging effect(s) applicable to this component type, material, and environment combination. ***There is no nickel alloy cladding on the Component Cooling side of the tube sheet. The nickel alloy cladding is only on the side of the tube sheet exposed to a raw water environment and is evaluated with the Service Water System for aging management review.***

**Change #2: Demineralized Water System**

**Affected LRA Sections: Table 3.3.1, Table 3.3.2-10**

**LRA Page Numbers: 3.3-62, 3.3-194**

**Description of Change:** A discrepancy in the material of the Pump Casing (Laundry Hot Water Tank – Braidwood only) component type in the Demineralized Water System has been identified. The material for this component type is changed from Carbon Steel to Gray Cast Iron in LRA Table 3.3.2-10. This component is exposed to Air with Borated Water Leakage (External) and Waste Water (Internal) environments and is aging managed by the Boric Acid Corrosion (B.2.1.4), External Surfaces Monitoring of Mechanical Components (B.2.1.23), Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components (B.2.1.25), and Selective Leaching (B.2.1.21) aging management programs. LRA Table 3.3.1, line item 3.3.1-72 is also revised to reflect this change.

**Table 3.3.1 Summary of Aging Management Evaluations for the Auxiliary Systems**

Item Number	Component	Aging Effect/ Mechanism	Aging Management Programs	Further Evaluation Recommended	Discussion
3.3.1-72	Gray cast iron, Copper alloy (>15% Zn or >8% Al) Piping, piping components, and piping elements, Heat exchanger components exposed to Treated water, Closed-cycle cooling water, Soil, Raw water, <b>Waste water</b>	Loss of material due to selective leaching	Chapter XI.M33, "Selective Leaching"	No	Consistent with NUREG-1801. The Selective Leaching (B.2.1.21) program will be used to manage loss of material of copper alloy with 15% zinc or more and gray cast iron heat exchanger components, structural members, piping, piping components, and piping elements exposed to closed cycle cooling water, <b>waste water</b> , and raw water in the Auxiliary Feedwater System, Chilled Water System, Demineralized Water System, Emergency Diesel Generator & Auxiliaries System, Essential Service Water Cooling Towers (Byron), Fire Protection System, <b>Heating Water and Heating Steam System, Sampling System</b> , and Service Water System.

**Table 3.3.2-10**                      **Demineralized Water System**

<b>Component Type</b>	<b>Intended Function</b>	<b>Material</b>	<b>Environment</b>	<b>Aging Effect Requiring Management</b>	<b>Aging Management Programs</b>	<b>NUREG-1801 Item</b>	<b>Table 1 Item</b>	<b>Notes</b>
Pump Casing (Laundry Hot Water Tank - Braidwood only)	Leakage Boundary	<del>Carbon Steel</del> <b>Gray Cast Iron</b>	Air with Borated Water Leakage (External)	Loss of Material	Boric Acid Corrosion (B.2.1.4)	VII.I.A-79	3.3.1-9	A
					External Surfaces Monitoring of Mechanical Components (B.2.1.23)	VII.I.A-77	3.3.1-78	A
			Waste Water (Internal)	Loss of Material	Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components (B.2.1.25)	VII.E5.AP-281	3.3.1-91	A
					<b>Selective Leaching (B.2.1.21)</b>	<b>VII.E5.A-407</b>	<b>3.3.1-72</b>	<b>A</b>

### **Change #3: Fire Protection System**

**Affected LRA Sections: 3.3.2.1.12, Table 3.3.1, Table 3.3.2-12**

**LRA Page Numbers: 3.3-15, 3.3-16, 3.3-17, 3.3-40, 3.3-47, 3.3-80, 3.3-221, 3.3-226, 3.3-235**

**Description of Change:** An additional material (Carbon Steel) was identified for the Fire Barriers (Penetration Seals) component type in the Fire Protection System. This component type and material combination is added to LRA Table 3.3.2-12. Carbon steel fire barrier penetration seals are exposed to Air-Indoor Uncontrolled (External) and Air with Borated Water Leakage (External) environments and are aging managed by the Fire Protection (B.2.1.15) and Boric Acid Corrosion (B.2.1.4) aging management programs.

Also, an additional material (Polymers) was identified for the Piping, Piping Component, and Piping Element component type in the Fire Protection System at Braidwood only. This component type and material combination is added to LRA Table 3.3.2-12. The polymer (i.e., HDPE) piping is exposed to Raw Water (Internal) and Soil (External) environments and are aging managed by the Buried and Underground Piping (B.2.1.28) and Fire Water System (B.2.1.16) aging management programs. As a result of this change, a new material and aging effect requiring management are added to the Fire Protection System aging management review summary in LRA Section 3.3.2.1.12. LRA Table 3.3.1, line items 3.3.1-30x and 3.3.1-104 are also revised to reflect this change.

#### **3.3.2.1.12 Fire Protection System**

##### **Materials**

The materials of construction for the Fire Protection System components are:

- Aluminum Alloy
- Carbon Steel
- Carbon Steel (with internal lining or coating)
- Carbon and Low Alloy Steel Bolting
- Ceramic Fiber
- Concrete Block
- Copper Alloy with 15% Zinc or More
- Copper Alloy with less than 15% Zinc
- Ductile Cast Iron
- Elastomers
- Galvanized Steel
- Galvanized Steel Bolting
- Gray Cast Iron
- Grout

- Gypsum
- Mineral Fiber
- **Polymers (Braidwood only)**
- Pyrocrete
- Reinforced Concrete
- Soil, Rip-Rap, Sand, Gravel
- Stainless Steel
- Stainless Steel Bolting

### **Environments**

The Fire Protection System components are exposed to the following environments:

- Air - Indoor Uncontrolled
- Air - Outdoor
- Air with Borated Water Leakage
- Air/Gas – Dry
- Concrete
- Condensation
- Diesel Exhaust
- Raw Water
- Soil
- Waste Water

### **Aging Effect Requiring Management**

The following aging effects associated with the Fire Protection System components require management:

- Concrete Cracking and Spalling
- Cracking
- **Cracking, Blistering, Change in Color**
- Cracking, Loss of Material, and Loss of Bond
- Cumulative Fatigue Damage
- Hardening, Loss of Strength, and Loss of Sealing
- Loss of Coating Integrity
- Loss of Form

- Loss of Material
- Loss of Material (Spalling, Scaling) and Cracking
- Loss of Preload

**Table 3.3.1 Summary of Aging Management Evaluations for the Auxiliary Systems**

Item Number	Component	Aging Effect/ Mechanism	Aging Management Programs	Further Evaluation Recommended	Discussion
3.3.1-9	Steel, Aluminum, Copper alloy (>15% Zn or >8% Al) External surfaces, Piping, piping components, and piping elements, Bolting exposed to Air with borated water leakage	Loss of material due to boric acid corrosion	Chapter XI.M10, "Boric Acid Corrosion"	No	Consistent with NUREG-1801. The Boric Acid Corrosion (B.2.1.4) program will be used to manage loss of material of steel, aluminum alloy, and copper alloy with 15% zinc or more bolting, crane/hoist components, doors, ducting and components, <b>fire barrier penetration seals</b> , fuel storage racks, gas bottles, gearboxes, heat exchanger components, piping, piping components, piping elements, and tanks exposed to air with borated water leakage in the Auxiliary Building Ventilation System, Auxiliary Feedwater System, Chemical & Volume Control System, Chilled Water System, Component Cooling System, Compressed Air System, Containment Ventilation System, Cranes and Hoists, Demineralized Water System, Fire Protection System, Fuel Handling & Fuel Storage System, Fuel Oil System, Heating Water and Heating Steam System, Non-Radioactive Drain System, Radiation Monitoring System, Radioactive Drain System, Radwaste System, Sampling System, Service Water System, and Spent Fuel Cooling System.

**Table 3.3.1 Summary of Aging Management Evaluations for the Auxiliary Systems**

Item Number	Component	Aging Effect/ Mechanism	Aging Management Programs	Further Evaluation Recommended	Discussion
3.3.1-30x	Fiberglass, HDPE Piping, piping components, and piping elements exposed to Raw water (internal)	Cracking, blistering, change in color due to water absorption	Chapter XI.M20, "Open-Cycle Cooling Water System"	No	<p>Not Applicable. There are no fiberglass or HDPE piping, piping components, and piping elements exposed to raw water in the Auxiliary Systems.</p> <p><b>The Fire Water System (B.2.1.16) program has been substituted and will be used to manage cracking, blistering, and change in color of polymeric (HDPE) piping exposed to raw water in the Fire Protection System.</b></p>
3.3.1-104	HDPE, Fiberglass Piping, piping components, and piping elements exposed to Soil or concrete	Cracking, blistering, change in color due to water absorption	Chapter XI.M41, "Buried and Underground Piping and Tanks"	No	<p>Consistent with NUREG-1801 with exceptions. The Buried and Underground Piping (B.2.1.28) program will be used to manage cracking, blistering, and change in color of polymer piping, piping components, and piping elements exposed to soil in the <b>Fire Protection System and Main Condensate and Feedwater System.</b></p> <p>Exceptions apply to NUREG-1801 recommendations for Buried and Underground Piping (B.2.1.28) program implementation.</p>

**Table 3.3.2-12 Fire Protection System**

<b>Component Type</b>	<b>Intended Function</b>	<b>Material</b>	<b>Environment</b>	<b>Aging Effect Requiring Management</b>	<b>Aging Management Programs</b>	<b>NUREG-1801 Item</b>	<b>Table 1 Item</b>	<b>Notes</b>
Fire Barriers (Penetration Seals)	Fire Barrier	<i>Carbon Steel</i>	<i>Air - Indoor Uncontrolled (External)</i>	<i>Loss of Material</i>	<i>Fire Protection (B.2.1.15)</i>			<i>F, 14</i>
			<i>Air with Borated Water Leakage (External)</i>	<i>Loss of Material</i>	<i>Boric Acid Corrosion (B.2.1.4)</i>	<i>VII.I.A-79</i>	<i>3.3.1-9</i>	<i>A</i>
					<i>Fire Protection (B.2.1.15)</i>			<i>F, 14</i>
Piping, piping components, and piping elements	Pressure Boundary	<i>Polymers (Braidwood only)</i>	<i>Soil (External)</i>	<i>Cracking, Blistering, Change in Color</i>	<i>Buried and Underground Piping (B.2.1.28)</i>	<i>VII.C1.AP-175</i>	<i>3.3.1-104</i>	<i>B</i>
			<i>Raw Water (Internal)</i>	<i>Cracking, Blistering, Change in Color</i>	<i>Fire Water System (B.2.1.16)</i>	<i>VII.C1.AP-239</i>	<i>3.3.1-30x</i>	<i>E, 15</i>

**Plant Specific Notes:**

**14. The Fire Protection (B.2.1.15) program will be used to manage the loss of material aging effect applicable to this material and environment combination.**

**15. Component material is HDPE (High Density Polyethylene). The Fire Water System (B.2.1.16) program is substituted to manage the aging effect(s) applicable to this component type, material, and environment combination.**

**Change #4: Heating Water and Heating Steam System**

**Affected LRA Sections: Table 3.3.1, Table 3.3.2-16**

**LRA Page Numbers: 3.3-62, 3.3-255**

**Description of Change:** A discrepancy in the material of the Pump Casing (Condensate Return Tank Pump) component type in the Heating Water and Heating Steam System has been identified. The material for this component type is changed from Carbon Steel to Gray Cast Iron in LRA Table 3.3.2-16. This component is exposed to Air with Borated Water Leakage (External) and Waste Water (Internal) environments and is aging managed by the Boric Acid Corrosion (B.2.1.4), External Surfaces Monitoring of Mechanical Components (B.2.1.23), Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components (B.2.1.25), and Selective Leaching (B.2.1.21) aging management programs. LRA Table 3.3.1, line item 3.3.1-72 is also revised, as shown under Change #2 above, to reflect this change.

**Table 3.3.2-16 Heating Water and Heating Steam System**

<b>Component Type</b>	<b>Intended Function</b>	<b>Material</b>	<b>Environment</b>	<b>Aging Effect Requiring Management</b>	<b>Aging Management Programs</b>	<b>NUREG-1801 Item</b>	<b>Table 1 Item</b>	<b>Notes</b>
Pump Casing (Condensate Return Tank Pump)	Leakage Boundary	<del>Carbon Steel</del>	Air with Borated Water Leakage (External)	Loss of Material	Boric Acid Corrosion (B.2.1.4)	VII.I.A-79	3.3.1-9	A
		<b>Gray Cast Iron</b>			External Surfaces Monitoring of Mechanical Components (B.2.1.23)	VII.I.A-77	3.3.1-78	A
		<b>Gray Cast Iron</b>	Waste Water (Internal)	Loss of Material	Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components (B.2.1.25)	VII.E5.AP-281	3.3.1-91	A
		<b>Gray Cast Iron</b>			<b>Selective Leaching (B.2.1.21)</b>	<b>VII.E5.A-407</b>	<b>3.3.1-72</b>	<b>A</b>

**Change #5: Radioactive Drain System**

**Affected LRA Section: Table 3.3.2-19**

**LRA Page Number: 3.3-275**

**Description of Change:** A discrepancy in the material of the Pump Casing (Auxiliary Building Floor Drain Tank Pump) component type in the Radioactive Drain System has been identified. The material for this component type is changed from Ductile Cast Iron to Stainless Steel in LRA Table 3.3.2-19. This component is exposed to Air with Borated Water Leakage (External) and Waste Water > 140 F (Internal) environments and is aging managed by the Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components (B.2.1.25) aging management program.

In addition, a discrepancy in the material of the Pump Casing (Chemical Drain Tank Pump) component type in the Radioactive Drain System has been identified. The material for this component type is changed from Ductile Cast Iron to Stainless Steel in LRA Table 3.3.2-19. This component is exposed to Air with Borated Water Leakage (External) and Waste Water > 140 F (Internal) environments and is aging managed by the Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components (B.2.1.25) aging management program.

**Table 3.3.2-19 Radioactive Drain System**

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG-1801 Item	Table 1 Item	Notes
Pump Casing (Auxiliary Building Floor Drain Tank Pump)	Leakage Boundary	Ductile Cast Iron <b>Stainless Steel</b>	Air with Borated Water Leakage (External)	Loss of Material <b>None</b>	Boric Acid Corrosion (B.2.1.4) <b>None</b>	VII.I.A-79 <b>VII.J.AP-18</b>	3.3.1-9 <b>3.3.1-120</b>	A
					External Surfaces Monitoring of Mechanical Components (B.2.1.23)	VII.I.A-77	3.3.1-78	A
			Waste Water > 140 F (Internal)	<b>Cracking</b>	<b>Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components (B.2.1.25)</b>		<b>G, 1</b>	
				Loss of Material	Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components (B.2.1.25)	VII.E5.AP-281 <b>VII.E5.AP-278</b>	3.3.1-91 <b>3.3.1-95</b>	A
Pump Casing (Chemical Drain Tank Pump)	Leakage Boundary	Ductile Cast Iron <b>Stainless Steel</b>	Air with Borated Water Leakage (External)	Loss of Material <b>None</b>	Boric Acid Corrosion (B.2.1.4) <b>None</b>	VII.I.A-79 <b>VII.J.AP-18</b>	3.3.1-9 <b>3.3.1-120</b>	A
					External Surfaces Monitoring of Mechanical Components (B.2.1.23)	VII.I.A-77	3.3.1-78	A
			Waste Water > 140 F (Internal)	<b>Cracking</b>	<b>Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components (B.2.1.25)</b>		<b>G, 1</b>	
				Loss of Material	Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components (B.2.1.25)	VII.E5.AP-281 <b>VII.E5.AP-278</b>	3.3.1-91 <b>3.3.1-95</b>	A

## **Change #6: Sampling System**

**Affected LRA Sections: 3.3.2.1.21, Table 3.3.1, Table 3.3.2-21**

**LRA Page Numbers: 3.3-25, 3.3-62, 3.3-310**

**Description of Change:** A discrepancy in the material of the Pump Casing (Secondary Cooler Pump) component type in the Sampling System has been identified. The material for this component type is changed from Ductile Cast Iron to Gray Cast Iron in LRA Table 3.3.2-21. This component is exposed to Air with Borated Water Leakage (External) and Closed Cycle Cooling Water (Internal) environments and is aging managed by the Boric Acid Corrosion (B.2.1.4), External Surfaces Monitoring of Mechanical Components (B.2.1.23), Closed Treated Water Systems (B.2.1.12), and Selective Leaching (B.2.1.21) aging management programs. As a result of this change, a new material is added to the Sampling System aging management review summary in LRA Section 3.3.2.21. LRA Table 3.3.1, line item 3.3.1-72 is also revised, as shown under Change #2 above, to reflect this change.

### **3.3.2.1.21 Sampling System**

#### **Materials**

The materials of construction for the Sampling System components are:

- Carbon Steel
- Carbon and Low Alloy Steel Bolting
- Copper Alloy with 15% Zinc or More
- Ductile Cast Iron
- **Gray Cast Iron**
- Stainless Steel
- Stainless Steel Bolting

**Table 3.3.2-21                      Sampling System**

<b>Component Type</b>	<b>Intended Function</b>	<b>Material</b>	<b>Environment</b>	<b>Aging Effect Requiring Management</b>	<b>Aging Management Programs</b>	<b>NUREG-1801 Item</b>	<b>Table 1 Item</b>	<b>Notes</b>
Pump Casing (Secondary Cooler Pump)	Leakage Boundary	<del>Ductile Cast Iron</del>	Air with Borated Water Leakage (External)	Loss of Material	Boric Acid Corrosion (B.2.1.4)	VII.I.A-79	3.3.1-9	A
		<b>Gray Cast Iron</b>			External Surfaces Monitoring of Mechanical Components (B.2.1.23)	VII.I.A-77	3.3.1-78	A
		<b>Gray Cast Iron</b>	Closed Cycle Cooling Water (Internal)	Loss of Material	Closed Treated Water Systems (B.2.1.12)	VII.E5.AP-281	3.3.1-91	A
		<b>Gray Cast Iron</b>			<b>Selective Leaching (B.2.1.21)</b>	<b>VII.C2.A-50</b>	<b>3.3.1-72</b>	<b>A</b>

**Change #7: Service Water System**

**Affected LRA Section: Table 3.3.2-22**

**LRA Page Number: 3.3-343**

**Description of Change:** A discrepancy in the material of the Pump Casing (Inline Booster – Byron only) component type in the Service Water System has been identified. The material for this component type is changed from Carbon Steel to Gray Cast Iron in LRA Table 3.3.2-22. This component is exposed to Air - Indoor Uncontrolled (External) and Raw Water (Internal) environments and is aging managed by the External Surfaces Monitoring of Mechanical Components (B.2.1.23), Open-Cycle Cooling Water System (B.2.1.11), and Selective Leaching (B.2.1.21) aging management programs.

**Table 3.3.2-22 Service Water System**

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG-1801 Item	Table 1 Item	Notes
Pump Casing (Inline Booster – Byron only)	Leakage Boundary	<del>Carbon Steel</del>	Air – Indoor Uncontrolled (External)	Loss of Material	External Surfaces Monitoring of Mechanical Components (B.2.1.23)	VII.I.A-77	3.3.1-78	A
		<b>Gray Cast Iron</b>						
			Raw Water (Internal)	Loss of Material	Open-Cycle Cooling Water System (B.2.1.11)	VII.C1.AP-183	3.3.1-38	A
					<b>Selective Leaching (B.2.1.21)</b>	<b>VII.C1.A-51</b>	<b>3.3.1-72</b>	<b>A</b>

**Change #8: Auxiliary Feedwater System**

**Affected LRA Sections: Table 3.4.1, Table 3.4.2-1**

**LRA Page Numbers: 3.4-20, 3.4-27, 3.4-45, 3.4-47, 3.4-48**

**Description of Change:** A discrepancy in the material of the Pump Casing (AFW Diesel Engine Shaft-Driven Essential Service Water Booster Pump) component type in the Auxiliary Feedwater System has been identified. The material for this component type is changed from Carbon Steel to Stainless Steel in LRA Table 3.4.2-1. This component is exposed to Air with Borated Water Leakage (External) and Raw Water (Internal) environments and is aging managed by the Open-Cycle Cooling Water System (B.2.1.11) aging management program. LRA Table 3.4.1, line items 3.4.1-19 and 3.4.1-20 are also revised to reflect this change.

In addition, a discrepancy in the material of the Pump Casing (AFW Diesel-Driven Pump Shaft-Driven Lube Oil Pump) component type in the Auxiliary Feedwater System has also been identified. The material for this component type is changed from Carbon Steel to Copper with less than 15% Zinc in LRA Table 3.4.2-1. This component is exposed to Lubricating Oil (External) and Lubricating Oil (Internal) environments and is aging managed by the Lubricating Oil Analysis (B.2.1.26) and One-Time Inspection aging management programs. LRA Table 3.4.1, line item 3.4.1-43 is also revised to reflect this change.

Finally, a discrepancy in the material of the Pump Casing (AFW Motor-Driven Pump Shaft-Driven Lube Oil Pump) component type in the Auxiliary Feedwater System has also been identified. The material for this component type is changed from Carbon Steel to Copper Alloy with less than 15% Zinc in LRA Table 3.4.2-1. This component is exposed to Lubricating Oil (External) and Lubricating Oil (Internal) environments and is aging managed by the Lubricating Oil Analysis (B.2.1.26) and One-Time Inspection aging management programs. LRA Table 3.4.1, line item 3.4.1-43 is also revised to reflect this change.

Table 3.4.1 Summary of Aging Management Evaluations for the Steam and Power Conversion System					
Item Number	Component	Aging Effect/Mechanism	Aging Management Programs	Further Evaluation Recommended	Discussion
3.4.1-19	Stainless steel, Steel Heat exchanger components exposed to Raw water	Loss of material due to general, pitting, crevice, galvanic, and microbiologically-influenced corrosion; fouling that leads to corrosion	Chapter XI.M20, "Open-Cycle Cooling Water System"	No	Consistent with NUREG-1801. The Open-Cycle Cooling Water System (B.2.1.11) program will be used to manage loss of material of steel and stainless steel heat exchanger components, <del>piping, piping components, and piping elements</del> exposed to raw water in the Auxiliary Feedwater System.
3.4.1-20	Copper alloy, Stainless steel Piping, piping components, and piping elements exposed to Raw water	Loss of material due to pitting, crevice, and microbiologically-influenced corrosion	Chapter XI.M20, "Open-Cycle Cooling Water System"	No	Consistent with NUREG-1801. The Open-Cycle Cooling Water System (B.2.1.11) program will be used to manage loss of material of copper alloy <b>and stainless steel</b> heat exchanger components <b>and pumps</b> exposed to raw water in the Auxiliary Feedwater System.
3.4.1-43	Copper alloy Piping, piping components, and piping elements exposed to Lubricating oil	Loss of material due to pitting and crevice corrosion	Chapter XI.M39, "Lubricating Oil Analysis," and Chapter XI.M32, "One-Time Inspection"	No	Consistent with NUREG-1801. The Lubricating Oil Analysis (B.2.1.26) program and One-Time Inspection (B.2.1.20) program will be used to manage loss of material of copper heat exchanger components <b>and pumps</b> exposed to lubricating oil in the Auxiliary Feedwater System.

**Table 3.4.2-1 Auxiliary Feedwater System**

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG-1801 Item	Table 1 Item	Notes
Pump Casing (AFW Diesel Engine Shaft-Driven Essential Service Water Booster Pump)	Pressure Boundary	<del>Carbon Steel</del> <b>Stainless Steel</b>	Air with Borated Water Leakage (External)	Loss of Material <b>None</b>	Boric Acid Corrosion (B.2.1.4) <b>None</b>	VIII.H.S-30 <b>VII.J.AP-18</b>	3.4.1-4 <b>3.3.1-120</b>	A
					External Surfaces Monitoring of Mechanical Components (B.2.1.23)	VIII.H.S-29	3.4.1-34	A
		Raw Water (Internal)	Loss of Material	Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components (B.2.1.25) <b>Open-Cycle Cooling Water System (B.2.1.11)</b>	VIII.G.SP-146 <b>VIII.G.SP-36</b>	3.4.1-19 <b>3.4.1-20</b>	C <b>A</b>	
Pump Casing (AFW Diesel-Driven Pump Shaft-Driven Lube Oil Pump)	Pressure Boundary	<del>Carbon Steel</del> <b>Copper Alloy with less than 15% Zinc</b>	Air with Borated Water Leakage (External) <b>Lubricating Oil (External)</b>	Loss of Material	Boric Acid Corrosion (B.2.1.4) <b>Lubricating Oil Analysis (B.2.1.26)</b>	VIII.H.S-30 <b>VIII.G.SP-92</b>	3.4.1-4 <b>3.4.1-43</b>	A
					External Surfaces Monitoring of Mechanical Components (B.2.1.23) <b>One-Time Inspection (B.2.1.20)</b>	VIII.H.S-29 <b>VIII.G.SP-92</b>	3.4.1-34 <b>3.4.1-43</b>	A
			Lubricating Oil (Internal)	Loss of Material	Lubricating Oil Analysis (B.2.1.26)	VIII.G.SP-94 <b>VIII.G.SP-92</b>	3.4.1-40 <b>3.4.1-43</b>	A
					One-Time Inspection (B.2.1.20)	VIII.G.SP-94 <b>VIII.G.SP-92</b>	3.4.1-40 <b>3.4.1-43</b>	A

**Table 3.4.2-1 Auxiliary Feedwater System**

<b>Component Type</b>	<b>Intended Function</b>	<b>Material</b>	<b>Environment</b>	<b>Aging Effect Requiring Management</b>	<b>Aging Management Programs</b>	<b>NUREG-1801 Item</b>	<b>Table 1 Item</b>	<b>Notes</b>
Pump Casing (AFW Motor-Driven Pump Shaft-Driven Lube Oil Pump)	Pressure Boundary	<del>Carbon Steel</del> <b>Copper Alloy with less than 15% Zinc</b>	Air with Borated Water Leakage (External)	Loss of Material	Boric Acid Corrosion (B.2.1.4)	VIII.H.S-30 <b>VIII.G.SP-92</b>	3.4.1-4 <b>3.4.1-43</b>	A
			<b>Lubricating Oil (External)</b>		<b>Lubricating Oil Analysis (B.2.1.26)</b>			
			Lubricating Oil (Internal)	Loss of Material	External Surfaces Monitoring of Mechanical Components (B.2.1.23)	VIII.H.S-29 <b>VIII.G.SP-92</b>	3.4.1-34 <b>3.4.1-43</b>	A
					<b>One-Time Inspection (B.2.1.20)</b>	Lubricating Oil Analysis (B.2.1.26)	VIII.G.SP-94 <b>VIII.G.SP-92</b>	
<b>One-Time Inspection (B.2.1.20)</b>		VIII.G.SP-94 <b>VIII.G.SP-92</b>	3.4.1-40 <b>3.4.1-43</b>	A				

## **Change #9: Monitoring of Neutron-Absorbing Materials Other than Boraflex**

**Affected LRA Section: B.2.1.27**

**LRA Page Numbers: B-168, B-169, B-171, B-172**

**Description of Change:** A discrepancy in the physical description of the Boral test coupons in the spent fuel pool provided in LRA Section B.2.1.27, Monitoring of Neutron-Absorbing Materials Other than Boraflex, has been identified. LRA Section B.2.1.27 states that the Boral test coupons are mounted in a stainless steel jacket. Contrary to this description, the Boral test coupons do not have a stainless steel jacket. The Boral test coupons are bolted directly to the coupon tree. The Program Description section, the common operating experience example, the second Byron operating experience example, and the second Braidwood operating experience example in LRA Section B.2.1.27 are revised to correct this discrepancy.

### **B.2.1.27 Monitoring of Neutron-Absorbing Materials Other than Boraflex**

#### **Program Description**

The Monitoring of Neutron-Absorbing Materials Other than Boraflex aging management program is an existing condition monitoring program that periodically inspects and analyzes test coupons of the Boral material in the spent fuel storage racks to determine if the neutron-absorbing capability of the material has degraded over time. This program ensures that a five (5) percent sub-criticality margin in the spent fuel pool is maintained during the period of extended operation by monitoring for loss of material, changes in dimension, and loss of neutron-absorption capacity of the Boral material.

The Monitoring of Neutron-Absorbing Materials Other than Boraflex aging management program monitors changes in condition of the Boral material in the spent fuel storage racks through visual inspections, dimensional measurements, neutron-attenuation testing, and weight and specific gravity measurements of representative test coupons. The test coupons are mounted **to a coupon tree assembly and directly exposed to the same spent fuel pool environment as** ~~in a vented stainless steel jacket, simulating as nearly as possible, the actual in-service geometry, physical mounting, and flow conditions of the Boral in the storage racks.~~ The primary measurements used to characterize performance of the Boral coupons are thickness measurements (to detect bulging or swelling) and neutron-attenuation testing (to confirm the boron-10 areal density). Results of each coupon surveillance are documented and retrievable for purposes of trending. Acceptance criteria thresholds are established as indicators of potential adverse trends in the condition of the Boral material so as to ensure corrective actions are taken prior to compromising the five (5) percent sub-criticality margin as contained within the spent fuel pool criticality analysis.

The acceptance criteria for coupon surveillances are for neutron-attenuation results to show that no more than a five (5) percent decrease in boron-10 areal density has occurred, and that dimensional measurements show that an increase in thickness at any point does not exceed 10 percent of the initial thickness at that point. These criteria are established with the intent of being indicators of potential degradation that could lead to challenges to the five (5) percent sub-criticality margin. Failure to meet

the established criteria, results in the condition being entered in the corrective action program.

The existing coupon inspection frequency ensures at least one (1) coupon is examined during each 10 year period, beginning 10 years prior to the period of extended operation, for both Byron and Braidwood Stations.

Common Operating Experience Example:

1. In 2009, the NRC published Information Notice (IN) 2009-26, "Degradation of Neutron-Absorbing Materials in the Spent Fuel Pool," to alert licensees of a trend in adverse findings relative to a variety of neutron-absorbing materials. Included in those materials experiencing degradations was Boral. One of the common degradations, and aging effects that require management, was a change in dimension of the Boral as seen through blistering of the Boral material and bulging of the racks.

Blistering of the material is a result of the aluminum cladding separating from the inner boron-aluminum matrix due to hydrogen gas generation from the material's submersion in the spent fuel pool water. Blistering of the Boral material does not affect the material's ability to absorb neutrons. Bulging of the racks occurs when the generated hydrogen gas is trapped within the stainless steel sheathing of the Boral, resulting in dimensional changes of the rack and cells. The concern in each case is that if the racks are unvented, the hydrogen gas generated can become trapped and displace water, reduce dimensions of flux traps, if included in the design, and ultimately challenge the dimensional assumptions used in the spent fuel pool criticality analysis. The spent fuel pool racks at Byron and Braidwood Stations are vented. Therefore, any hydrogen generation from the Boral material's submersion in the spent fuel pool water will not result in dimensional changes to the racks, gas displacement of water, and changes in the dimensional assumptions used in the spent fuel pool criticality analysis. Furthermore, test coupons are installed in the spent fuel pool ~~mimicking the actual in-service mounting and environmental conditions of~~ **and are, therefore, exposed to the same environment as** the racks. These test coupons are periodically inspected, including visual examinations for evidence of blistering and swelling. Of the five coupons tested at Byron Station and four coupons tested at Braidwood Station since installation of the racks, no evidence of blistering has been observed.

Another potential degradation concern, based on industry operating experience, relating to Boral is the potential loss of material. As documented in NUREG-1801 Revision 2, XI.M40, Element 10, example 1, increases in the aluminum concentration in the spent fuel pool water chemistry of another applicant were observed following installation of their Boral spent fuel racks. Increases in the aluminum concentration in the spent fuel pool water can be an indicator of loss of material of the Boral material. Byron and Braidwood Stations perform water chemistry sampling and testing for aluminum concentrations in the spent fuel pool once a month. A review of the last six years of sampling data did not identify any instances of aluminum concentrations exceeding acceptance criteria or otherwise indicating loss of material of the Boral material is a concern.

This example provides objective evidence that the degradation phenomena documented in known industry operating experience events, as discussed above, are not occurring at Byron and Braidwood Stations. Swelling and bulging of spent fuel pool storage racks is not a concern due to the vented design of the racks. Spent fuel pool water chemistry monitoring has not indicated a loss of material of the aluminum and aluminum-carbide constituents of the Boral material. Therefore, there is sufficient confidence that the Boral neutron-absorber material in the spent fuel storage racks will continue to perform its intended function.

Byron Operating Experience Example #2:

2. In Spring of 2010, a Boral test coupon was removed from the common Byron spent fuel pool for testing. This was the fifth coupon test since installation of the high density Boral spent fuel pool racks in 2000. Testing of the Boral coupon included visual inspections for evidence of blistering and pitting, weight and specific gravity measurements, neutron-attenuation testing for boron-10 content, and dimensional measurements for height, length, and thickness. The test coupons are mounted **to a coupon tree assembly and directly exposed to the same spent fuel pool environment as** ~~in a vented stainless steel jacket, simulating as nearly as possible, the actual in-service geometry, physical mounting, and flow conditions of the Boral in the storage racks.~~ Visual examination of the test coupon identified no evidence of blistering or pitting on the coupon. The measurements for coupon thickness and boron-10 content were compared to values taken prior to submersion in the spent fuel pool and irradiation. The acceptance criteria consists of no more than a 10% increase in thickness and no more than a 5% reduction in boron-10 content. Both of these criteria were found satisfactory. The change in thickness of the coupon was reported as a decrease of 3%, attributed to removal of the oxide film during decontamination, and the average boron-10 areal density taken at five locations on the coupon exhibited no change from the pre-irradiated value. As a result, Byron Station will continue coupon testing in accordance with the manufacturers recommended frequency. The next scheduled coupon inspection is planned for 2014.

This example provides objective evidence that Byron Station has implemented a Boral monitoring program that periodically inspects representative test coupons for parameters that will ensure the Boral poison panels in the spent fuel pool racks continue to perform their intended function. This example also demonstrates that the Boral spent fuel racks continue to maintain the sub-criticality margin of the spent fuel pool.

Braidwood Operating Experience Example #2:

2. In Spring of 2009, a Boral test coupon was removed from the common Braidwood spent fuel pool for testing. This was the fourth coupon test since installation of the high density Boral spent fuel pool racks in 2001. Testing of the Boral coupon included visual inspections for evidence of blistering and pitting, weight and specific gravity measurements, neutron-attenuation testing for boron-10 content, and dimensional measurements for height, length, and thickness. The test coupons are mounted **to a coupon tree assembly and directly exposed to the same spent fuel pool environment as** ~~in a vented stainless steel jacket,~~

~~simulating as nearly as possible, the actual in-service geometry, physical mounting, and flow conditions of the Boral in the storage racks.~~ Visual examination of the test coupon identified no evidence of blistering or pitting on the coupon. The measurements for coupon thickness and boron-10 content were compared to values taken prior to submersion in the spent fuel pool and irradiation. The acceptance criteria consists of no more than a 10% increase in thickness and no more than a 5% reduction in boron-10 content. Both of these criteria were found satisfactory. The change in thickness of the coupon was reported as a decrease of 2.3%, attributed to removal of the oxide film during decontamination, and the average boron-10 areal density taken at five locations on the coupon exhibited no change from the pre-irradiated value. As a result, Braidwood Station will continue coupon testing in accordance with the manufacturers' recommended frequency. The next scheduled coupon inspection is planned for 2013.

This example provides objective evidence that Braidwood Station has implemented a Boral monitoring program that periodically inspects representative test coupons for parameters that will ensure the Boral poison panels in the spent fuel pool racks continue to perform their intended function. This example also demonstrates that the Boral spent fuel racks continue to maintain the sub-criticality margin of the spent fuel pool.

**Change #10: 10 CFR Part 50, Appendix J (B.2.1.32) Aging Management Program**

**Affected LRA Section: B.2.1.32**

**LRA Page Numbers: B-214, B-215, B-216**

**Description of Change:** A discrepancy in the total allowable technical specification limit for containment leakage that was specified in the operating experience section of LRA Section B.2.1.32, 10 CFR Part 50, Appendix J aging management program has been identified. The first Byron operating experience example in the Operating Experience section of LRA Section B.2.1.32 is revised to correct this discrepancy. In addition, the first Braidwood operating experience example is revised for clarity. Finally, the summary discussion for the operating experience section is also revised to correct this discrepancy.

**Byron Operating Experience Example #1:**

1. The cumulative maximum leakage test results at Byron Unit 1 ~~in~~ **as of August, 2012** was 125.647 standard cubic feet per hour (SCFH), or ~~14.0%~~ **23.3%** of the total allowable technical specification limit of ~~899.03~~ **539.41** SCFH (*i.e., 0.6 L<sub>a</sub>*). The cumulative maximum leakage test results at Byron Unit 2 ~~in~~ **as of August, 2012** was 122.889 SCFH, or ~~14.8%~~ **24.7%** of the total allowable technical specification limit of ~~829.99~~ **497.99** SCFH (*i.e., 0.6 L<sub>a</sub>*). The historical data indicates not only that equipment is being adequately maintained but also that the equipment maintenance has been capable of creating a significant safety margin between the technical specification allowable limits and the as-tested values. The test results show the effects of aging are effectively being managed for primary containment.

This example provides objective evidence that the 10 CFR Part 50, Appendix J aging management program effectively manages leakage through the reactor containment, and, systems and components penetrating primary containment to ensure that the leakage rate does not exceed allowable leakage rate values as specified in the technical specifications or associated bases.

**Braidwood Operating Experience Example #1:**

1. The cumulative maximum leakage test results at Braidwood Unit 1 ~~in~~ **as of August, 2012** was 57.7 standard cubic feet per hour (SCFH), or 10.7% of the total allowable technical specification limit of 540.48 SCFH (*i.e., 0.6 L<sub>a</sub>*). The cumulative maximum leakage test results at Braidwood Unit 2 ~~in~~ **as of August, 2012** was 44.1 SCFH, or 8.8% of the total allowable technical specification limit of 499.12 SCFH (*i.e., 0.6 L<sub>a</sub>*). The historical data indicates not only that equipment is being adequately maintained but also that the equipment maintenance has been capable of creating a significant safety margin between the technical specification allowable limits and the as-tested values. The test results show the effects of aging are effectively being managed for primary containment.

This example provides objective evidence that the 10 CFR Part 50, Appendix J aging management program effectively manages leakage through the reactor containment, and, systems and components penetrating primary containment to

ensure that the leakage rate does not exceed allowable leakage rate values as specified in the technical specifications or associated bases.

Operating Experience Summary Discussion:

The above examples provide objective evidence that the 10 CFR Part 50, Appendix J program is capable of ensuring that the leakage through containment, or systems and components penetrating these containments, does not exceed allowable leakage rates specified in the technical specifications, and that the integrity of the containment structure is being maintained. No instances of significant age-related degradation were documented. The data from the ~~most recent~~ running summary totals ~~in~~ **as of August, 2012** show the total leakage has adequate margin at ~~14.0%~~ **23.3%**, ~~14.8%~~ **24.7%**, 10.7%, and 8.8% of the allowable technical specification limit (*i.e., 0.6 L<sub>a</sub>*) at Byron and Braidwood Stations, Units 1 and 2, respectively. Problems identified would not cause significant impact to the safe operation of the plant, and adequate corrective actions were taken to prevent recurrence. Appropriate guidance for re-evaluation, repair, or replacement is provided for locations where age-related degradation is found. Assessments of the 10 CFR Part 50, Appendix J aging management program are performed to identify the areas that need improvement to maintain the quality performance of the program. Therefore, there is sufficient confidence that continued implementation of the 10 CFR Part 50, Appendix J aging management program will effectively identify age-related degradation prior to failure.

**Change #11: Exelon Letter RS-14-129**

**Affected RAI: RAI 4.2.5-1/A.4.2.5-1**

**Letter Page Number: Page 9 of 12**

**Description of Change:** A discrepancy in the letter date of Exelon Letter RS-13-285 provided in the response to Request 2 of RAI 4.2.5-1/A.4.2.5-1 (included in Exelon letter RS-14-129) has been identified. The response to Request 2 is revised to correct this discrepancy.

2. The current TS 5.6.6 required methodologies and the plant procedures for implementing the PTLR process will be valid for updating the P-T limit curves that will be generated for the period of extended operation. Given that the P-T limits minimum temperature requirement methodology in WCAP-16143-P is not based on the configurations of current RPV closure flange assemblies at Byron Unit 2 and Braidwood Unit 2, as an interim measure, commitments have been made in Exelon's response to Notice of Violation dated December 13, 2013 to take corrective steps to revise WCAP-16143-P to reflect the Braidwood Unit 2 configuration of 53 RPV head bolts. In addition, the revision of WCAP-16143-P will include the 53 RPV head bolt configuration at Byron Unit 2. The revision of WCAP-16143-P will bring the methodology in agreement with the current configuration. With regard to the period of extended operation, a commitment was made to restore the configuration for Byron Unit 2 and Braidwood Unit 2 RPV closure flange assemblies to that analyzed in WCAP-16143-P (all 54 reactor head studs tensioned) prior to the period of extended operation. This commitment was made in Exelon's response to NRC RAI B.2.1.3-2 in letter RS-13-285, dated December 13 ~~13~~ **19**, 2013. Implementing these commitments will maintain the current TS 5.6.6 methodologies and plant procedures for implementing the PTLR process valid for the current operating period and the period of extended operation.