



Order No. EA-12-049

RS-16-020

February 26, 2016

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

Braidwood Station, Unit 1
Renewed Facility Operating License No. NPF-72
NRC Docket No. STN 50-456

Subject: Sixth Six-Month Status Report in Response to March 12, 2012 Commission Order Modifying Licenses with Regard to Requirements for Mitigation Strategies for Beyond-Design-Basis External Events (Order Number EA-12-049)

References:

1. NRC Order Number EA-12-049, "Issuance of Order to Modify Licenses with Regard to Requirements for Mitigation Strategies for Beyond-Design-Basis External Events," dated March 12, 2012
2. NRC Interim Staff Guidance JLD-ISG-2012-01, "Compliance with Order EA-12-049, Order Modifying Licenses with Regard to Requirements for Mitigation Strategies for Beyond-Design-Basis External Events," Revision 0, dated August 29, 2012
3. NEI 12-06, "Diverse and Flexible Coping Strategies (FLEX) Implementation Guide," Revision 0, dated August 2012
4. Exelon Generation Company, LLC's Initial Status Report in Response to March 12, 2012 Commission Order Modifying Licenses with Regard to Requirements for Mitigation Strategies for Beyond-Design-Basis External Events (Order Number EA-12-049), dated October 25, 2012
5. Exelon Generation Company, LLC Overall Integrated Plan in Response to March 12, 2012 Commission Order Modifying Licenses with Regard to Requirements for Mitigation Strategies for Beyond-Design-Basis External Events (Order Number EA-12-049), dated February 28, 2013 (RS-13-017)
6. Exelon Generation Company, LLC First Six-Month Status Report in Response to March 12, 2012 Commission Order Modifying Licenses with Regard to Requirements for Mitigation Strategies for Beyond-Design-Basis External Events (Order Number EA-12-049), dated August 28, 2013 (RS-13-113)
7. Exelon Generation Company, LLC Second Six-Month Status Report in Response to March 12, 2012 Commission Order Modifying Licenses with Regard to Requirements for Mitigation Strategies for Beyond-Design-Basis External Events (Order Number EA-12-049), dated February 28, 2014 (RS-14-007)

8. Exelon Generation Company, LLC Third Six-Month Status Report in Response to March 12, 2012 Commission Order Modifying Licenses with Regard to Requirements for Mitigation Strategies for Beyond-Design-Basis External Events (Order Number EA-12-049), dated August 28, 2014 (RS-14-205)
9. Exelon Generation Company, LLC Fourth Six-Month Status Report in Response to March 12, 2012 Commission Order Modifying Licenses with Regard to Requirements for Mitigation Strategies for Beyond-Design-Basis External Events (Order Number EA-12-049), dated February 27, 2015 (RS-15-016)
10. Exelon Generation Company, LLC Fifth Six-Month Status Report in Response to March 12, 2012 Commission Order Modifying Licenses with Regard to Requirements for Mitigation Strategies for Beyond-Design-Basis External Events (Order Number EA-12-049), dated August 28, 2015 (RS-15-208)
11. NRC letter to Exelon Generation Company, LLC, Braidwood Station, Units 1 and 2 – Interim Staff Evaluation Relating to Overall Integrated Plan in Response to Order EA-12-049 (Mitigation Strategies) (TAC Nos. MF0895 and MF0896), dated December 17, 2013
12. NRC letter to Exelon Generation Company, LLC, Braidwood Station, Units 1 and 2 – Report for the Audit Regarding Implementation of Mitigating Strategies and Reliable Spent Fuel Pool Instrumentation Related to Orders EA-12-049 and EA-12-051 (TAC Nos. MF0895 and MF0896), dated May 27, 2015

On March 12, 2012, the Nuclear Regulatory Commission (“NRC” or “Commission”) issued an order (Reference 1) to Exelon Generation Company, LLC (EGC). Reference 1 was immediately effective and directs EGC to develop, implement, and maintain guidance and strategies to maintain or restore core cooling, containment, and spent fuel pool cooling capabilities in the event of a beyond-design-basis external event. Specific requirements are outlined in Attachment 2 of Reference 1.

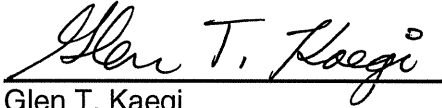
Reference 1 required submission of an initial status report 60 days following issuance of the final interim staff guidance (Reference 2) and an overall integrated plan pursuant to Section IV, Condition C. Reference 2 endorses industry guidance document NEI 12-06, Revision 0 (Reference 3) with clarifications and exceptions identified in Reference 2. Reference 4 provided the EGC initial status report regarding mitigation strategies. Reference 5 provided the Braidwood Station, Unit 1 Overall Integrated Plan.

Reference 1 requires submission of a status report at six-month intervals following submittal of the Overall Integrated Plan. Reference 3 provides direction regarding the content of the status reports. References 6, 7, 8, 9, and 10 provided the first, second, third, fourth, and fifth six-month status reports, respectively, pursuant to Section IV, Condition C.2, of Reference 1 for Braidwood Station, Unit 1. The purpose of this letter is to provide the sixth six-month status report pursuant to Section IV, Condition C.2, of Reference 1, that delineates progress made in implementing the requirements of Reference 1. The enclosed report provides an update of milestone accomplishments since the last status report, including any changes to the compliance method, schedule, or need for relief and the basis, if any. The enclosed report also addresses the NRC Interim Staff Evaluation Open and Confirmatory Items contained in Reference 11, and the NRC Audit Report open items contained in Reference 12.

This letter contains no new regulatory commitments. If you have any questions regarding this report, please contact David P. Helker at 610-765-5525.

I declare under penalty of perjury that the foregoing is true and correct. Executed on the 26th day of February 2016.

Respectfully submitted,



Glen T. Kaegi
Director - Licensing & Regulatory Affairs
Exelon Generation Company, LLC

Enclosure:

1. Braidwood Station, Unit 1 Sixth Six-Month Status Report for the Implementation of Order EA-12-049, Order Modifying Licenses with Regard to Requirements for Mitigation Strategies for Beyond-Design-Basis External Events

cc: NRC Regional Administrator - Region III
NRC Senior Resident Inspector - Braidwood Station
NRC Project Manager, NRR - Braidwood Station
Mr. John D. Hughey, NRR/JLD/JOMB, NRC
Illinois Emergency Management Agency - Division of Nuclear Safety

Enclosure

Braidwood Station, Unit 1

**Sixth Six-Month Status Report for the Implementation of Order EA-12-049, Order
Modifying Licenses with Regard to Requirements for Mitigation Strategies for Beyond-
Design-Basis External Events**

(19 pages)

Braidwood Station, Unit 1

Sixth Six-Month Status Report for the Implementation of Order EA-12-049, Order Modifying Licenses with Regard to Requirements for Mitigation Strategies for Beyond-Design-Basis External Events

1 Introduction

Braidwood Station developed an Overall Integrated Plan (Reference 1 in Section 8), documenting the diverse and flexible strategies (FLEX), in response to Reference 2. This enclosure provides an update of milestone accomplishments since submittal of the last status report, including any changes to the compliance method, schedule, or need for relief/relaxation and the basis, if any.

With the report of Unit 2 full compliance (Reference 38) December 16, 2015, this six-month update provides the status of Braidwood Station, Unit 1 mitigating strategies implementation.

2 Milestone Accomplishments

The following milestone(s) have been completed since July 28, 2015 and are current as of January 30, 2016.

- Procedure Development, Unit 1
 - Strategy procedures
 - Validate procedures (NEI 12-06, Sect. 11.4.3)
 - Maintenance procedures
- Training completion

NOTE: The "Status" indicated in this document is as of January 30, 2016. This date was chosen to support the development, review, approval and submittal of this report by the required February 26, 2016 due date.

3 Milestone Schedule Status

The following provides an update to Attachment 2 of the Overall Integrated Plan. It provides the activity status of each item, and whether the expected completion date has changed. The dates are planning dates subject to change as design and implementation details are developed.

Site: Braidwood

Original Target Completion Date	Activity	Status	Revised Target Completion Date
	Submit 60 Day Status Report	Complete	
	Submit Overall Integrated Implementation Plan	Complete	
	Contract with Strategic Alliance	Complete	

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		for FLEX Emergency Response National SAFER Response Center				
		Submit Six (6) month updates				
Aug 2013		Update 1	Complete			
Feb 2014		Update 2	Complete			
Aug 2014		Update 3	Complete			
Feb 2015		Update 4	Complete			
Aug 2015		Update 5	Complete			
Feb 2016		Update 6	Complete with this submittal			
Aug 2016		Update 7	Not Started			
Unit 1	Unit 2	Modification Development	Unit 1	Unit 2	Unit 1	Unit 2
Feb 2014	Sept 2014	• Phase 1 modifications	Started	Complete	Oct 2016	Oct 2015
Feb 2014	Sept 2014	• Phase 2 modifications	Complete	Complete	Dec 2014	Dec 2014
Feb 2014	Sept 2014	• Phase 3 modifications	Complete	Complete		
Unit 1	Unit 2	Modification Implementation	Unit 1	Unit 2	Unit 1	
Apr 2015	Oct 2015	• Phase 1 modifications	Started	Complete	Oct 2016	
Apr 2015	Oct 2015	• Phase 2 modifications	Complete	Complete		
Apr 2015	Oct 2015	• Phase 3 modifications	Complete	Complete		
Unit 1	Unit 2	Procedure Development	Unit 1	Unit 2	Unit 1	
Apr 2015	Oct 2015	• Strategy procedures	*Complete	Complete	Oct 2016	
Apr 2015	Oct 2015	• Validate procedures (NEI 12-06, Sect. 11.4.3)	*Complete	Complete	Oct 2016	
Apr 2015	Oct 2015	• Maintenance procedures	*Complete	Complete	Oct 2016	
Nov 2014		Staffing analysis	Complete			
Apr 2015		Storage plan and construction	Complete			

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Apr 2015	FLEX equipment acquisition	Complete	
Apr 2015	Training completion	Complete	Sept 2015
Dec 2014	National SAFER Response Center operational	Complete	Feb 2015
Apr 2015	Unit 1 Implementation date	Started	October 2016
Oct 2015	Unit 2 Implementation date	Complete	

Notes:

* Procedures completed. Awaiting implementation during A1R19 due to the RCP Seals.

4 Changes to Compliance Method

Change 1

Section: General Integrated Plan Elements PWR - Provide a sequence of events and identify any time constraint required for success including the technical basis for the time constraint.

Reason for Change: Calculations CN-LIS-15-39 and CN-LIS-15-40 have been completed.

Change:

- Change sequence of events action, Verify DDAF Pp is operating properly, elapsed time from 5 - 50 minutes to 5 - 30 minutes.
- Change RCS cool down rate from approximately 75°F/hr cool down to ≤ 100 °F/hr. Also change the elapsed time from 1.5 hour to 1.5 hours - 8 hours.
- Change SX short cycle start time from 55 - 90 minutes to 30 - 90 minutes.

Change 2

Section: Attachment 1A, Sequence of Events time line.

Reason for Change: Calculations CN-LIS-15-39 and CN-LIS-15-40 have been completed

Change:

- Change sequence of events action, Verify DDAF Pp is operating properly, elapsed time from 5 - 50 minutes to 5 - 30 minutes. Also changed its time constraint from 1 hour to 45 minutes.
- Change line item 10 action from "Start depressurization of SGs to 260 psig at approximately 75°F/hr cool down with SG PORV local/manual operation. SG feed is controlled with Local/Manual operation of AFW flow control valves" to "Start depressurization of SGs to 260 psig at ≤ 100 °F/hr cool down with SG PORV local/manual operation. SG feed is controlled with Local/Manual operation of AFW flow control valves". Also change the elapsed time from 1.5 hour to 1.5 hours - 8 hours and the time constraint from 2 hours to 8 hours.

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- Change SX short cycle, SI accumulator and maintaining SG pressure actions as a result of sequence changes listed above.

Updated timeline is provided in Attachment 1A of this document.

5 Need for Relief/Relaxation and Basis for the Relief/Relaxation

Braidwood Station, Unit 1 has received an 18-month extension of the Order due to Pressurized-Water Reactor Owners Group (PWROG) refining RCP Seal Leakage rate projections and is scheduled to be in compliance by October 2016 in accordance with NRC letter, dated April 15, 2015 (ADAMS Accession No. ML 15068A215) stating: "Accordingly, based upon the authority granted to the Director, Office of Nuclear Reactor Regulation, the requirement of the order for full order implementation for Braidwood Station, Unit 1, is relaxed until the completion of the fall 2016 refueling outage. This additional time will allow Exelon to complete the engineering analysis associated with the additional information provided by the PWROG regarding the analytical basis for RCP seal leakage".

6 Open Items from Overall Integrated Plan and Draft Safety Evaluation

The following tables provide a summary of the open items documented in the Overall Integrated Plan or the Draft Safety Evaluation (SE) and the status of each item.

NOTE: The "Status" indicated in this document is as of January 30, 2016. This date was chosen to support the development, review, approval and submittal of this report by the required February 26, 2016 due date.

Section Reference	Overall Integrated Plan Open Item	Status
Key Site assumptions (p.4)	Primary and secondary storage locations have not been selected yet; once locations are finalized implementation strategies and routes will be assessed for hazard impact.	Item Closed During Onsite NRC Audit (Ref. 31). Complete – Closure supplied as part of fifth 6-month update (Ref. 36).
Sequence of events (p.5)	The final timeline will be time validated once detailed designs are completed and procedures are developed.	Item Closed During Onsite NRC Audit (Ref. 31). Complete - The site FLEX procedures have been developed and validated consistent with the NEI FLEX validation process. The results have been compared to the site Phase 2 staffing study (Ref. 37). The comparison confirmed that site existing emergency response resources are sufficient to perform the required plant actions and implement the multi-unit BDBEE response strategies.

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Identify how strategies will be deployed (p.7)	Identification of storage area and creation of the administrative program.	Item Closed During Onsite NRC Audit (Ref. 31). Complete – Closure supplied as part of fifth 6-month update (Ref. 36).
Programmatic controls (p.8)	Develop an administrative program for FLEX responsibilities, and testing & maintenance.	Item Closed During Onsite NRC Audit (Ref. 31). Complete – Closure supplied as part of fifth 6-month update (Ref. 36).
National SAFER Response Center plan (p.9)	Development of Braidwood Station's playbook.	Item Closed During Onsite NRC Audit (Ref. 31). Complete – Closure supplied as part of fifth 6-month update (Ref. 36).
Key Reactor Parameters (p. multiple)	Identify additional parameters that are needed in order to support key actions identified in the plant procedures/guidance or to indicate imminent or actual core damage.	Item Closed During Onsite NRC Audit (Ref. 31). Complete – Closure supplied as part of third 6-month update (Ref. 25).
Deployment Conceptual Design (p. multiple)	Develop the storage structure conceptual design.	Item Closed During Onsite NRC Audit (Ref. 31). Complete – Closure supplied as part of fourth 6-month update (Ref. 29).
Maintain RCS Inventory Control, Phase 2 (p.23)	A calculation will be required for the timing of the boration and quantity required.	Item Closed During Onsite NRC Audit (Ref. 31). Complete - Braidwood Station has decided to install the Westinghouse reactor coolant pump (RCP) SHIELD Passive Thermal Shutdown Seals (SDS) (Generation III). As a result of installing the SHIELD seals, calculation CN-LIS-15-39, Exelon Byron and Braidwood Stations Reactor Coolant System ELAP Long-Term Subcriticality Analysis with Low-Leakage Reactor Coolant Pump Seal Packages (Ref. 35), was performed. Calculation CN-LIS-15-39 (Ref. 35) determined the timing and quantity of borated water required to maintain the reactor subcritical. Boration will need to start within 16 hours of the event initiation and require approximately 6,000 gallons of 2300 ppm water injected into the RCS. This calculation supersedes calculation BYR13-239/BRW-13-0221-M (Ref. 10).
Maintain Containment, Phase 1 (p.31)	Additional calculations will be performed to evaluate containment response.	Item Closed During Onsite NRC Audit (Ref. 31). Complete – Closure supplied as part of fifth 6-month update (Ref. 36).

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Maintain Spent Fuel Pool Cooling, Phase 1 (p.39)	Procedure development for Initial Spent fuel pool make-up with gravity drain from the RWST.	Item Closed During Onsite NRC Audit (Ref. 31). Complete – Closure supplied as part of third 6-month update (Ref. 25).
Maintain Spent Fuel Pool Cooling, Phase 1 (p.39)	Initial calculations were used to determine the fuel pool timelines. Formal calculations will be performed to validate this information during development of the spent fuel pool cooling strategy detailed design.	Item Closed During Onsite NRC Audit (Ref. 31). Complete - Closure supplied as part of third 6-month update (Ref. 25).
Maintain Spent Fuel Pool Cooling, Phase 1, (p.39 and p.42)	Evaluation of the spent fuel pool area for steam and condensation will be performed and used to determine if vent path strategy is needed.	Item Closed During Onsite NRC Audit (Ref. 31). Complete - Closure supplied as part of third 6-month update (Ref. 25).
Safety Functions Support, Phase 2 (p.51)	Habitability conditions will be evaluated and a strategy will be developed to maintain Main Control Room.	Item Closed During Onsite NRC Audit (Ref. 31). Complete - Closure supplied as part of third 6-month update (Ref. 25).
Safety Functions Support, Phase 2 (p.51)	Critical ventilation assets may be required to support DDAF pumps, station battery rooms, miscellaneous electric equipment rooms, and fuel handling building personnel habitability and/or component survivability. Specific analyses of these rooms will be performed.	Item Closed During Onsite NRC Audit (Ref. 31). Complete – Closure supplied as part of fourth 6-month update (Ref. 29).

Interim Safety Evaluation Open Item			Status
Braidwood's ISE Response			
Line Number	Item Number	Description	Answer
1	Open Item 3.2.1.8.A	Core Subcriticality- The NRC staff has not endorsed the industry-proposed position paper regarding boron mixing. The licensee has indicated that Braidwood is planning on following this methodology. Thus, further resolution of this issue will be necessary in the next phase of the audit process.	Item Closed During Onsite NRC Audit (Ref. 31). Complete - Braidwood will abide by the position expressed by the Nuclear Regulatory Commission (NRC) staff in the letter dated January 8, 2014 regarding the boron mixing issue for Pressurized Water Reactors (PWRs) (Ref. 22). Calculation CN-LIS-15-39 (Ref. 35) determined the timing and quantity of borated water required to maintain the reactor subcritical. Boration will need to start within 16 hours of the event initiation and require approximately

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			<p>6,000 gallons of 2300 ppm water injected into the RCS. This calculation supersedes calculation BYR13-239/BRW-13-0221-M (Ref. 10).</p> <p>Calculation CN-LIS-15-34 (Ref. 33) determined the RCS loss of single phase natural circulation will occur 58 hours into the event.</p> <p>The Braidwood Overall Integrated Plan (OIP) Attachment 1A, Action Item 16 shows that the high pressure FLEX pumps are available between 11 and 14 hours following the Beyond-Design-Basis External Event (BDBEE) which meets the timing requirements outlined in Ref. 22.</p>
	Confirmatory Items		
2	3.1.1.1.A	Storage & Protection of FLEX equipment - Confirm final design of FLEX storage structure conforms to NEI 12-06, Sections 5.3.1, 7.3.1, and 8.3.1 for storage considerations for the hazards applicable to Braidwood.	Complete – Closure supplied as part of fifth 6-month update (Ref. 36).
3	3.1.1.3.A	Procedural Interface Considerations (Seismic) –Confirm procedure for measuring key instruments at containment penetrations using portable instrument.	Item Closed During Onsite NRC Audit (Ref. 31). Complete – Closure supplied as part of fourth 6-month update (Ref. 29).
4	3.1.1.4.A	Off-Site Resources – Confirm National SAFER Response Center local staging area and method of transportation to the site in future 6-month update	Item Closed During Onsite NRC Audit (Ref. 31). Complete – Closure supplied as part of fifth 6-month update (Ref. 36).
5	3.1.5.1.A	Protection of Equipment (High Temperature) - Confirm FLEX storage structure will maintain FLEX equipment at a temperature range to ensure its likely function when called upon.	Item Closed During Onsite NRC Audit (Ref. 31). Complete – Closure supplied as part of fourth 6-month update (Ref. 29).
6	3.1.5.3.A	Deployment of Equipment (High Temperature) - Confirm that the effects of high temperature on FLEX equipment have been evaluated in the locations they are intended to operate.	Item Closed During Onsite NRC Audit (Ref. 31). Complete – Closure supplied as part of fourth 6-month update (Ref. 29).
7	3.2.1.A	RCS cooling & RCS inventory control - Specify which analysis performed in WCAP-17601 is being	Item Closed During Onsite NRC Audit (Ref. 31).

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		applied to Braidwood. Additionally, justify the use of that analysis by identifying and evaluating the important parameters and assumptions demonstrating that they are representative of Braidwood and appropriate for simulating the ELAP transient.	Complete – Closure supplied as part of fifth 6-month update (Ref. 36).
8	3.2.1.1.A	NOTRUMP - Confirm that the use of NOTRUMP in the ELAP analysis is limited to the flow conditions before reflux condensation initiates. This includes specifying an acceptable definition for reflux condensation cooling.	Item Closed During Onsite NRC Audit (Ref. 31). Complete – Closure supplied as part of fifth 6-month update (Ref. 36).
9	3.2.1.1.B	ELAP Analysis - Confirm calculations to verify no nitrogen injection into RCS during depressurization.	Item Closed During Onsite NRC Audit (Ref. 31). Complete – Closure supplied as part of fourth 6-month update (Ref. 29).
10	3.2.1.1.C	Confirm analysis for secondary side SG fouling due to the use of abnormal water sources (RWST, well water, SX water)	Item Closed During Onsite NRC Audit (Ref. 31). Complete – Closure supplied as part of fourth 6-month update (Ref. 29).
11	3.2.1.1.D	Complete analysis for length of time prior to depletion of the RWST and determine whether additional boration equipment is needed for Phase 3 coping strategy.	Item Closed During Onsite NRC Audit (Ref. 31). Complete – Closure supplied as part of fourth 6-month update (Ref. 29).
12	3.2.1.2.B	Reactor Coolant Pump (RCP) Seal Leakage - In some plant designs, the cold legs could experience temperatures as high as 580 °F before cooldown commences. This is beyond the qualification temperature (550°F) of the 0-rings used in the RCP seals. For those Westinghouse designs, a discussion should be provided to justify that (1) the integrity of the associated 0-rings will be maintained at the temperature conditions experienced during the ELAP event, and (2) the seal leakage rate of 21 gpm/seal used in the ELAP is adequate and acceptable.	Item Closed During Onsite NRC Audit (Ref. 31). Complete: Braidwood Station has decided to install the Westinghouse reactor coolant pump (RCP) SHIELD Passive Thermal Shutdown Seals (SDS) (Generation III). The SHIELD SDSs were installed on all 4 RCPs on Unit 2 in the Fall of 2015 and will be installed on Unit 1 in the Fall of 2016. Braidwood Station has Westinghouse RCP Model 93A. Credit for the SHIELD seals has been endorsed for Westinghouse Model 93A RCPs as documented in ADAMS Accession No. ML14132A128. The RCP seal leakage assumed in CN-LIS-15-34, Exelon Byron and Braidwood Stations Reactor Coolant System ELAP

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		<p>Inventory Control Analysis SHIELD Reactor Coolant Pump Seal Packages, (Ref. 33) is consistent with ADAMS Accession No. ML14132A128 limitations and conditions number 4.</p> <p>The qualification testing of the shutdown seal was performed at conditions based on a cold leg temperature of 571°F. The maximum shutdown seal temperature remains below the shutdown seal temperatures experienced during qualification testing.</p> <p>Following a loss of AC power, it is possible for the RCS cold leg temperature to exceed 571°F for short periods of time without the shutdown seal heating up beyond the temperatures experienced during qualification testing. This is due to the significant thermal inertia of the massive reactor coolant pump internals and pressure boundary. The evaluation documented in calculation CN-LIS-15-40 (Ref. 34) concludes that even if the cold leg temperature is 581°F for the first 3000 seconds (50 minutes) following ELAP initiation, the maximum fluid temperature at the reactor coolant pump seal inlet remains below the temperatures experienced during shutdown seal qualification testing. Auxiliary Feedwater flow to the steam generators will be initiated at approximately 30 minutes into the ELAP event. Following the restoration of Auxiliary Feedwater flow to the steam generators and prior to initiating plant cooldown, cold leg temperature will be dictated by the Main Steam Safety Valves. Cold leg temperature will remain less than 571°F during this period based on the lowest Main Steam Safety Valve setting of 1175</p>
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			<p>psig adjusted for setting tolerance and lift setpoint testing uncertainty.</p> <p>Westinghouse LTR-RES-13-153, Documentation of 7228C Compound O-Rings at ELAP Conditions, concludes, with a high level of confidence, that the integrity of the RCS O-rings will be maintained at the temperature conditions experienced during the ELAP event.</p>
13	3.2.1.2.E	RCP Seal Leakage Rates - The licensee is requested to provide the manufacturer and model number of the RCP seals and discuss whether or not the RCP and seal combination complies with a seal leakage model described in WCAP-17601.	<p>Item Closed During Onsite NRC Audit (Ref. 31).</p> <p>Complete – Closure supplied as part of fifth 6-month update (Ref. 36).</p>
14	3.2.1.3.A	Decay Heat- Verify that the Integrated Plan update provides the details of the WCAP 17601-P methodology to include the values of certain key parameters used to determine the decay heat levels. Address the adequacy of the values used.	<p>Item Closed During Onsite NRC Audit (Ref. 31).</p> <p>Complete – Closure supplied as part of fifth 6-month update (Ref. 36).</p>
15	3.2.1.4.A	Initial Values for Key Plant Parameters and Assumptions- Confirm WCAP-17601-P analyses are bounding for Braidwood for strategy response or verify plant-specific analyses if more restrictive limits are used due to more restrictive plant specific limits.	<p>Item Closed During Onsite NRC Audit (Ref. 31).</p> <p>Complete – Closure supplied as part of fifth 6-month update (Ref. 36).</p>
16	3.2.1.4.B	Initial Values for Key Plant Parameters and Assumptions- Confirm calculations to validate 8 hours run time limit on DDAF pump batteries and DDAF room temp for pump operation and human occupancy. Also, confirm site phase 2 staffing study confirms the required time can be met for refilling diesel day tank.	<p>Item Closed During Onsite NRC Audit (Ref. 31).</p> <p>Complete – Closure supplied as part of fourth 6-month update (Ref. 29).</p>
17	3.2.1.5.A	Monitoring Instruments and Control- Confirm additional parameters evaluated for use in plant procedures/guidance or to indicate imminent or actual core damage.	<p>Item Closed During Onsite NRC Audit (Ref. 31).</p> <p>Complete - Closure supplied as part of third 6-month update (Ref. 25).</p>

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18	3.2.1.6.A	Sequence of Events - Confirm that the final timeline has been time validated after detailed designs are completed and procedures are developed. The results may be provided in a future 6-month update.	Complete - The site FLEX procedures have been developed and validated consistent with the NEI FLEX validation process. The results have been compared to the site Phase 2 staffing study (Ref. 37). The comparison confirmed that site existing emergency response resources are sufficient to perform the required plant actions and implement the multi-unit event response strategies.
19	3.2.1.6.B	Sequence of Events - Confirm analysis to validate Phase 2 pump capacities.	Item Closed During Onsite NRC Audit (Ref. 31). Complete – Closure supplied as part of fourth 6-month update (Ref. 29).
20	3.2.1.9.A	Use of portable pumps - Confirm final design of strategies meets "use of portable pumps" guideline in NEI 12-06, Section 3.2.2, Guideline 13.	Item Closed During Onsite NRC Audit (Ref. 31). Complete – Closure supplied as part of fourth 6 month update (Ref. 29).
21	3.2.2.A	SFP cooling -Verify procedure for SFP makeup via gravity drain; confirm verification of timeline for performing the strategy; and confirm evaluation of SFP area for steam and condensation affects.	Item Closed During Onsite NRC Audit (Ref. 31). Complete – Closure supplied as part of fourth 6-month update (Ref. 29).
22	3.2.3.A	Containment - Confirm containment reanalysis supports no Phase 1, 2, and 3 mitigation strategies are required because containment pressure and temperature are maintained within acceptable limits.	Complete – Closure supplied as part of fifth 6-month update (Ref. 36).
23	3.2.3.B	Containment - Confirm evaluation performed for the need to monitor containment temperature.	Item Closed During Onsite NRC Audit (Ref. 31). Complete – Closure supplied as part of fifth 6-month update (Ref. 36).
24	3.2.4.1.A	Equipment cooling - Confirm modification has been performed to prevent DDAF pump from overheating due to cooling water recirculation flow paths within the SX system cycling and overheating the pump within 1 hour.	Item Closed During Onsite NRC Audit (Ref. 31). Complete – Closure supplied as part of fourth 6-month update (Ref. 29).
25	3.2.4.2.A	Ventilation - Equipment Cooling - Review licensee's evaluation of loss of ventilation effects on equipment in various rooms (DDAF pump room, battery rooms, control room, miscellaneous electrical equipment	Item Closed During Onsite NRC Audit (Ref. 31). Complete – Closure supplied as part of fourth 6-month update (Ref. 29).

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		rooms)	
26	3.2.4.2.B	A discussion is needed on the extreme high/low temperatures effects of the battery's capability to perform its function for the duration of the ELAP event and hydrogen gas ventilation during recharging batteries during Phase 2 and 3.	Item Closed During Onsite NRC Audit (Ref. 31). Complete – Closure supplied as part of fourth 6-month update (Ref. 29).
27	3.2.4.3.A	Heat Tracing - Confirm that potential adverse impacts from a loss of heat tracing and normal heating on any equipment credited for ELAP mitigation are adequately addressed. In particular, ensure an RCS inventory and source of borated water is available for a BDBEE associated with extreme cold, ice, and snow.	Item Closed During Onsite NRC Audit (Ref. 31). Complete – Closure supplied as part of fourth 6-month update (Ref. 29).
28	3.2.4.4.A	Communications - Confirm that upgrades to the site's communications systems have been completed.	Item Closed During Onsite NRC Audit (Ref. 31). Complete – Closure supplied as part of fifth 6-month update (Ref. 36).
29	3.2.4.6.A	Personnel Habitability - Review licensee's evaluation of loss of ventilation effects on personnel habitability and accessibility.	Item Closed During Onsite NRC Audit (Ref. 31). Complete - Closure supplied as part of third 6-month update (Ref. 25).
30	3.2.4.7.A	Water Sources - Justify the time at which SG dryout will occur.	Item Closed During Onsite NRC Audit (Ref. 31). Complete – Site specific calculation CN-LIS-15-40 (Ref. 34), demonstrates SG dry out will occur 45 minutes after the event initiation. This data supersedes the generic information used in WCAP-17601-P, Table 5.4.1.1-1, Case 2A (Ref. 18).
31	3.2.4.8.A	Electrical Power Sources / Isolation and interactions- confirm class 1E equipment is protected from faults in portable/FLEX equipment and multiple sources do not attempt to power electrical buses.	Item Closed During Onsite NRC Audit (Ref. 31). Complete – Closure supplied as part of fourth 6-month update (Ref. 29).
32	3.2.4.9.A	Portable Equipment Fuel - Confirm that complete analysis of fuel usage requirements has been developed after the specific FLEX equipment is identified and the fuel usage is determined. A discussion is needed on maintaining the quality of fuel stored in the tanks for extended periods of time	Item Closed During Onsite NRC Audit (Ref. 31). Complete – Closure supplied as part of fifth 6-month update (Ref. 36).

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33	3.2.4.10.A	Load reduction to conserve DC power- Confirm sizing calculations for FLEX generators and details of load shedding.	Item Closed During Onsite NRC Audit (Ref. 31). Complete – Closure supplied as part of fourth 6-month update (Ref. 29).
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NRC Audit Open Items Braidwood Station Response		Status
SE#9	Please provide adequate justification for the reactor coolant Pump (RCP) seal leakage rates calculated according to the Westinghouse seal leakage model that was revised following the issuance of NSAL-14-1. The justification should include a discussion of the following factors: a. benchmarking of the seal leakage model against relevant data from tests or operating events, b. discussion of the impact on the seal leakage rate due to fluid temperatures greater than 550°F resulting in increased deflection at the seal interface, c. clarification whether the second-stage RCP seal would remain closed under ELAP conditions predicted by the revised seal leakage model and a technical basis to support the determination, and, d. justification that the interpolation scheme used to compute the integrated leakage from the RCP seals from a limited number of computer simulations (e.g., three) is realistic or conservative.	Complete – Closure supplied as part of fifth 6-month update (Ref. 36).
SE #10	The NRC staff understands that Westinghouse has recently recalculated RCP seal leakoff line pressures under loss of seal cooling events based on a revised seal leakage model and additional design-specific information for certain plants. a. Please clarify whether the piping and all components (e.g., flow elements, flanges, valves, etc.) in your seal leakoff line are capable of withstanding the pressure predicted during an ELAP event according to the revised seal leakage model. b. Please clarify whether operator actions are credited with isolating low-pressure portions of the seal leakoff line and if so, please explain how these actions will be executed under ELAP conditions. c. If overpressurization of piping or components could occur under ELAP conditions, please discuss any planned modifications to the seal leakoff piping and component design and the associated completion timeline. d. Alternately, please identify the seal leakoff piping or components that would be susceptible to overpressurization under ELAP conditions, clarify their locations, and provide justification that the seal leakage rate would remain in an acceptable range if the affected piping or components were to rupture.	Complete – Closure supplied as part of fifth 6-month update (Ref. 36).

7 Potential Draft Safety Evaluation Impacts

There are no potential impacts to the Draft Safety Evaluation identified at this time.

8 References

The following references support the updates to the Overall Integrated Plan described in this enclosure.

1. Braidwood Station, Units 1 and 2, "Overall Integrated Plan in Response to March 12, 2012 Commission Order Modifying Licenses with Regard to Requirements for Mitigation Strategies for Beyond-Design-Basis External Events (Order Number EA-12-049)," dated February 28, 2013 (RS-13-017).
2. NRC Order Number EA-12-049, "Order Modifying Licenses with Regard to Requirements for Mitigation Strategies for Beyond-Design-Basis External Events," dated March 12, 2012.
3. NEI 12-06 Rev. 0, Diverse and Flexible Coping Strategies (FLEX) Implementation Guide, dated August 2012.
4. Braidwood Station's First Six Month Status Report for the Implementation of FLEX, dated August 28, 2013.
5. Braidwood Station's Second Six Month Status Report for the Implementation of FLEX, dated February 28, 2014.
6. Braidwood Station, Units 1 and 2 – NRC Interim Staff Evaluation Relating to Overall Integrated Plan in Response to Order EA-12-049 (Mitigating Strategies) (TAC NOS. MF0895 AND MF0896), dated December 17, 2013.
7. BYR99-010/BRW-99-0017-I, Rev. 2, Documentation of the Basis of the Emergency Operating Procedures (EOP) Setpoints, dated September 2014.
8. BYR14-060/BRW-14-0080-E, Rev. 0, Unit 1(2) 125 VDC Battery FLEX Coping Calculation – Common Calc – Beyond Design Basis, dated September 2014.
9. BYR13-240/BRW-13-0222-M, Rev. 0, Spent Fuel Pool Boil Off Analysis during an ELAP Event, dated April 2014.
10. BYR13-239/BRW-13-0221-M, Rev. 0, RCS Boration Analysis during an ELAP Event, dated August 2014.
11. Exelon Structural Drawing S-183, Rev. AF, Roadway Plan Plant and Construction Laydown Area, dated May 2014.
12. BYR13-235/BRW-13-0217-M, Rev. 0, Containment Pressure and Temperature Response during an ELAP Event, dated September 2014.
13. BYR13-234/BRW-13-0216-M, Rev. 0, Auxiliary FW Pump Room Temperature Analysis during and ELAP Event, dated April 2014.

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14. BYR13-237/BRW-13-0219-M, Rev. 0, MEER and Battery Room Conditions Following ELAP, dated July 2014.
15. BYR13-236/BRW-13-0218-M, Rev. 0, Control Room and Auxiliary Electric Equipment Room heat up and Ventilation during an ELAP, dated June 2014.
16. BYR13-026/BRW-13-0031-M, Rev. 0, Transient Analysis of SX System Following Loss of A-C Power, dated August 2013.
17. BYR14-046/BRW-14-0058-M, Rev. 0, Containment Environment Following an Extended Loss of AC Power During Shutdown, dated September 2014.
18. WCAP 17601-P, Rev. 1, Reactor Coolant System Response to the Extended Loss of AC Power Event for Westinghouse, Combustion Engineering and Babcock & Wilcox NSSS Designs, dated January 2013.
19. BRW-97-0340-E, Rev. 3, Battery Duty Cycle and Sizing for the Braidwood Diesel Driven Auxiliary Feedwater Pumps, dated August 2014.
20. BYR13-144/BRW-13-0160-M, Rev. 2, FLEX Pump Sizing and Hydraulic Analysis, dated December 2014.
21. BRW-14-0030-M, Rev. 0, Godwin Pump Suction Line Hydraulic Analysis to Support FLEX, dated August 2014.
22. Letter to Mr. Jack Stringfellow requesting endorsement of Westinghouse position paper entitled "Westinghouse Response to NRC Generic Request for Additional Information (RAI) on Boron Mixing in support of the Pressurized Water Reactor Owners Group (PWROG)", Accession Number ML13276A183, date January 8, 2014.
23. Westinghouse Correspondence LTR-FSE-14-43, Revision 0, "Exelon Generation Company, LLC Mitigation Strategies Order (EA-12-049) Design ELAP Simulation Parameters," dated June 15, 2015.
24. Westinghouse Correspondence LTR-FSE-14-61, Rev.0 "Exelon Generation Company, LLC Mitigation Strategies Order (EA-12-049) Open and Confirmatory Item Responses," dated June 15, 2015.
25. Braidwood Station's Third Six Month Status Report for the Implementation of FLEX, dated August 28, 2014.
26. BRW-14-0255-M, Rev.1, Braidwood Units 1 and 2 FLEX Steam Generator Degraded Heat Transfer Analysis through 72 hours, dated December 2014.
27. BYR14-129/BRW-14-0212-M, Rev. 0, RWST Usage during FLEX Scenarios, dated October 2014.
28. BRW-14-0211-M, Rev.0, Evaluation of Tank and Hose Freezing during an ELAP, dated September 2014.
29. Braidwood Station's Fourth Six Month Status Report for the Implementation of FLEX, dated February 27, 2015.
30. BRW-15-0002-S, Rev.0, Evaluation of FLEX Equipment Haul Paths for Soil Liquefaction Potential, dated March 2015.
31. Braidwood Station, Units 1 and 2 – NRC Report for the Audit Regarding Implementation of Mitigating Strategies and Reliable Spent Fuel Pool Instrumentation Related to Orders EA-12-049 and EA-12-051 (TAC Nos. MF0895 and MF0896), dated May 27, 2015 (ADAMS Accession No. ML15134A459).

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32. PWROG-14027-P, Rev. 3, No.1 Seal Flow Rate for Westinghouse Reactor Coolant Pumps Following Loss of all AC Power, dated April 2015.
33. CN-LIS-15-34, Rev. 0, Exelon Byron and Braidwood Stations Reactor Coolant System ELAP Inventory Control Analysis SHIELD Reactor Coolant Pump Seal Packages, dated July 13, 2015.
34. CN-LIS-15-40, Rev. 0, Exelon Byron and Braidwood Stations Delayed AFW FLEX Studies, dated September 2015.
35. CN-LIS-15-39, Rev.0, Exelon Byron and Braidwood Stations Reactor Coolant System ELAP Long-Term Subcriticality Analysis with Low-Leakage Reactor Coolant Pump Seal Packages, dated September 2015.
36. Braidwood Station's Fifth Six Month Status Report for the Implementation of FLEX, dated August 28, 2015.
37. Braidwood Station, Units 1 and 2 - Response Regarding Phase 2 Staffing Submittals Associated With Near-term Task Force Recommendation 9.3 Related to the Fukushima Dai-ichi Nuclear Power Plant Accident (ADAMS Accession No.: ML 151568260), dated June 2015.
38. Exelon Generation Company, LLC letter to the NRC, "Braidwood Station, Unit 2, Report of Full Compliance with March 12, 2012 Commission Order Modifying Licenses with Regard to Requirements for Mitigation Strategies for Beyond-Design-Basis External Events (Order Number EA-12-049), dated December 16, 2015 (RS-15-276).
39. Westinghouse Correspondence LTR-RES-13-153, "Documentation of 7228C O-Rings at ELAP Conditions," dated October 31, 2013.

Attachment 1A Sequence of Events Timeline

Action item	Elapsed Time	Action	Time Constraint Y/N ¹	Remarks / Applicability
1	0	Event Starts, BDBEE occurs, Unit 1 and Unit 2 reactors automatically trip and all rods are inserted. Loss of off-site power (LOOP) affecting both units occurs.	NA	Unit 1 and Unit 2 @100% power
2	1 min	Emergency Operating Procedures, (EOPs) and Station Black Out, (SBO), Procedures are entered.	NA	_BwCA 0.0, Loss of All AC Power, action.
3	3-5 mins	MCR closes C & D S/G PORVs to conserve inventory.	Y – 5 minutes	_BwCA 0.0, Loss of All AC Power, action. CN-LIS-15-40 (Ref. 34).
4	5-30 mins	Verify DDAF Pp is operating properly.	Y – 45 minutes	_BwCA 0.0, Loss of All AC Power, action. CN-LIS-15-40 (Ref. 34).
5	10-30 mins	Attempt starting Emergency D/G's.	NA	_BwCA 0.0, Loss of All AC Power, action.
6	30 mins	ELAP condition recognized and ELAP Procedures are entered.	NA	_BwCA 0.0, Loss of All AC Power, attachment B for

¹ Instructions: Provide justification if No or NA is selected in the remarks column
If yes, include technical basis discussion as required by NEI 12-06, Section 3.2.1.7

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Action item	Elapsed Time	Action	Time Constraint Y/N ¹	Remarks / Applicability
				ELAP.
7	30 mins to 90 mins	SX Short Cycle Cooling EC is aligned to cool the B AF Pp within 2 hour after pump start.	Y - 2 hours	_BwCA 0.0, Loss of All AC Power, action. BRW-13-0031-M (Ref. 16)
8	30 mins to 6 hrs	Connect FLEX 480V AC generators to ESF bus _32X and verify they are supplying power to Div 2 - 125V DC battery chargers.	Y - 8 hours	BRW-14-0080-E (Ref. 8)
9	35 mins to 65 mins	Operators dispatched to perform DC Bus Load Shed.	Y - 65 minutes	BRW-14-0080-E (Ref. 8)
10	1.5 hrs - 8 hrs	Start depressurization of SGs to 260 psig at $\leq 100^{\circ}\text{F/hr}$ cooldown with SG PORV local/manual operation. SG feed is controlled with Local/Manual operation of AFW flow control valves.	Y - 8 hours	_BwCA 0.0, Loss of All AC Power, action. CN-LIS-15-39 (Ref. 35)
11	3 - 4.5 hrs	Setup and establish ventilation in AEER and MCR.	4.75	Directed from 0BFSG-51 and BYR13-236/BRW-13-0218-M (Ref. 15)
12	3 hrs - 10 hrs	SI Accumulator borated water begins to inject into the RCS.	16 hrs	CN-LIS-15-39 (Ref. 35)
13	6 - 10 hrs	Deploy all hoses and connections in FHB for alternate SFP Fill strategy before FHB becomes uninhabitable from SFP Boiling.	Y - 10.94 hours	Directed from 0BwFSG-5 and 0FSG-11. BRW-13-0222-M (Ref. 9)
14	9 hrs - 16 hrs	Maintain SG pressure 260 psig and RCS temperature between 420F - 410F with SG PORV operation. Maintain SG level.	NA	CN-LIS-15-39 (Ref. 35)
15	9 hrs - 16 hrs	Isolate SI Accumulators.	NA	CN-LIS-15-39 (Ref. 35)

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Action item	Elapsed Time	Action	Time Constraint Y/N ¹	Remarks / Applicability
16	11 – 14 hrs	Stage and connect Phase 2 high pressure FLEX Pumps and ensure they are available to supply borated make-up to the RCS.	Y – 16 hours	CN-LIS-15-39 (Ref. 35)
17	16 - 20 hrs	Connect Phase 2 med head FLEX Pumps and ensure they are available to supply make-up to the SG's.	NA	1/2BwFSG-5 action
18	24 hrs	Initiate SFP Make up via 0A Refueling Water Purification Pump as required for level and temperature control.	NA	0BwFSG-11 action. BRW-13-0222-M (Ref. 9)
19	24 hrs	National SAFER Response Center resources begin arriving on site.	NA	National SAFER Response Center Guide
20	24 - 72 hrs	Continue to maintain critical functions of Core Cooling (via DDAF), RCS Inventory Control (via FLEX pump injection to RCS) and SFP Cooling (via FLEX pump injection to SFP). Utilize initial National SAFER Response Center NRC equipment and resources.	NA	End of analytical simulation