Exelon Generation®

Order No. EA-12-049

RS-15-208

August 28, 2015

U.S. Nuclear Regulatory Commission
ATTN: 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

Subject: 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)

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. 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
11. 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, Units 1 and 2 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, and 9 provided the first, second, third, and fourth six-month status reports, respectively, pursuant to Section IV, Condition C.2, of Reference 1 for Braidwood Station. The purpose of this letter is to provide the fifth 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 10, and the NRC Audit Report open items contained in Reference 11.

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 28th day of August 2015.

Respectfully submitted,

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

Enclosure:

1. Braidwood Station, Units 1 and 2 Fifth 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: Director, Office of Nuclear Reactor Regulation
NRC Regional Administrator - Region III
NRC Senior Resident Inspector - Braidwood Station, Units 1 and 2
NRC Project Manager, NRR - Braidwood Station, Units 1 and 2
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# Enclosure

## Braidwood Station, Units 1 and 2

## Fifth 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

(34 pages)

**Braidwood Station, Units 1 and 2**

**Fifth 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.

## 2 Milestone Accomplishments

The following milestone(s) have been completed since February 27, 2015 and are current as of July 28, 2015.

- Modification Implementation, Phase 2 modifications, Unit 1
- Storage plan and construction
- FLEX equipment acquisition
- National SAFER Response Center operational

NOTE: The "Status" indicated in this document is as of July 28, 2015. This date was chosen to support the development, review, approval and submittal of this report by the required August 28, 2015 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 for FLEX Emergency Response National SAFER Response Center | Complete | |
| | Submit Six (6) month updates | | |

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|---|---|---|---|---|---|---|
| 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 with this submittal | | | |
| Feb 2016 | | Update 6 | Not Started | | | |
| 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 | Started | 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 | Started | Oct 2016 | |
| Apr 2015 | Oct 2015 | • Phase 2 modifications | Complete | Started | | |
| 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 | Started | Started | Oct 2016 | |
| Apr 2015 | Oct 2015 | • Validate procedures (NEI 12-06, Sect. 11.4.3) | Started | Started | Oct 2016 | |
| Apr 2015 | Oct 2015 | • Maintenance procedures | Started | Started | Oct 2016 | |
| Nov 2014 | | Staffing analysis | Complete | | | |
| Apr 2015 | | Storage plan and construction | Complete | | | |
| Apr 2015 | | FLEX equipment acquisition | Complete | | | |
| Apr 2015 | | Training completion | Started | | Sept 2015 | |
| Dec 2014 | | National SAFER Response | Complete | | Feb 2015 | |

| | | | |
|---|---|---|---|
| | Center operational | | |
| Apr 2015 | Unit 1 Implementation date | Started | October 2016 |
| Oct 2015 | Unit 2 Implementation date | Started | |

## 4 Changes to Compliance Method

### Change 1

Section: Maintain RCS Inventory Control - PWR Installed Equipment Phase 1- Identify modifications.

Reason for Change: Braidwood Station has decided to install the Westinghouse reactor coolant pump (RCP) SHIELD Passive Thermal Shutdown Seals (SDS) (Generation III). The SHIELD SDSs will be installed in all 4 RCPs on Unit 2 in the fall of 2015 and on Unit 1 in the fall of 2016. The NRC has concluded that the use of the Westinghouse SHIELD Passive Thermal SDS is acceptable for use in ELAP evaluation for Order EA-12-049 as documented in ADAMS Accession No. ML14132A128.

Change: Braidwood Station will be installing Westinghouse reactor coolant pump (RCP) SHIELD Passive Thermal Shutdown Seals (SDS) (Generation III) in all Unit 1 and Unit 2 RCPs.

### Change 2

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: FLEX strategy procedure validation and PWROG-14027-P Rev.3 issued.

Note: Braidwood Station has decided to install the Westinghouse reactor coolant pump (RCP) SHIELD Passive Thermal Shutdown Seals (SDS) (Generation III). The SHIELD SDSs will be installed in all 4 RCPs on Unit 2 in the fall of 2015 and on Unit 1 in the fall of 2016. The NRC has concluded that the use of the Westinghouse SHIELD Passive Thermal SDS is acceptable for use in ELAP evaluation for Order EA-12-049 as documented in ADAMS Accession No. ML14132A128.

Installation of the SHIELD seals will change the Unit's response in a BDBEE described in NEI 12-06. As a result, the site is in the process of performing additional calculations to ensure the site Fukushima strategy remains viable. The additional calculations will be completed prior to the completion of A2R18, in the fall of 2015. The results of these calculations will be communicated with the post outage compliance letter or in a future 6-month update.

Change:

- Adjusted the timeline for closing the C and D SG PORV to 3 to 5 minutes ensuring SG water volume is conserved until the diesel driven auxiliary Feedwater pump is operating.
- Adjusted the timeline for setting up the high pressure FLEX pump and hoses at 11 to 14 hours ensuring RCS makeup will be available prior to reflux boiling based on PWROG-14027-P Rev. 3, No.1 Seal Flow Rate for Westinghouse Reactor Coolant Pumps Following Loss of ALL AC Power.

**Change 3**

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

Reason for Change: FLEX strategy procedure validation and PWROG-14027-P Rev.3 issued.

Note: Braidwood Station has decided to install the Westinghouse reactor coolant pump (RCP) SHIELD Passive Thermal Shutdown Seals (SDS) (Generation III). The SHIELD SDSs will be installed in all 4 RCPs on Unit 2 in the fall of 2015 and on Unit 1 in the fall of 2016. The NRC has concluded that the use of the Westinghouse SHIELD Passive Thermal SDS is acceptable for use in ELAP evaluation for order EA-12-049 as documented in ADAMS Accession No. ML14132A128.

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Change:

- Adjusted the timeline for closing the C and D SG PORV to 3 to 5 minutes ensuring SG water volume is conserved until the diesel driven auxiliary Feedwater pump is operating.
- Adjusted the timeline for setting up the high pressure FLEX pump and hoses at 11 to 14 hours ensuring RCS makeup will be available prior to reflux boiling based on PWROG-14027-P Rev. 3, No.1 Seal Flow Rate for Westinghouse Reactor Coolant Pumps Following Loss of ALL AC Power.

  Updated timeline is in Attachment 1A of this document.

**Change 4**

Section: Maintain Core Cooling & Heat Removal – PWR Installed Equipment Phase 1 and Maintain RCS Inventory Control - PWR Installed Equipment Phase 1.

Reason for Change: Align wording to site strategy

Change: Change last paragraph to the following:

Deploying and implementing portable FLEX pumps to supply injection flow must commence immediately from the time direction is provided in site emergency procedures. This should be plausible because more personnel are on site during outages to provide the necessary resources. Strategies for makeup water include deploying a FLEX pump to take suction from the RWST and /or UHS as described in the Phase 2 Core Cooling section. Guidance will be provided to ensure that sufficient area is available for deployment and that haul paths remain accessible without interference from outage equipment during refueling outages.

**Change 5**

Section: PWR Portable Equipment Phase 2.

Reason for Change: The Phase 2 equipment required to support Braidwood Station ELAP strategy has been refined as the strategy has been developed.

Change: Delete the Three (3) Diesel Trash pumps, Six (6) 42" Box Fans and the Ten (10) 20" portable vent fans.

**Change 6**

Section: General Integrated Plan Elements PWR – Extent to which the guidance, JLD-ISG-2012-01 and NEI 12-06, are being followed. Identify any deviations to JLD-ISG-2012-01 and NEI 12-06.

Reason for Change: Braidwood is taking an alternate approach to NEI 12-06 Sections 3.2 and 3.2.1.3. The alternate approach is for the method of protecting the permanently installed power operated relief valve (PORV) manual hand pumps from all design basis external events. The PORV operators are within robust structures with a non-robust access door. The PORV hand pumps are relied upon for symmetric cool down following a beyond design basis external event (BDBEE).

Basis for alternate approach:
NEI 12-06, Rev. 0, Section 3.2 states, "Installed equipment that is designed to be robust with respect to design basis external events is assumed to be fully available. Installed equipment that is not robust is assumed to be unavailable." Also, Section 3.2.1.3 states, "Permanent plant equipment that is contained in structures with designs that are robust with respect to seismic events, floods, and high winds, and associated missiles, are available." Robust is defined in Appendix A as, "the design of an SSC either meets the current plant design basis for the applicable external hazards or has been shown by analysis or test to meet or exceed the current design basis."

Braidwood's PORV hand pumps do not meet all of the plant robust requirements for all design basis external events, due to the location behind a non-robust door. Specifically, the door is designed for high winds, but not tornado winds or wind driven missiles.

The PORV operators are within the Category I, robust main steam safety valve (MSSV) room concrete structures at grade elevation, surrounding the containment building. The rooms are protected from tornado missiles and wind by robust concrete labyrinth vestibules with entry via steel Category II doors. The non-safety related PORV manual operators are seismically-mounted within the labyrinth vestibules, but the components are subject to tornado winds and wind generated missiles through the non-robust door.

Per Braidwood UFSAR Section 2.3.1.2.2, the predominant tornado path is southwest to northeast. These doors are located on the east side of the site. As a result, the turbine building, auxiliary building, containment and transformer yards provide a shield protecting these doors from tornado winds and wind driven missiles traveling in the predominant tornado direction.

The Unit 1 and Unit 2 A/D MSSV rooms are located back, closer to the turbine building, and protected by the turbine building structure and transformer yard firewalls. These structures provide reasonable assurance that tornado winds or wind driven missiles will not strike or damage the outer door and prevent access or disable the PORV manual controllers.

The Unit 1 and Unit 2 B/C MSSV rooms are exposed to the environment facing east. Large concrete blocks will be placed in front of the two (2) B/C MSSV room doors to protect the PORV operators from design basis horizontal missiles. The blocks also limit

the amount of possible large debris build-up in front of the doors, since the blocks are placed approximately 4 feet from the entrance.

This configuration ensures all four sets of permanently installed PORV hand pumps have "reasonable protection" and will survive all BDBEEs.

Change: The site is crediting the availability of the SG PORV manual controllers to provide the operators with a method to symmetrically cool down the RCS following a BDBEE.

**Change 7**

Section: General Integrated Plan Elements PWR – Extent to which the guidance, JLD-ISG-2012-01 and NEI 12-06, are being followed. Identify any deviations to JLD-ISG-2012-01 and NEI 12-06.

Reason for Change: Exelon proposes an alternate approach to NEI 12-06, Revision 0 for protection of FLEX equipment as stated in Section 5.3.1 (seismic,) Section 7.3.1 (severe storms with high winds), and Section 8.3.1 (impact of snow, ice and extreme cold). This alternate approach will be to store "N" sets of equipment in a fully robust building and the +1 set of equipment in a commercial building. Note that, for Braidwood Station, some of the +1 equipment will be stored in a fully robust building.

Basis for the alternate approach:
For all hazards scoped in for the site, the FLEX equipment will be stored in a configuration such that no one external event can reasonably fail the site FLEX capability (N).

To ensure that no one external event will reasonably fail the site FLEX capability (N), Exelon will ensure that N equipment is protected in the robust building. To accomplish this, Exelon will develop procedures to address the unavailability allowance as stated in NEI 12-06, Revision 0 Section 11.5.3., (see Maintenance and Testing section below for further details). This section allows for a 90-day period of unavailability. If a piece of FLEX equipment stored in the robust building were to become or found to be unavailable, Exelon will impose a shorter allowed outage time of 45 days. For portable equipment that is expected to be unavailable for more than 45 days, actions will be initiated within 24 hours of this determination to restore the site FLEX capability (N) in the robust storage location and implement compensatory measures (e.g., move the +1 piece of equipment into the robust building) within 72 hours where the total unavailability time is not to exceed 45 days. Once the site FLEX capability (N) is restored in the robust storage location, Exelon will enter the 90-day allowed out of service time for the unavailable piece of equipment with an entry date and time from the discovery date and time.

Maintenance and Testing:

1. The unavailability of equipment and applicable connections that directly performs a FLEX mitigation strategy for core, containment, and SFP should be managed such that risk to mitigating strategy capability is minimized.
    a. The unavailability of plant equipment is controlled by existing plant processes such as the Technical Specifications. When plant equipment which supports

FLEX strategies becomes unavailable, then the FLEX strategy affected by this unavailability does not need to be maintained during the unavailability.

b. The required FLEX equipment may be unavailable for 90 days provided that the site FLEX capability (N) is met. If the site FLEX (N) capability is met but not protected for all of the site's applicable hazards, then the allowed unavailability is reduced to 45 days.[1]

c. The duration of FLEX equipment unavailability, discussed above, does not constitute a loss of reasonable protection from a diverse storage location protection strategy perspective.

d. If FLEX equipment or connections become unavailable such that the site FLEX capability (N) is not maintained, initiate actions within 24 hours to restore the site FLEX capability (N) and implement compensatory measures (e.g., use of alternate suitable equipment or supplemental personnel) within 72 hours.

e. If FLEX equipment or connections to permanent plant equipment required for FLEX strategies are unavailable for greater than 45/90 days, restore the FLEX capability or implement compensatory measures (e.g., use of alternate suitable equipment or supplemental personnel) prior to exceedance of the 45/90 days.

For Section 5, seismic hazard, Exelon will also incorporate these actions:

1. Large portable FLEX equipment such as pumps and power supplies should be secured as appropriate to protect them during a seismic event (i.e., Safe Shutdown Earthquake (SSE) level).
2. Stored equipment and structures will be evaluated and protected from seismic interactions to ensure that unsecured and/or non-seismic components do not damage the equipment.

For Section 7, severe storms with high winds, Exelon will also incorporate this action:

- (N+1) of on-site FLEX equipment are required. The plant screens in per Sections 5 through 9 for seismic, wind (both tornado and hurricane), snow, ice and extreme cold, and high temperatures.
    - To meet Section 7.3.1.1.a, either of the following are acceptable:
        - All equipment (N+1) in a structure(s) that meets the plant's design basis for high wind hazards, or
        - (N) equipment in a structure(s) that meets the plant's design basis for high wind hazards and (+1) equipment stored in a location not protected for a high wind hazard.

For Section 8, impact of snow, ice and extreme cold, Exelon will also incorporate this action:

- Storage of FLEX equipment should account for the fact that the equipment will need to function in a timely manner. The equipment should be maintained at a

[1] The spare FLEX equipment is not required for the FLEX capability to be met. The allowance of 90- day unavailability is based on a normal plant work cycle of 12 weeks. In cases where the remaining N equipment is not fully protected for the applicable site hazards, the unavailability allowance is reduced to 45 days to match a 6-week short cycle work period. Aligning the unavailability to the site work management program is important to keep maintenance of spare FLEX equipment from inappropriately superseding other more risk-significant work activities.

temperature within a range to ensure its likely function when called upon. For example, by storage in a heated enclosure or by direct heating (e.g., jacket water, battery, engine block heater, etc.).

Exelon will meet all of the requirements in NEI 12-06, Revision 0 for Section 6.2.3.1 for external flood hazard and Section 9.3.1 for impact of high temperatures.

Change: Exelon proposes an alternate approach to NEI 12-06, Revision 0 for protection of FLEX equipment as stated in Section 5.3.1 (seismic,) Section 7.3.1 (severe storms with high winds), and Section 8.3.1 (impact of snow, ice and extreme cold). This alternate approach will be to store "N" sets of equipment in a fully robust building and the +1 set of equipment in a commercial building with the additional actions listed above.

**Change 8**

Section: General Integrated Plan Elements PWR – Extent to which the guidance, JLD-ISG-2012-01 and NEI 12-06, are being followed. Identify any deviations to JLD-ISG-2012-01 and NEI 12-06.

Reason for Change: An alternate approach is being proposed to the N+1 requirement applicable to hoses and cables as stated in Section 3.2.2 of NEI 12-06.

Basis for the alternate approach:
NEI 12-06, Section 3.2.2 specifically states that a site will have FLEX equipment to meet the needs of each unit on a site plus one additional spare. This is commonly known as N+1 where N is the number of units at a given site. The relevant text from NEI 12-06 is as follows:

NEI 12-06, Section 3.2.2 states: "In order to assure reliability and availability of the FLEX equipment required to meet these capabilities, the site should have sufficient equipment to address all functions at all units on-site, plus one additional spare, i.e., an N+1 capability, where "N" is the number of units on-site. Thus, a two-unit site would nominally have at least three portable pumps, three sets of portable ac/dc power supplies, three sets of hoses & cables, etc."

NEI 12-06, Section 11.3.3 states: "FLEX mitigation equipment should be stored in a location or locations informed by evaluations performed per Sections 5 through 9 such that no one external event can reasonably fail the site FLEX capability (N)."

Typically the hoses utilized to implement a FLEX strategy are not a single continuous hose but are composed of individual sections of a smaller length joined together to form a sufficient length. In the case of cables, multiple individual lengths are used to construct a circuit such as in the case of 3-phase power.

Proposed Alternative:

NEI 12-06 currently requires N+1 sets of hoses and cables. As an alternative, the spare quantity of hose and cable is adequate if it meets either of the two methods described below:

Method 1: Provide additional hose or cable equivalent to 10% of the total length of each type/size of hose or cable necessary for the "N" capability. For each type/size of hose or cable needed for the "N" capability, at least 1 spare of the longest single section/length must be provided.

Example 1-1: An installation requiring 5,000 ft. of 5 in. diameter fire hose consisting of 100 50 ft. sections would require 500 ft. of 5 in. diameter spare fire hose (i.e., ten 50 ft. sections).

Example 1-2: A pump requires a single 20 ft. suction hose of 4 in. diameter, its discharge is connected to a flanged hard pipe connection. One spare 4 in. diameter 20 ft. suction hose would be required.

Example 1-3: An electrical strategy requires 350 ft. cable runs of 4/0 cable to support 480 volt loads. The cable runs are made up of 50 ft. sections coupled together. Eight cable runs (2 cables runs per phase and 2 cable runs for the neutral) totaling 2800 ft. of cable (56 sections) are required. A minimum of 280 ft. spare cable would be required or 6 spare 50 ft. sections.

Example 1-4: An electrical strategy requires 100 ft. of 4/0 cable (4 cables, 100 ft. each) to support one set of 4 kv loads and 50 ft. of 4/0 (4 cables, 50 ft. each) to support another section of 4 kv loads. The total length of 4/0 cable is 600 ft. (100 ft. x 4 plus 50 ft. x 4). One spare 100' 4/0 cable would be required representing the longest single section/length.

Method 2: Provide spare cabling and hose of sufficient length and sizing to replace the single longest run needed to support any single FLEX strategy.

Example 2-1 – A FLEX strategy for a two unit site requires 8 runs each of 500 ft. of 5 in. diameter hose (4000 ft. per unit). The total length of 5 in. diameter hose required for the site is 8000 ft. with the longest run of 500 ft. Using this method, 500 ft. of 5 in. diameter spare hose would be required.

For either alternative method, both the N sets of hoses or cables and the spare set of hoses or cables would all be kept in a location that meets the reasonable protection requirements for the site.

The NRC has endorsed (ML15125A442) the NEI position paper (ML15126A135) for the above stated alternate approach. If using Method 2, per the endorsement letter, Exelon will ensure that the FLEX pumps and portable generators are confirmed to have sufficient capability to meet flow and electrical requirements when a longer spare hose/cable is substituted for a shorter length. Exelon acknowledges that the NRC staff has not reviewed and is not endorsing the specific examples included in the NEI endorsement request dated May 1, 2015. If necessary, Exelon will provide additional justification regarding the acceptability of various cable and hose lengths with respect to voltage drops, and fluid flow resistance, rather than merely relying on the additional, longest length cable/hose as implied by Example 1-4 in the subject letter.

Hoses and cables are passive devices unlikely to fail provided they are appropriately inspected and maintained. The most likely cause of failure is mechanical damage during handling provided that the hoses and cables are stored in areas with suitable environmental conditions (e.g., cables stored in a dry condition and not subject to chemical or petroleum products). The hoses and cables for the FLEX strategies will be stored and maintained in accordance with manufacturers' recommendations including any shelf life requirements. Initial inspections and periodic inspections or testing will be incorporated into the site's maintenance and testing program implemented in accordance with Section 11.5 of NEI 12-06.

Therefore, the probability of a failure occurring during storage is minimal, resulting in the only likely failure occurring during implementation. Mechanical damage will likely occur in a single section versus a complete set of hose or cable. Therefore, the N+1 alternative addresses the longest individual section/length of hose or cable.

Providing either a spare cable or hose of a length of 10% of the total length necessary for the "N" capability or alternatively providing spare cabling or hose of sufficient length and sizing to replace the single longest run needed to support any single FLEX strategy is sufficient to ensure that a strategy can be implemented. Mechanical damage during implementation can be compensated for by having enough spares to replace any damaged sections with margin. It is reasonable to expect that an entire set of hoses or cables would not be damaged provided they have been reasonably protected.

Change: The spare quantity of hose and cable is adequate if it meets either of the two methods described below:

Method 1: Provide additional hose or cable equivalent to 10% of the total length of each type/size of hose or cable necessary for the "N" capability. For each type/size of hose or cable needed for the "N" capability, at least 1 spare of the longest single section/length must be provided.

Method 2: Provide spare cabling and hose of sufficient length and sizing to replace the single longest run needed to support any single FLEX strategy.

For either alternative method, both the N sets of hoses or cables and the spare set of hoses or cables would all be kept in a location that meets the reasonable protection requirements for the site.

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

Braidwood Station, Unit 2 expects to comply with the Order implementation date of October 2015.

Braidwood Station, Unit 1 has received an 18-month extension of the order due to Pressurized-Water Owners Group (PWROG) refining RCP Seal Leakage rate projections and is scheduled to be in compliance by October 2016. NRC letter ADAMS Accession No. ML 15068A215: "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 July 28, 2015. This date was chosen to support the development, review, approval and submittal of this report by the required August 28, 2015 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).<br><br>Complete - Exelon proposes an alternate approach to NEI 12-06 Revision 0 for protection of FLEX equipment as stated in Section 5.3.1 (seismic,) Section 7.3.1 (severe storms with high winds), and Section 8.3.1 (impact of snow, ice and extreme cold). This alternate approach will be to store "N" sets of equipment in a fully robust building and the +1 set of equipment in a commercial building. Note that for Braidwood Station, some of the +1 equipment will be stored in a fully robust building. Braidwood Station alternate approach basis is documented in Section 4 as change number 6.<br><br>The robust and commercial buildings will be located adjacent to each other outside the protected area, southeast of the main parking lot.<br><br>Primary and alternate deployment routes for FLEX equipment have been identified and are being recorded within the site program document.<br><br>Snow removal will be addressed as part of the site snow removal plan. Post event snow removal will be accomplished by a FLEX truck with snow plow or FLEX tractor with bucket.<br><br>The site maximum flood water level is at elevation 601.91 feet resulting from a probable maximum precipitation (PMP) event. Braidwood plant grade elevation is at 600.0 feet and does not vary significantly across the site. The FLEX storage building floor will be constructed above the flood level to an elevation of 602 feet. A majority of the travel path elevations are between elevation 600 feet and 601 feet (Ref. 11). Some travel path location may be covered by a small amount of water. Since the FLEX pumps and generators are trailer mounted, they should be maintained available when being deployed to different locations at the site. |

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| | | Debris removal impacts of the travel routes have been evaluated. Guidance exists for coping with downed power lines. The alternate travel route will be utilized in the event the primary path becomes unavailable due to debris. In addition, the site has purchased an F750 and two T5.115 New Holland tractors to assist in debris removal.<br><br>Extreme hot and cold temperatures should have little impact on the site travel paths.<br><br>BRW-15-0002-S, Evaluation of FLEX Equipment Haul Paths for Soil Liquefaction Potential (Ref. 30), concludes that there is a potential for liquefaction at intermittent depths between about 6 feet to 16 feet. The induced ground settlement for the Braidwood FLEX equipment paths outside the main plant area is about 1 inch. The induced ground settlement for the Braidwood equipment paths in the main plant area is about 2 inches. Considering the size of the haul vehicles and the trailer loads, 1-inch to 2-inch settlement should not impose a significant impediment to FLEX equipment deployment. |
| 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).<br><br>Started - The site FLEX procedure validation is in progress. The site will utilize NEI developed validation process. |
| 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).<br><br>Complete - Exelon proposes an alternate approach to NEI 12-06, Revision 0 for protection of FLEX equipment as stated in section 5.3.1 (seismic,) section 7.3.1 (severe storms with high winds), and section 8.3.1 (impact of snow, ice and extreme cold). This alternate approach will be to store "N" sets of equipment in a fully robust building and the +1 set of equipment in a commercial building. Note that for Braidwood Station, some of the +1 equipment will be stored in a fully |

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| | | robust building. Braidwood Station alternate approach basis is documented in section 4 as change number 7.<br><br>The robust and commercial buildings will be located adjacent to each other outside the protected area, southeast of the main parking lot.<br><br>Site program document CC-BR-118-1001, Site Implementation of Diverse And Flexible Coping Strategies (Flex) and Spent Fuel Pool Instrumentation Program, has been approved. The program document contains a summary of the FLEX strategy, deployment paths and staging areas. |
| Programmatic controls (p.8) | Develop an administrative program for FLEX responsibilities, and testing & maintenance. | Item Closed During Onsite NRC Audit (Ref. 31).<br><br>Complete - Site program document CC-BR-118-1001, Site Implementation of Diverse And Flexible Coping Strategies (Flex) and Spent Fuel Pool Instrumentation Program, has been approved. The program document contains FLEX responsibilities, testing and maintenance. |
| National SAFER Response Center plan (p.9) | Development of Braidwood Station's playbook. | Item Closed During Onsite NRC Audit (Ref. 31).<br><br>Complete - CC-BR-118-1002, SAFER Response Plan for Braidwood Generating Station is approved. |
| Key Reactor Parameters<br><br>(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).<br><br>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).<br><br>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).<br><br>Started - Calculation BYR13-239/BRW-13-0221-M (Ref. 10) identifies the timing and quantity of boration required. Specifically, boration will need to start prior to 17 hours into the event and require 15,240 gallons of water injected at 40 gallons per minute.<br><br>Braidwood Station has decided to install |

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| | | the Westinghouse reactor coolant pump (RCP) SHIELD Passive Thermal Shutdown Seals (SDS) (Generation III). The SHIELD SDSs will be installed in all 4 RCPs on Unit 2 in the fall of 2015 and on Unit 1 in the fall of 2016. The NRC has concluded that the use of the Westinghouse SHIELD Passive Thermal SDS is acceptable for use in ELAP evaluation for order EA-12-049 as documented in ADAMS Accession No. ML14132A128.<br><br>Installation of the SHIELD seals will change the Unit's response in a BDBEE described in NEI 12-06. As a result, the site is in the process of performing additional calculations to ensure the site Fukushima strategy remains viable. 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), is in progress and may impact the site strategy. These results will be reported in the post outage compliance letter or in a future 6-month update. |
| Maintain Containment, Phase 1 (p.31) | Additional calculations will be performed to evaluate containment response. | Item Closed During Onsite NRC Audit (Ref. 31).<br><br>Complete - Calculation BYR13-235/BRW-13-0217-M (Ref. 12) and BYR14-046/BRW-14-0058-M (Ref. 17) evaluate containment response in all modes. In Mode 1-4, design basis temperature and pressure are not reached until > 30 days. The results show site action during Phase 1 and Phase 2 are not necessary. 1/2BwFSG-12, Containment Cooling, provides operators with different options for restoring containment cooling to maintain containment temperature and pressure within limits.<br><br>Installation of the Westinghouse RCP SHIELD Passive SDS (Generation III) will reduce the amount of leakage into containment assumed in calculation BYR13-235/BRW-13-0217-M (Ref. 12), resulting in additional margin to reaching design basis temperature and pressure. |
| Maintain Spent Fuel Pool Cooling, Phase 1 | Procedure development for Initial Spent fuel pool make-up with gravity drain | Item Closed During Onsite NRC Audit (Ref. 31). |

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| (p.39) | from the RWST. | 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).<br>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).<br>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).<br>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).<br>Complete – Closure supplied as part of fourth 6-month update (Ref. 29). |

| **Interim Safety Evaluation Open Item Braidwood's ISE Response** | | | **Status** |
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| 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).<br><br>Started- 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). The NRC letter states that the NRC staff has reviewed the information submitted to date and concluded that use of the industry approach dated August 15, 2013, entitled "Westinghouse Response to NRC Generic Request for Additional Information (RAI) on Boron Mixing in Support of the Pressurized Water |

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| | | | Reactor Owners Group (PWROG)," Agency wide Documents Access and Management System (ADAMS) Accession Number ML13235A135, (being withheld from public disclosure for proprietary reasons) is acceptable with clarifications listed in the letter.<br><br>The analysis in Ref.10 demonstrates that the Flexible and Diverse Coping Strategies (FLEX) Reactor Coolant System (RCS) make-up pump is capable of meeting an injection time line to ensure adequate sub-criticality for both the maximum seal leakage and no seal leakage scenarios including the appropriate time delay margin. Installation of the SHIELD seals may change the Unit's response. As a result, the site is in the process of performing Calculation CN-LIS-15-39 (Ref. 35) to ensure the site Fukushima strategy remains viable.<br><br>Calculation CN-LIS-15-34 (Ref. 33) has extended the RCS inventory loss of single phase natural circulation to 58 hours.<br><br>The Braidwood Overall integrated plan (OIP) Attachment 1A, Action Item 15 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, Clarifications (1) and (3) as described previously. Therefore, the boron mixing criteria are met. |
| | 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 - Exelon proposes an alternate approach to NEI 12-06, Revision 0 for protection of FLEX equipment as stated in section 5.3.1 (seismic,) section 7.3.1 (severe storms with high winds), and section 8.3.1 (impact of snow, ice and extreme cold). This alternate approach will be to store "N" sets of equipment in a fully robust building and the +1 set of equipment in a commercial building. |

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| | | | Note that for Braidwood Station, some of the +1 equipment will be stored in a fully robust building. Braidwood Station alternate approach basis is documented in Section 4 as change number 7.<br><br>EC398039, FLEX Storage Robust Building Construction and EC398040, FLEX Buildings - Commercial Building, contain the design details for the robust and commercial buildings respectively. |
| 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).<br><br>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).<br><br>Complete - Site primary staging area (Area C) location is the Pontiac Municipal Airport in Pontiac, Illinois. The Alternate staging area (Area D) location is LaSalle Nuclear Station near Marseilles, Illinois. The site has approved memorandum of understanding (MOU) with Pontiac Municipal Airport and LaSalle Nuclear Station. Primary and alternate transportation routes have been identified between these locations and the site. These routes are detailed within the site's response plan (playbook). The main transportation method will be by a heavy haul vehicle. If an accessible transportation route cannot be identified, helicopter transportation will be utilized. The EOF will coordinate SAFER communications and the transportation of equipment to the site. This has been communicated to the State of Illinois and is in the Illinois Plan for Radiological Accidents (IPRA). |
| 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).<br><br>Complete – Closure supplied as part of fourth 6-month update (Ref. 29). |

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| 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).<br><br>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 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. | Item Closed During Onsite NRC Audit (Ref. 31).<br><br>Complete - The primary system conditions considered are based on the Westinghouse reference coping cases described in Section 5.2.1 of WCAP-17601-P (Ref. 18). The extended loss of alternating current (AC) power (ELAP) simulation parameters matrix provided in Ref. 23 outlines the comparison of items for Braidwood Station.<br><br>Braidwood Station has decided to install the Westinghouse reactor coolant pump (RCP) SHIELD Passive Thermal Shutdown Seals (SDS) (Generation III). The SHIELD SDSs will be installed in all 4 RCPs on Unit 2 in the fall of 2015 and on Unit 1 in the fall of 2016. The NRC has concluded that the use of the Westinghouse SHIELD Passive Thermal SDS is acceptable for use in ELAP evaluation for Order EA-12-049 as documented in ADAMS Accession No. ML14132A128.<br><br>Installation of the SHIELD seals will change the Unit's response in a BDBEE described in NEI 12-06. As a result, the site is in the process of performing additional calculations to ensure the site Fukushima strategy remains viable. These calculations may alter the site strategy from the case described in WCAP-17601-P. Calculations include CN-LIS-15-34, CN-LIS-15-39, and CN-LIS-15-40, which are being performed by Westinghouse. The new analyses will replace or supplement existing analyses which were previously demonstrated to be representative of Braidwood Station and remain consistent with the methodology in WCAP-17601-P.<br><br>CN-LIS-15-34, has extended the RCS |

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| | | | inventory loss of single phase natural circulation to 58 hours. Calculations CN-LIS-15-39 and CN-LIS-15-40 are in progress and may impact the site strategy. These results will be reported in the response to ISE questions 3.2.4.7.A and 3.2.1.8.A with the post outage compliance letter or in a future 6-month update. |
| 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).<br><br>Complete – Exelon has used generic ELAP analyses performed in WCAP-17601-P (Ref. 18) with the NOTRUMP computer code to support the mitigating strategy in its Overall Integrated Plan (OIP). The use of NOTRUMP was limited to the thermal-hydraulic conditions before reflux condensation initiates. The initiation of reflux condensation cooling is defined when the one hour centered moving average (CMA) of the flow quality at the top of the steam generator u-tube bend exceeds 0.1 in any one loop. The timing shown in PWROG-14027-P (Ref. 32) for the Category 1 4-loop Westinghouse Nuclear Steam Supply System (NSSS) PWRs is shown as 15.6 hours. A plant specific evaluation (Ref. 33) was performed by Westinghouse as a result of installing the Westinghouse RCP SHIELD Passive Thermal SDS that demonstrated margin above the generic timing value. The analyses and evaluations supporting the OIP demonstrate that the Flexible and Diverse Coping Strategies (FLEX) Reactor Coolant System (RCS) make-up pump will be aligned prior to the loop flow rate decreasing below the loop flow rate corresponding to the definition of the onset of reflux cooling. Braidwood Station Overall integrated plan (OIP) Attachment 1A, Action Item 15 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, Clarifications (1) and (3). |

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| 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).<br>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).<br>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).<br>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).<br>Started - Braidwood Station has decided to install the Westinghouse reactor coolant pump (RCP) SHIELD Passive Thermal Shutdown Seals (SDS) (Generation III). The SHIELD SDSs will be installed in all 4 RCPs on Unit 2 in the fall of 2015 and on Unit 1 in the fall of 2016.<br>Installation of the SHIELD seals will change the Unit's response in a BDBEE described in NEI 12-06. As a result, the site is in the process of performing additional calculations (CN-LIS-15-34, CN-LIS-15-39, and CN-LIS-15-40) to ensure the site Fukushima strategy remains viable. The additional calculations will be completed prior to the completion of A2R18, in the fall of 2015. The results of these calculations will be communicated with the post outage compliance letter or in a future 6-month update. |
| 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. | Item Closed During Onsite NRC Audit (Ref. 31).<br>Complete - Braidwood station has decided to install the Westinghouse reactor coolant pump (RCP) SHIELD Passive Thermal Shutdown Seals (SDS) (Generation III). The SHIELD SDSs will be installed on all 4 RCPs on Unit 2 in the fall of 2015 and on Unit 1 in the fall of 2016.<br>Braidwood Station has Westinghouse |

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| | | | 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 Inventory Control Analysis SHIELD Reactor Coolant Pump Seal Packages, (Ref 33) is consistent with ADAMS Accession No. ML14132A128 limitations and conditions number 4. |
| 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. | Item Closed During Onsite NRC Audit (Ref. 31).<br><br>Complete - The Westinghouse Nuclear Steam Supply System (NSSS) calculations documented in WCAP17601-P (Ref. 18) using the NOTRUMP code were performed with the ANS 5.1 1979 + 2 sigma decay heat model and assumed the reactor is initially operating at 100% power (NOTRUMP reference case core power is 3723 MWt). Implementation of this model includes fission product decay heat resulting from the fission of U-235, U-238, and Pu-239 and actinide decay heat from U-239 and Np-239. The power fractions are typical values expected for each of the three fissile isotopes through a three region burn-up with an enrichment based on typical fuel cycle feeds that approach 5%. With that, a conversion ratio of 0.65 was used to derive the decay power of the two actinides U-239 and Np-239. Fission product neutron capture is treated per the ANS standard. The decay heat calculation utilizes a power history of three 540-day cycles separated by two 20-day outages that bounds initial condition 3.2.1.2 (1) of the Nuclear Energy Institute (NEI) document NEI 12-06 (Ref. 3), Section 3.2.1.2 (with a minimum assumption from NEI 12-06 that the reactor has been operated at 100% power for at least 100 days prior to event initiation). Therefore, the decay heat curve assumed in the Westinghouse calculations in Ref. 18 is representative of Braidwood Units 1 |

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| | | | and 2.<br><br>The primary-side transient profile assumed in the reactor coolant system (RCS) inventory control and long-term sub-criticality calculations for Modes 1 through 4 with steam generators available is based on the Westinghouse reference coping case of WCAP-17601-P (Ref. 18) and plant specific parameters such as reactor coolant system nominal temperature(s), pressures(s), and volumes, and accumulator cover gas pressures presented in Ref. 23. These calculations do not, however, include any decay heat model and rely on the case runs cited from WCAP-17601-P regarding decay heat related phenomenon. |
| 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. | Item Closed During Onsite NRC Audit (Ref. 31).<br><br>Complete - The primary system conditions considered are based on the Westinghouse reference coping cases described in Section 5.2.1 of WCAP-17601-P (Ref. 18). The extended loss of alternating current (AC) power (ELAP) simulation parameters matrix provided in Ref. 23 outlines the comparison of items for Braidwood Station.<br><br>Braidwood Station has decided to install the Westinghouse reactor coolant pump (RCP) SHIELD Passive Thermal Shutdown Seals (SDS) (Generation III). The SHIELD SDSs will be installed in all 4 RCPs on Unit 2 in the fall of 2015 and on Unit 1 in the fall of 2016. The NRC has concluded that the use of the Westinghouse SHIELD Passive Thermal SDS is acceptable for use in ELAP evaluation for order EA-12-049 as documented in ADAMS Accession No. ML14132A128.<br><br>Installation of the SHIELD seals will change the Unit's response in a BDBEE described in NEI 12-06. As a result, the site is in the process of performing additional calculations to ensure the site Fukushima strategy remains viable. These calculations |

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| | | | may alter the site strategy from the case described in WCAP-17601-P. Calculations include CN-LIS-15-34, CN-LIS-15-39, and CN-LIS-15-40, which are being performed by Westinghouse. The new analyses will replace or supplement existing analyses which were previously demonstrated to be representative of Braidwood Station and remain consistent with the methodology in WCAP-17601-P.<br><br>CN-LIS-15-34, has extended the RCS inventory loss of single phase natural circulation to 58 hours. Calculations CN-LIS-15-39 and CN-LIS-15-40 are in progress and may impact the site strategy. These results will be reported in the response to ISE questions 3.2.4.7.A and 3.2.1.8.A with the post outage compliance letter or in a future 6-month update. |
| 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. | Item Closed During Onsite NRC Audit (Ref. 31).<br><br>Complete – Closure supplied as part of fourth 6-month update (Ref. 29). |
| 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. | Item Closed During Onsite NRC Audit (Ref. 31).<br><br>Complete - Closure supplied as part of third 6-month update (Ref. 25). |
| 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. | Started - The final time line will be validated as the time sensitive actions, listed in Attachment 1A, go through the validation process. Results will be provided in a future update. |
| 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).<br><br>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).<br><br>Complete – Closure supplied as part |

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| | | | 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).<br>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 – BYR13-235/BRW-13-0217-M, Containment Pressure and Temperature Response during an ELAP Event (Ref. 12), confirms that no actions are required to mitigate containment temperature and pressure in Phases 1 and 2. These parameters will be monitored as part of the site strategy. Containment pressure and temperature will reach the FSG set point limits in > 30 days and 13.7 days, respectively. In addition, containment pressure and temperature will not reach design basis pressure and temperature limits until >30 days.<br>1/2BwFSG-12, Containment Cooling, provides operators with different options for restoring containment cooling to maintain containment temperature and pressure within limits.<br>Installation of the Westinghouse RCP SHIELD Passive SDS (Generation III) will reduce the amount of leakage into containment assumed in calculation BYR13-235/BRW-13-0217-M (Ref. 12), resulting in additional margin to reaching design basis temperature and pressure. |
| 23 | 3.2.3.B | Containment - Confirm evaluation performed for the need to monitor containment temperature. | Item Closed During Onsite NRC Audit (Ref. 31).<br>Complete - BYR13-235/BRW-13-0217-M (Ref. 12) shows containment temperature will reach the FSG setpoint limits in 13.7 days and reach design basis temperature limit in > 30 days. Even with these long timeframes, containment temperature has been added to the key parameter list to provide operators with additional tools. Monitoring of containment temperature can be performed on intermittent bases and will be |

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| | | | controlled by emergency procedures and 1/2BwFSG-7, Loss of Vital Instrument or Control Power.<br><br>Installation of the Westinghouse RCP SHIELD Passive SDS (Generation III) will reduce the amount of leakage into containment assumed in calculation BYR13-235/BRW-13-0217-M (Ref. 12), resulting in additional margin to reaching FSG temperature setpoint and design basis temperature. |
| 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).<br><br>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 rooms) | Item Closed During Onsite NRC Audit (Ref. 31).<br><br>Complete – Closure supplied as part of fourth 6-month update (Ref. 29). |
| 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).<br><br>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).<br><br>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).<br><br>Complete - Communications upgrade detailed design is complete.<br><br>For the 1st - 2nd refuel outage (A1R18), the site will have 3 iridium satellite phones available for emergency response in the MCR area. |

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| | | | Emergency responders will use handheld radios in the talk around mode, sound powered phones, face-to-face, and bull horns.<br><br>For the 2nd – 2nd refuel outage (A2R18), the site will complete the NARS system upgrade and satellite communications system installation. EC 399332 and EC399598 provide the design details respectively. |
| 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).<br><br>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).<br><br>Started – Braidwood Station has decided to install the Westinghouse reactor coolant pump (RCP) SHIELD Passive Thermal Shutdown Seals (SDS) (Generation III). The SHIELD SDSs will be installed in all 4 RCPs on Unit 2 in the fall of 2015 and on Unit 1 in the fall of 2016. The NRC has concluded that the use of the Westinghouse SHIELD Passive Thermal SDS is acceptable for use in ELAP evaluation for Order EA-12-049 as documented in ADAMS Accession No. ML14132A128.<br><br>Installation of the SHIELD seals will change the Units response in a BDBEE described in NEI 12-06. As a result, the site is in the process of performing additional calculations to ensure the site Fukushima strategy remains viable. Calculation CN-LIS-15-40, Exelon Byron and Braidwood Stations Delayed AFW FLEX Studies (Ref. 34), is in progress and may impact the site strategy. These results will be reported in the post outage compliance letter or in a future 6-month update. |
| 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).<br><br>Complete – Closure supplied as part of fourth 6-month update (Ref. 29). |

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| 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).<br><br>Complete - The Units 1 and 2 "B" diesel fuel oil storage tanks contain 191,400 gallons of fuel. EC394149 and EC394156 provide Unit 1 and Unit 2 FLEX connections to these fuel sources. 0BwFSG-5 provides operators the necessary direction to utilize these sources for refueling FLEX equipment. A fuel usage white paper has been developed to show this source will last for >31 days.<br><br>The site has an additional 191,400 gallons contained in the "A" train tanks. 0BWFSG-50 provides the operators with the necessary direction to transfer the "A" train tanks to the "B" train tanks.<br><br>The site also has 125,000 gallons and 50,000 gallons storage tanks that are not robust and must be assumed unavailable, but would be used if available.<br><br>Fuel oil change out will be addressed in the FLEX preventive maintenance (PM) program. |
| 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).<br><br>Complete – Closure supplied as part of fourth 6-month update (Ref. 29). |

| **NRC Audit Open Items<br>Braidwood Station Response** | | **Status** |
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| 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:<br>a. benchmarking of the seal leakage model against relevant data from tests or operating events,<br>b. discussion of the impact on the seal leakage rate seal leakage rates due to fluid temperatures greater than 550°F resulting in increased deflection at the seal interface,<br>c. clarification whether the second-stage RCP seal would remain closed under ELAP conditions predicted by the revised seal leakage model and a | Complete - Braidwood station has decided to install the Westinghouse reactor coolant pump (RCP) SHIELD Passive Thermal Shutdown Seals (SDS) (Generation III). The SHIELD SDSs will be installed on all four (4) RCPs on Unit 2 in the fall of 2015 and on all four (4) Unit 1 RCPs in the fall of 2016. The use of Westinghouse reactor coolant pump (RCP) SHIELD Passive Thermal Shutdown Seals (SDS) (Generation III) has been determined to be acceptable for use in ELAP evaluations for satisfying Order EA-12-049 as documented in ADAMS |

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| | technical basis to support the determination, and,<br>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. | Accession No. ML14132A128.<br>The RCP seal leakage assumed in CN-LIS-15-34, Exelon Byron and Braidwood Stations Reactor Coolant System ELAP Inventory Control Analysis SHIELD Reactor Coolant Pump Seal Packages, (Ref 33) is consistent with ADAMS Accession No. ML14132A128 limitations and conditions number 4. |
| 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.<br>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.<br>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.<br>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.<br>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 -<br>a. Calculation NED-P-MSD-7 concludes that the Number 1 seal leakoff piping and components are capable of withstanding the elevated pressures expected during an ELAP event as determined by PWROG-14015-P.<br>b. Seal return to the VCT is isolated early in the ELAP event as directed by 1/2BwCA-0.0 Attachment B. This does not isolate the low pressure portions of the seal leakoff/return line. An operator is dispatched to locally close the 1/2CV8100 valve (Containment Isolation Valve) using the manual override on the MOV. This action is performed in the same step that isolates seal injection and seal cooling. No credit is taken to protect the seal leakoff lines from overpressurization by this action to close the 1/2CV8100 valves.<br>c. Braidwood station has decided to install the Westinghouse reactor coolant pump (RCP) SHIELD Passive Thermal Shutdown Seals (SDS) (Generation III). The SHIELD SDSs will be installed on all four (4) RCPs on Unit 2 in the fall of 2015 and on all four (4) Unit 1 RCPs 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. Actuation of the SDS will reduce the number 1 seal leakoff pressure to values less than documented in |

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| | | PWROG-14015-P.<br>d. Calculation NED-P-MSD-7. evaluates the potential overpressurization of the Number 1 seal leakoff lines. The lines are not expected to rupture at the pressure conditions for seal failures during an ELAP event. NED-P-MSD-7 performed an evaluation at 2485 psig (RCS design pressure) and determined that the lines are qualified at this pressure. |

## 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 28th, 2013.
5. Braidwood Station's Second Six Month Status Report for the Implementation of FLEX, dated February 28th, 2014.
6. Braidwood Station, Units 1 and 2 – 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.
14. BYR13-237/BRW-13-0219-M Rev. 0, MEER and Battery Room Conditions Flowing 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 28th, 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 28, 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 – 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).
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, Exelon Byron and Braidwood Stations Delayed AFW FLEX Studies, Draft
35. 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, Draft

# Attachment 1A
# Sequence of Events Timeline

| Action item | Elapsed Time | Action | Time Constraint Y/N [2] | Remarks / Applicability |
|---|---|---|---|---|
| The times to complete actions in the Events Timeline are based on operating judgment, the conceptual designs, and the current supporting analyses. The final timeline will be time validated once detailed designs are completed, procedures are developed, and the results will be provided in a future six (6) month update. | | | | |
| 1 | 0 | Event Starts, BDBEE occurs, Unit 1 and Unit 2 reactors automatically trip and all rods are inserted.<br>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 | 5-50 mins | Verify DDAF Pp is operating properly. | Y – 1 hour | _BwCA 0.0, Loss of All AC Power, action. Reference WCAP 17601-P (Ref. 18). |
| 4 | 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. Reference WCAP 17601-P (Ref. 18). and operator judgment |

[2] Instructions: Provide justification if No or NA is selected in the remark column
If yes include technical basis discussion as requires by NEI 12-06, Section 3.2.1.7

| Action item | Elapsed Time | Action | Time Constraint Y/N [2] | Remarks / Applicability |
|---|---|---|---|---|
| 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 ELAP |
| 7 | 35 mins to 65 mins | Operators dispatched to perform DC Bus Load Shed. | Y - 65 minutes | BRW-14-0080-E (Ref. 8) |
| 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 | 55 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) |
| 10 | 1.5 hrs | Start depressurization of SGs to 260 psig at approximately 75°F/hr cooldown with SG PORV local/manual operation. SG feed is controlled with Local/Manual operation of AFW flow control valves. | Y - 2 hours | _BwCA 0.0, Loss of All AC Power, action. BRW-13-0221-M (Ref. 10) |
| 11 | 2.25 hrs | SI Accumulator borated water begins to inject into the RCS. | NA | Operator Judgment |
| | 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 | 3.5 hrs | Maintain SG pressure 260 psig and RCS temperature between 420F – 410F with SG PORV operation.<br><br>Maintain SG level. | NA | BRW-13-0221-M (Ref. 10) |
| 13 | 5 – 7 hrs | Isolate SI Accumulators. | NA | 1/2BwFSG -10 action |

| Action item | Elapsed Time | Action | Time Constraint Y/N [2] | Remarks / Applicability |
|---|---|---|---|---|
| 14 | 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) |
| 15 | 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 – 15.3 hours | PWROG-14027-P Rev. 3 |
| 16 | 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-5action |
| 17 | 24 hrs | Initiate SFP Make up via 0A Refueling Water Purification Pump as required for level and temperature control. | NA | 0BwFSG-11action. BRW-13-0222-M (Ref. 9) |
| 18 | 24 hrs | National SAFER Response Center resources begin arriving on site. | NA | National SAFER Response Center Guide |
| 19 | 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 |