Exelon Generation®

Order No. EA-12-049

RS-15-215

August 28, 2015

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

Quad Cities Nuclear Power Station, Units 1 and 2
Renewed Facility Operating License Nos. DPR-29 and DPR-30
NRC Docket Nos. 50-254 and 50-265

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-13-025)
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-13-129)
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-14-015)

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-14-213)
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-15-024)
10. NRC letter to Exelon Generation Company, LLC, Quad Cities Nuclear Power Station, Units 1 and 2 – Interim Staff Evaluation Relating to Overall Integrated Plan in Response to Order EA-12-049 (Mitigation Strategies) (TAC Nos. MF1048 and MF1049), dated November 22, 2013
11. NRC letter to Exelon Generation Company, LLC, Quad Cities Nuclear Power Station, Units 1 and 2 – Report for the Onsite Audit Regarding Implementation of Mitigating Strategies and Reliable Spent Fuel Pool Instrumentation Related to Orders EA-12-049 and EA-12-051 (TAC Nos. MF1048, MF1049, MF1052, and MF1053), dated June 25, 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 Quad Cities Nuclear Power 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 Quad Cities 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 any 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. Quad Cities Nuclear Power 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
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NRC Senior Resident Inspector – Quad Cities Nuclear Power Station, Units 1 and 2
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Enclosure

Quad Cities Nuclear Power 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

(37 pages)

Enclosure

Quad Cities Nuclear Power 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

Quad Cities Nuclear Power Station, Units 1 and 2, 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 Unit One Modifications have been completed since the last update. All Non-outage Unit Two Modifications have been completed since the last update.

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.

The revised target completion dates impact the Order implementation date. An explanation of the impact of these changes is provided in Section 5 of this enclosure.

Milestone Schedule

Milestone	Target Completion Date	Activity Status	Revised Target Completion Date
Submit 60 Day Status Report	Oct 2012	Complete	
Submit Overall Integrated Plan	Feb 2013	Complete	
Contract with RRC		Complete	
Submit 6 Month Updates:			
Update 1	Aug 2013	Complete	
Update 2	Feb 2014	Complete	
Update 3	Aug 2014	Complete	
Update 4	Feb 2015	Complete	
Update 5	Aug 2015	Complete with	

Milestone	Target Completion Date	Activity Status	Revised Target Completion Date
		this submittal	
Update 6	Feb 2016	Not Started	
Update 7	Aug 2016	Not Started	
Modifications Development & Implementation:			
Unit 1 Modification Development (All FLEX Phases)	Feb 2014	Completed	April 2014
Unit 1 Modification Implementation (All FLEX Phases)	Apr 2015	Completed	Mar 2015
Unit 2 Modification Development (All FLEX Phases)	Mar 2015	Completed	
Unit 2 Modification Implementation (All FLEX Phases)	Apr 2016	Started	
Common Unit Modification Development (Interim Storage Pads and Deep Well)	Mar 2015	Started	Dec 2015
Common Unit Modification Implementation (Interim Storage Pads and Deep Well)	Mar 2015	Started	Dec 2015
Robust Storage Building	Oct 2015	Started	
ASCE 7-10 FLEX +1 Storage Building	Apr 2016	Started	
Procedures:			
Create Site-Specific Procedures	Apr 2015	Completed	Mar 2015
Validate Procedures (NEI 12-06, Sect. 11.4.3)	Apr 2015	Completed	Mar 2015
Create Maintenance Procedures	Apr 2015	Completed	Mar 2015
Perform Staffing Analysis	Nov 2014	Completed	
Storage Plan and Construction	Apr 2015	Started	April 2016
FLEX Equipment Acquisition	Apr 2015	Completed	Mar 2015
Training Completion	Apr 2015	Completed	Mar 2015
National SAFER Response Center Operational	Dec 2014	Completed	

Milestone	Target Completion Date	Activity Status	Revised Target Completion Date
Unit 1 FLEX Implementation	Apr 2015	Started	Apr 2017 See Section 5 of this enclosure.
Unit 2 FLEX Implementation	Apr 2016	Started	Apr 2018 See Section 5 of this enclosure.
Submit Unit 1 Compliance Report	June 2015	Not Started	June 2017 See Section 5 of this enclosure.
Submit Unit 2 Compliance Report	June 2016	Not Started	June 2018 See Section 5 of this enclosure.

4 Changes to Compliance Method

The timeline submitted with the Fifth Six-Month update has been modified based on adjustment of critical times and debris removal. The timeline is enclosed in Attachment 1.

Change 1- Interim FLEX Equipment Storage Alternative Approach:

General Integrated Plan Elements BWR Requirement:
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. The allowed unavailability time requirements are stated in NEI 12-06, Section 11.5.3 and described as: "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."

Reason for Change:
Due to delays in completing the Robust FLEX Building, Quad Cities will be utilizing an outdoor two-pad equipment storage configuration on an interim basis. This configuration will only be utilized until construction of the Robust FLEX Building is complete, which is expected by October 2015. This temporary two-pad storage configuration is an interim approach to the standard FLEX building strategy that meets the requirements of NEI 12-06 and satisfies the intent of NRC Order EA-12-049. During the period Quad Cities is in this configuration for storage, Quad Cities will implement an Alternate Approach to meet the Order for allowed unavailability time.

Change to Compliance Method:

Unavailability Alternate Approach

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 fully protected for the site's applicable hazards, then the allowed unavailability is reduced to 45 days.
    c. Connections to plant equipment required for FLEX strategies can be unavailable for 90 days provided the remaining connection remains available such that the site FLEX strategy is available.
    d. If FLEX equipment is likely to be unavailable during forecast site specific external events (e.g., flooding), appropriate compensatory measures should be taken to restore equivalent capability in advance of the event.
    e. The duration of FLEX equipment unavailability, discussed above, does not constitute a loss of reasonable protection from a diverse storage location protection strategy perspective.
    f. If FLEX equipment or connections becomes 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.
    g. If FLEX equipment or connections to permanent plant equipment required for FLEX strategies are unavailable for greater than 45/90 days, initiate actions to restore the FLEX capability and implement compensatory measures (e.g., use of alternate suitable equipment or supplemental personnel) prior to exceeding the 45/90 days.

Basis for an Alternate Approach:

The interim storage pad design requires use of two separate storage pads separated by a large distance. The lower pad is designed to withstand the seismic event, while the upper pad travel path is not analyzed for seismic capabilities. As a result, the upper pad may become unavailable for accessing FLEX equipment during a seismic event; therefore, the Alternate Approach described herein for a reduced Unavailability Time applied to the interim storage pad equipment will be used to compensate for the upper pad not being analyzed for seismic capabilities. If the remaining N equipment is not protected from the applicable hazards, instead of the 90-day allowed out of service time, an allowed out of service time of 45 days will apply. This is based on 6-week short cycle work scheduling. This will allow the station to continue to manage work associated with equipment important to safety. Placing the FLEX equipment into the site work schedule at the 6-week period still allows proper planning and resource loading while

maintaining schedule compliance and stability. This action will not cause the station to be distracted from other scheduled work.

The probability of an event causing an ELAP and loss of the UHS is low, and reducing the allowed unavailability time will further reduce the probability of an event during this period. Therefore, it is reasonable to expect equipment availability during periods when it is required.

Change 2 - Storage, Maintenance and Testing Alternate Approach:

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. 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 unavailable equipment with an entry date and time based on 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 the 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]

[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.

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 exceeding 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:

- For a 2-unit site, 3 sets (N+1) of on-site FLEX equipment are required. The plant screens in per Sections 5 through 9 for seismic, flooding, 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 three sets (N+1) in a structure(s) that meets the plant's design basis for high wind hazards, or
    - Two sets (N) in a structure(s) that meets the plant's design basis for high wind hazards and one set (+1) 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 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 3 N+1 Hoses and Cables Alternative Approach:

Issue:

An alternative is being proposed to the N+1 requirement applicable to hoses and cables as stated in Section 3.2.2 of NEI 12-06.

Background

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.

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 one hundreds 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

cable 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.

Basis for an alternative approach:

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 the NRC staff has not reviewed and is not endorsing the specific examples included in the NEI endorsement request dated May 1, 2015.

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 in 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 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 4 - Seismic Water Source Alternative Approach

Issue

The station is designing and installing a single Deep Well as a seismically qualified source of water for the FLEX mitigation strategy. This single Deep Well is fully capable of supplying both Units 1 and 2 FLEX requirements simultaneously. Schedule relief for this well has been approved under References 13, 14 and 15. This configuration does not utilize a redundant seismic deep well. As such, Quad Cities will implement an Alternate Approach to meet the Order for allowed unavailability time on the single seismic deep well.

Background

Since only one deep well is being installed, this alternative approach provides the actions that will occur upon unavailability of this deep well during maintenance and testing, or its unavailability during a FLEX event response. The plant circulating water discharge bay will be utilized as a source of backup water during deep well unavailablilty periods. The discharge bay has not been seismically evaluated but there is reasonable assurance that this water supply will remain available as a source of water following a seismic event due to the size of the two diffuser pipes which connect to the main channel of the Mississippi River.

To the extent to which the guidance of JLD-ISG-2012-01 and NEI 12-06 is being followed, deviations should be identified. The allowed unavailability time requirements are stated in NEI 12-06, Section 11.5.3 and are described as: "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." As such, this alternative approach is an acceptable deviation from the guidance of JLD-ISG-2012-01 and NEI 12-06 as described below.

Alternative

Unavailability Alternate Approach (Consistent with NEI 12-06, Section 11.5.3)

1. The unavailability of the seismic deep well 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 installed plant equipment is controlled by existing plant processes such as the Technical Specifications (TS). When installed 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 seismic deep well equipment may be unavailable for 90 days provided that the site seismic water supply capability is met. If the site seismic water supply capability is met but not fully protected for the site's applicable hazards, then the allowed unavailability is reduced to 45 days.
    c. If seismic deep well equipment or connections becomes unavailable such that the site seismic water supply capability is not maintained, initiate actions within 24 hours to restore the site

seismic water supply capability and implement compensatory measures (ensure equipment for use of the discharge bay water supply is ready for deployment) within 72 hours, and then initiate a concurrent 45-day period to repair the seismic well to full availability.

d. If seismic deep well permanently installed equipment required for FLEX strategies are expected to be unavailable for greater than 45 days, initiate actions to restore the seismic deep well capability and implement compensatory measures (e.g., use of alternate suitable equipment) prior to exceeding the 45 days.

Actions During a Seismic FLEX Event

For an ELAP event with a seismic initiator the station will perform the following actions:

1. Phase 1 Actions:
   - Initiate RCIC for FLEX RPV water injection. RCIC will operate under these conditions for > 72 hours. This will allow time for station staff to deploy Phase 2 FLEX strategies.
2. Phase 2:
   - Deploy FLEX generator to power the deep well for primary source of water for FLEX requirements for Suppression Chamber level control, Spent Fuel Pool level and Reactor Pressure Vessel water level control. The deep well pump is powered by one FLEX generator and the well is sufficient to provide water to both Units. Two additional FLEX generators are deployed, one per unit, to restore voltage to the 480V buses.
3. ERO Response Actions:
   - Following the initial stabilization actions for Phase 2, establish a backup water supply using a FLEX pump taking suction from the discharge bay.
   - Monitor the condition of Lock and Dam 14 for a potential failure and/or the discharge bay for level change that may be indicating a degradation of this source.
   - Upon indication or prediction of degradation of the discharge bay level, deploy a submersible pump with the suction placed in low point of the discharge bay with the discharge of the submersible pump connected to the FLEX pump suction to provide additional NPSH should the discharge bay level drop.
4. Continue to operate well pump or the submersible and FLEX pumps as required to supply the FLEX water needs.

Actions 1 – 4, above can be performed within the minimum time requirements needed for FLEX injection.

The discharge bay used in this strategy provides access for use of NSRC Phase 3 equipment as a backup to Phase 2 equipment and addresses indefinite coping time.

Actions During Maintenance or Testing Should the Deep Well Become Unavailable

1. Initiate actions to restore well pump within 24 hours.
2. Verify FLEX and submersible pumps and necessary support components are ready for deployment and are protected from the seismic hazard. This contingency action is required to be completed within 72 hours.
3. Restore well pump to operation within 45 days.

Basis for An Alternative Approach

During times when the single seismic deep well is unavailable, Quad Cities will compensate by use of an Alternate Approach which consists of a FLEX pump and portable submersible pump that will take suction from Quad Cities Station discharge bay. The discharge bay will supply the necessary backup water supply. Access to the river as a water source remains available during this event. This method provides a compensatory separate and diverse FLEX water supply, should the single seismic deep well become unavailable.

As a result, if the single seismic deep well becomes unavailable for a FLEX event (specifically a seismic event), the Alternate Approach described herein, will be utilized. This Approach applies a reduced Unavailability Time to the single seismic deep well which when coupled with the associated compensatory measures, will be used to compensate when the seismic deep is not available. If the equipment is not protected from the applicable hazards, instead of the NEI recommended 90-day unavailability period, an allowed unavailability period of 45 days will apply. This is based on the 6-week short cycle work scheduling. This will allow the station to continue to manage work associated with equipment important to safety. Placing the seismic deep well equipment into the site work schedule at the 6-week period still allows proper planning and resource loading while maintaining schedule compliance and stability. This action will not cause the station to be distracted from other scheduled work.

The probability of an event causing an ELAP and loss of the UHS is low and reducing the allowed unavailability time will further reduce the probability of an event during this period. Therefore, it is reasonable to expect equipment availability during periods when it is required.

Supporting Plant Conditions

- Discharge Bay Water Level:
  - Normal discharge bay and Mississippi River level is 572 feet controlled by downstream Lock and Dam 14.
  - Per UFSAR 2.4.4, the minimum elevation of the discharge bay is 561 feet, should Lock and Dam 14 fail, which is the normal elevation downstream of Lock and Dam 14.
  - Bottom elevation of discharge bay is 557 feet.
  - Godwin FLEX pumps will provide the necessary water to a suction level of 565 feet which will be reached 90 hours after the Lock and Dam 14 failure per UFSAR 2.4.4.
  - At 565 feet or lower, the station plans to use a submersible booster pump to provide additional required NPSH for the FLEX Godwin pump.
- Torus and Reactor:
  - Per EC 395980 and calc QDC-1300-M-2074 analysis, the RCIC system pump will have sufficient NPSH and is capable of operation greater than 72 hours.
- Spent Fuel Pool:
  - From Calculation QDC-1900-M-2079 for a Full Core Offload time to 12 ft. above fuel is 31.5 hours and the time to 10 ft. is 38.6 hours. The more restrictive time of 31.5 hours will be utilized for this alternate approach.
- Therefore, the shortest time that Phase 2 FLEX water injection is required is 31.5 hours based on Spent Fuel Pool water needs.

- Discharge bay remains open to the river following the event. The diffuser piping (Two-16 ft. pipes) remains open to allow sufficient backflow from the Mississippi River main channel to the discharge bay and remains open to the river following the event.
- The discharge bay bottom elevation is 557 feet. The minimum water level is 561 feet which is consistent with the normal water level downstream of Lock and Dam 14, should it fail. Therefore, a depth of 4 feet of usable water will remain available in the Discharge bay and will be maintained by open path to the Mississippi River main channel via the diffuser piping.
- The discharge bay is expected to remain accessible following the event due to its construction that utilizes a sheet pile enclosure reinforced with rip-rap slope stabilization.
- The discharge bay pump pad was designed and installed to be seismically robust.
- The travel path to the discharge bay was evaluated for liquefaction.
- The station stores one FLEX pump in the FLEX storage building and one FLEX pump in the ASCE 7-10 building.
- The station will provide a booster pump or utilize the Dresden Station, diesel driven hydraulic submersible booster pump to provide the additional NPSH for the FLEX pump if the Discharge bay level continues to drop below or is expected to degrade below 565 feet.

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

By letter dated February 27, 2014 (Ref. 5), Quad Cities Station requested relaxation from certain schedule requirements of Order EA-12-049 (Ref. 2) related to installation of the severe accident capable containment vent required by Order EA-13-109 (Ref. 3). The NRC granted that schedule relief via letter dated April 15, 2014 (Ref. 9).

By letter dated March 4, 2015 (Ref. 13) and supplemented by a letter dated March 6, 2015 (Ref. 14) Quad Cities Station requested schedule relaxation of the requirements of Order EA-12-049 (Ref. 2) related to the completion of installation of the mitigating strategies equipment and modifications to implement the strategies. The NRC granted the schedule relief via letter dated March 11, 2015 (Ref. 15).

No additional need for relief/relaxation relative to Order EA-12-049 has been identified at this time.

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 (Reference 1) or the Interim Safety Evaluation (SE) (Reference 7), and the status of each item.

Section Reference	Overall Integrated Plan Open Item	Status

Section Reference	Overall Integrated Plan Open Item	Status
Sequence of Events (p. 4)	1. The times to complete actions in the Events Timeline are based on operating judgment, conceptual designs, and current supporting analyses. The final timeline will be time validated once detailed designs are completed and procedures are developed, and the results will be provided in a future 6-month update.	Completed this update. Closed during Site FLEX Audit 1/29/15 In the Sequence of Events timeline on page 56-59 of the QC OIP, ERVs are used to control reactor pressure through manual operation. Specifically steps 6, 10 and 19 are in alignment with the existing Emergency Operating Procedures, QGA 100 RPV Control and QGA 200 Primary Containment Control. As part of pressure control in the EOPs reactor pressure is first stabilized using ERVs (Timeline step 6), then a depressurization of the RPV is started (this is not time critical) with cool down rate limit specified of less than 100°F per hour (Timeline step 10), and finally a RVP Blow down is initiated when the Torus Heat Capacity Limit is reached (Timeline step 19). Step 19 is the only time critical step as explained on page 6 of the QC OIP. These steps were developed within the EOPs to provide procedural guidance to the operators to perform a controlled cool down of the RPV, less than 100°F per hour, and avoid a rapid depressurization of the RPV which is required if containment parameters warrant (the Heat Capacity Limit is reached). Step 10 of the timeline specifies less than or equal to 80 °F per hour to add margin.
Sequence of Events (p. 4,5)	2. Issuance of BWROG document NEDC-33771P, "GEH Evaluation of FLEX Implementation Guidelines," on 01/31/2013 did not allow sufficient time to perform the analysis of the deviations between Exelon's engineering analyses and the analyses contained in the BWROG document prior to submittal of this Integrated Plan. This analysis is expected to be completed, documented on Attachment 1B, and provided to the NRC in the August 2013 Six-Month status update.	Completed See August 2013 Six-Month update
Sequence of Events (p. 6)	3. Additional work will be performed during detailed design development to ensure Suppression Pool temperature will support RCIC operation, in accordance with approved BWROG analysis, throughout the event.	Completed See August 2014 Six-Month update

Section Reference	Overall Integrated Plan Open Item	Status
Sequence of Events (p. 7)	4. 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 designs, and will be provided in a future 6-month update.	Completed See August 2014 Six-Month update
Multiple Sections	5. Procedures and programs will be developed to address storage structure requirements, haul path requirements, and FLEX equipment requirements relative to the external hazards applicable to Quad Cities	Completed this update Closed during Site FLEX Audit 1/29/15 QCOS 0050-02 FLEX Haul Path Inspection has been drafted to inspect the areas both external to the buildings and internal that if blocked could hamper the deployment of equipment in response to an ELAP event. Included are actions to be taken when the surveillance is found unsatisfactory. The debris removal equipment includes the plow on the F-750 truck, a 4 wheel drive tractor with a front bucket and battery and AC powered tools for cutting of debris for removal. Also there is additional hose and cable to allow traversing the debris if the capability of the F750 truck and/or tractor are exceeded. Validation of deployment procedures is in progress and will provide times for non-debris deployment. An assessment of these times will then determine what impact debris removal will have on overall completion times.
Programmatic controls (p. 8)	6. Quad Cities Nuclear Power Station will implement an administrative program for FLEX to establish responsibilities, and testing and maintenance requirements.	Complete this update The site FLEX Program Document which contains Preventative Maintenance and Surveillances has been completed.

Section Reference	Overall Integrated Plan Open Item	Status
Multiple Sections	7. Detailed designs based on the current conceptual designs will be developed to determine the final plan and associated mitigating strategies. Analysis will be performed to validate that the plant modifications, selected equipment, and identified mitigating strategy can satisfy the safety function requirements of NEI 12-06. Once these designs and mitigating strategies have been fully developed, Exelon will update the integrated plan for Quad Cities Nuclear Power Station during a scheduled 6-month update. This update will include any changes to the initial designs as submitted in this Integrated Plan.	Started
Maintain Core Cooling Phase 1 (p.13)	8. 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.	Completed this update Closed during Site FLEX Audit 1/29/15 The approved QCOS 0050-02 for FLEX haul path deployment path inspection designates the area that could affect the successful deployment of FLEX if required.
Maintain Spent Fuel Pool Cooling Phase 1 (p.32)	9. Evaluation of the spent fuel pool area for steam and condensation has not yet been performed. The results of this evaluation and the vent path strategy, if needed, will be provided in a future 6-month update.	Completed this update Closed during Site FLEX Audit 1/29/15 EC 395698 has been installed and QCOP 0050-04 FLEX Refuel Floor Actions and QCOP 0050-05, 06 provide direction for hose deployment and establishing restoration of water to the spent fuel pool. Approved FSGs: QCOP 0050-04 FLEX Refuel Floor Actions, QCOP 0050-05 FLEX Hose Deployment, and QCOP 0050-06 FLEX RPV, Suppression Pool, Spent Fuel Pool Level Control, all have elements that support habitability of the area and actions to supply the SFPs with makeup.

Section Reference	Overall Integrated Plan Open Item	Status
Safety Function Support (p. 42)	10. Habitability conditions will be evaluated and a strategy will be developed to maintain RCIC habitability.	Completed this update Closed during Site FLEX Audit 1/29/15 Calculation 2014-02948, Reactor Building Temperature Analysis Resulting from Extended Loss of AC Power, has been approved under EC 400393. The implementing procedure is QCOP 0050-17, Rev. 0, issued 01/20/15. The following is from the EC Scope for EC 400393: The results of calculation 2014-02948 show that the RCIC room will reach 150°F in approximately 9 hours. All analyzed BDBEEs except Localized Intense Precipitation (LIP) allow FLEX equipment deployment before this duration, and are thus bounded by this result. (Reference the FLEX Overall Integrated Plan and MAAP analysis QC-MISC-013.) A LIP event may prevent external equipment deployment up to 10 hours. These results assume doors opened to start natural circulation, which are already implemented in QCOP 0050-04. There are no other compensating actions planned. Note that even if Localized Intense Precipitation (LIP) were to prevent FLEX deployment for 10 hours, the ELAP is an extended version of the Station Blackout evaluated in NUMARC 87-00, Guidelines and Technical Bases for NUMARC Initiatives Addressing Station Blackout at Nuclear Power Plants. In Appendix G of that report, the topical report on the relevant equipment shows reasonable assurance of operability up to 180°F. Per the RB habitability study Appendix M, chart M1, the RCIC Pump Room never reaches 180°F for the 72 hours of the event that were analyzed. Based on this, there is reasonable assurance of RCIC operability throughout all BDBEEs.
Safety Function Support (p. 42)	11. Habitability conditions will be evaluated and a strategy will be developed to maintain Main Control Room habitability.	Complete Duplicate of 3.2.4.6.A

Section Reference	Overall Integrated Plan Open Item	Status
Safety Function Support (p. 43)	12. Battery Room Ventilation: Alternate ventilation will be provided to address Hydrogen generation and cold weather, as required.	Completed this update Closed during Site FLEX Audit 1/29/15 Calculation 2014-05860, Battery and Charger Room Heat Up for FLEX Evaluation, has been accepted by the site under EC 399874. The results report that battery electrolyte temperature reaches 67°F in Unit 1 in 4 hours and 65°F in Unit 2 in 4 hours. Unit 1 will reach 65°F in 6 hours, which is enough time for FLEX deployment with no need for a compensating action to mitigate cold in Unit 1. This is reflected in Quad Cities FLEX Program document. EC 394892, Modify the Battery Room Exhaust Fan Electrical Supply from Emergency Lighting Cabinets, has been installed. Procedure QCOP 0050-10, FLEX Battery Room Ventilation, implements starting the fan, and displaced air is made up from the Turbine Building through the door to the Battery Room. The function of the fan is to prevent hydrogen buildup, and the modification allows powering the fan by a source that will survive a BDBEE.
Safety Function Support (p. 43)	13. Fuel Oil Supply to Portable Equipment: A detailed fuel oil supply plan will be developed.	Completed this update. Closed during Site FLEX Audit 1/29/2015 EC 399944, FLEX Fuel Oil Plan, has been approved as a detailed fuel oil supply plan.
Attachment 1A, Item 20 (p.59)	14. Provide alternate cooling to the RCIC rooms. Procedure to be developed.	Completed this update. Closed during Site FLEX Audit 1/29/2015 Procedure QCOP 0050-17, FLEX RCIC Room Cooler Lineup, has been issued and time validated per the NEI validation process.

Section Reference	Interim Safety Evaluation Open/Confirmatory Items	Status
3.2.3.A	SIGNIFICANT OPEN Item. Generic concern related to adoption of Revision 3 to the BWROG EPG/SAG [Emergency Procedure Guidelines/Severe Accident Guidelines] relating to potential detrimental effects on containment response.	Complete See February 2014 Six-Month update. Closed during Site FLEX Audit 1/29/15 On January 9, 2014, the NRC informed NEI (see ML13358A206) that changes to the containment venting strategies as described in the BWROG information report "BWR Containment Venting"

		Revision 1, dated 10/29/13 (ML13352A061, ML13352A066, ML13352A079) are acceptable for Order EA-12-049
3.2.4.6.A	OPEN Item Licensee asserts 120 °F used for habitability in SBO is adequate for FLEX. Habitability of the control room should consider 110 degree F temperature limits of NUMARC 87-00 and MIL-STD-1472C.	Completed this update Closed during Site FLEX Audit 1/29/2015 Regarding a maximum temperature limit of 120 degrees F for habitability of the main control room, the station is using 120 degrees F as the upper limit for the Control Room based on plant's current design and licensing basis for compliance to the SBO. Applicable discussion of this limit is documented in the SER for the SBO rule, dated December 11, 1990. Quad Cities Station will employ a "Toolbox Approach" for coping with extreme temperatures during FLEX implementation. Examples of acceptable toolbox actions to cope with extreme temperatures are: -Opening doors when room temperatures become elevated -Rotation of personnel -Use of ice vests, etc. when tasks are in high heat and humidity -Utilizing small fans for air movement -Warming/cooling in available vehicles -Utilizing firefighting turn-out gear to cope with extreme low temperatures Procedure QCOP 0050-11, FLEX Control Room Ventilation, provides the primary means to ventilate the room and will open the doors and use of portable fans.
3.3.2.A	OPEN Item Control of equipment and connections for unavailability needs to be addressed.	Complete this update Closed during Site FLEX Audit 1/29/15 The equipment and connections for unavailability is addressed by QCAP 1500-07, "Administrative Tracking Requirements for Non-Functional FLEX Equipment". Procedure QCAP 1500-07 provides a list of FLEX equipment required to be maintained available and action to be taken to restore availability of equipment in accordance with guidance set forth in NEI 12-06. The procedure has been updated to separate the unavailability of equipment by event for which it is used.
3.4.B	OPEN Item Details not provided to demonstrate the minimum capabilities for offsite resources will be met per NEI 12-06, Section 12.2.	Complete See February 2014 Six-Month update Closed during Site FLEX Audit 1/29/15

		The NRC endorsement (ML14265A107) of the NEI white paper on this topic covers Section 12.2. Procedure CC-QC-118-1001is the Quad Cities SAFER Response Plan. QCOP 0050-16, FLEX National SAFER Response Center Interface, has been issued to address the use of SAFER equipment. Staging area C is the Whiteside County airport. Staging area B is the contractor parking lot, which has helicopter landing capability. Staging area D is the Quad Cities (Moline) airport. SAFER is notified of an event as follows: Loss of all A/C initiates procedure QCOA 6100-04, Station Blackout. Step D10 performs Attachment D. Att. D has the SM initiate the E-plan and notify the Exelon Nuclear Duty officer. The NDO directs the Corporate Supply Duty person to contact SAFER and request equipment delivery, see NDO checklist EP-AA-112-400-F-01. When the EOF (at Cantera) is activated, the Corporate Emergency Director checklist also has the ED contact SAFER, checklist EP-AA-112-400-F-02. Other EP checklists also direct contact with SAFER.
3.1.1.2.A	Confirmatory Item Studies for liquefaction and the effects on haul paths and storage location(s) are not complete.	Complete this update Closed during Site FLEX Audit 1/29/15 The use of two interim temporary storage pads until the Robust FLEX building is completed, has been submitted formally to NRC as an Alternate Strategy which has been inserted into the FLEX 4th 6 Month OIP Update Report (2/27/15) (RS-15-024) to allow a 45-day (vs 90-day) unavailability period if equipment on the seismic pad becomes unavailable. The basis for this Alternate Strategy is provided in FLEX Storage Pad Summary R4 Changes. Liquefaction evaluations on the upper pad haul path and pad impacts are addressed in Quad Cities calculation QDC-0000-S-2134 (FLEX Travel Path Liquefaction Evaluation). The Alternate Strategy discussion from the FLEX 4th 6 Month OIP Update Report (2/27/15) (RS-15-024) to allow a 45-day (vs 90-day) unavailability period if equipment on the seismic pad becomes unavailable, is provided below: See Changes to Compliance Method Section 4, Change 1 - Interim FLEX Equipment Storage Alternative Approach, in this document.
3.1.1.2.B	Confirmatory Item A postulated downstream dam failure from a seismic event is still being evaluated.	Complete this update See Changes to Compliance Method Section 4, Change 4 - Seismic Water Source Alternative Approach
3.1.1.2.C	Confirmatory Item Need to confirm implementation of strategy for power to move or deploy FLEX equipment and	Complete this update Closed during Site FLEX Audit 1/29/15

	opening of doors.	All FLEX response equipment; pumps, generators, and hoses are located on trailers which will be connected and hauled to the deployment location with capable haul vehicle(s). Power for starting the diesel engine powered portable equipment will be from contained batteries. Therefore, no external power will be necessary for deployment or operation of the FLEX equipment. The FLEX storage building(s) design is being finalized. The door operation will not require external power. One of the deployment paths via the 1/2 Equipment Trackway does have a closing wedge that could block door opening. The hydraulic circuit was modified under EC 398254 to allow retracting the wedge to allow door opening.
3.1.1.3.A	Confirmatory Item Plans for strategies have insufficient information to demonstrate alternate sources of instrument readings and adequate tolerances/accuracies if there is seismic impact to primary sources. Also, need identification of installed instrumentation location and power source.	Complete this update Closed during Site FLEX Audit 1/29/15 QCOP 0050-09, FLEX Response Instrumentation, provides detailed lists of all instrumentation including Main Control Room and Local Instrument Racks and the power supplies. Additionally indicators on local racks that are not power dependent are provided. Alternate methods for obtaining the necessary pressure and reactor levels are also provided in the procedure. FLUKE instruments for execution of these procedural steps have also been procured.
3.1.1.3.B	Confirmatory Item Need identification of instrumentation used to monitor FLEX electrical power equipment including measurement tolerance/accuracy.	Complete See August 2014 Six-Month update Closed during Site FLEX Audit 1/29/15 The FLEX 480VAC generators are supplied by Cummins Power Generation. The instruments supplied with the generator measure line to line and line to neutral voltage, phase current, and power output. Specifications are provided in the engineering submittal provided by the vendor.
3.1.2.2.A	Confirmatory Item A detailed fuel supply plan is to be provided in a future 6-month status update including what is needed, what is available, and how it will be transported.	Complete this update Closed during Site FLEX Audit 1/29/15 Closed to 3.2.4.9.A
3.1.3.2.A	Confirmatory Item Completion of development of an administrative program to ensure pathways remain clear or compensatory actions will be implemented to ensure all strategies can be deployed during all modes of operation. Procedures and programs are to be developed.	Complete this update Closed during Site FLEX Audit 1/29/15 QCOS 0050-02 FLEX Haul Path Inspection, to inspect the areas both external to the buildings and internal that if blocked could hamper the deployment of equipment in response to an ELAP event. Included are actions to be taken when the surveillance is found unsatisfactory. The debris removal equipment includes the plow on the F-750 truck, a 4 wheel drive tractor with a front bucket and battery and AC powered tools for cutting of

		debris for removal. Also there is additional hose and cable to allow traversing the debris if the capability of the F750 truck and/or tractor are exceeded. Validation of deployment procedures is complete and provides times for non-debris deployment. An assessment of these times determined impact debris removal has on overall completion times. See Attachment 1 for updated timeline with debris removal impact.
3.1.3.2.B	Confirmatory Item Completion of assessment on the adequacy of the debris removal equipment and the effect on the timeline to assure the critical times are capable of being met. This will be tracked as an open item in the 6-month update.	Complete this update See 3.1.3.2.A
3.2.1.1.A	Confirmatory Item Need benchmarks to demonstrate Modular Accident Analysis Program (MAAP)4 is the appropriate code for simulation of ELAP.	Complete See August 2014 Six-month update Closed during Site FLEX Audit 1/29/15 The generic response provided by EPRI BWR Roadmap "Technical Basis for Establishing Success Timelines in Extended Loss of AC Power Scenarios in Boiling Water Reactors Using MAAP4," (EPRI Product ID 3002002749). Acceptability of MAAP was analyzed in EPRI Technical Report 3002001785, "Use of Modular Accident Analysis Program (MAAP) in Support of Post Fukushima Applications" and QC-MISC-014, Use of MAAP in Support of FLEX Implementation. Reference Att. 4 of the August 2014 6-month update.
3.2.1.1.B.	Confirmatory Item The collapsed level must remain above Top of Active Fuel (TAF) and the cool down rate must be within technical specification limits in the MAAP4 analysis.	Complete See August 2014 Six-Month update Closed during Site FLEX Audit 1/29/15 The Quad Cities Overall Integrated Plan (August 2014 Six-Month Update), states that the operators would commence a cooldown of the RPV after the RPV water level reaches +40" at a rate of 80°F/hr which is within the technical specifications limit of 100°F/hr. The plot of the RPV pressure from the MAAP analysis uses a cooldown initiation setpoint of +40" water level in the RPV. For the representative MAAP run (Case 6), the collapsed RPV water level inside the shroud remains above TAF for the duration of the analysis. The plot below shows that the lowest RPV level, calculated by MAAP, was approximately -40" below instrument zero. (TAF is located at -142" relative to instrument zero, Instrument zero is at +503" above vessel zero.) The collapsed RPV water level remains at least 8.5' above TAF for the duration of the analysis.

3.2.1.1.C.	Confirmatory Item MAAP4 must be used in accordance with Sections 4.1, 4.2, 4.3, 4.4, and 4.5 of the June 2013 position paper.	Complete See August 2014 Six-Month update Closed during Site FLEX Audit 1/29/15 The MAAP analysis performed for Quad Cities was carried out in accordance with Sections 4.1, 4.2, 4.3, 4.4, and 4.5 of the June 2013 position paper, EPRI Technical Report 3002001785, "Use of Modular Accident Analysis Program (MAAP) in Support of Post-Fukushima Applications". Preparation and Review of the MAAP analysis was conducted under engineering training certification guide ENANRM08.
3.2.1.1.D.	Confirmatory Item In using MAAP4, the licensee must identify and justify the subset of key modeling parameters cited from Tables 4-1 through 4-6 of the "MAAP4 Application Guidance, Desktop Reference for Using MAAP4 Software, Revision 2" (Electric Power Research Institute Report 1 020236).	Complete See August 2014 Six-Month update Closed during Site FLEX Audit 1/29/15 See 3.2.1.1.A
3.2.1.1.E.	Confirmatory Item The specific MAAP4 analysis case that was used to validate the timing of mitigating strategies in the integrated plan must be identified and available on thee-Portal for NRC staff to view. Alternately, a comparable level of information may be included in the supplemental response.	Complete See August 2014 Six-Month update Closed during Site FLEX Audit 1/29/15 The MAAP analysis performed in support of the Quad Cities Integrated Plan is documented in calculation QC-MISC-013 Rev. 2. Case 6 was the specific MAAP run selected to represent the scenario as described in Attachment 1A of the August 2014 6-month update.
3.2.1.2.A.	Confirmatory Item Questions remain unanswered regarding recirculation pump seal leakage rates. Aspects such as pressure dependence, leakage phase assumptions (single phase liquid, steam, mixed) are not discussed.	Complete this update. Closed during Site FLEX Audit 1/29/15 The Reactor Recirculation pump seal leakage is assumed to be 42 gpm. This includes 5 gpm of unidentified leakage, 1 gpm of identified leakage, and 18 gpm recirculation pump seal leakage per pump. Per QC-MISC-013, Rev 2, this is modeled in MAAP as a hole of fixed size which yields 42 gpm leakage at 1000 psig. Therefore, the leakage is reactor pressure limited. For phase flow, ERIN report QC-MISC-014, Rev. 0, discusses the phase flow from reactor vessel leakage. Reactor recirculation seal leakage is single-phase liquid due to the location of the break low in the RPV with RPV level continued to be maintained above TAF. Recirc Pump Model: Byron Jackson/Flowserve, DVSS 28x28x30. Quad Cities has Generation 2 and Generation 4 pumps installed. Recirc Pump Seals: All pumps use the Flowserve N-7500

		mechanical seals. QCOS 1600-07, Reactor Coolant System Leakage in the Drywell (DWFDS and DWEDS Available), demonstrates administrative controls in place for monitoring and responding to changes in Drywell leakage rates. Historical data provided to demonstrate normal Drywell Leakage rates at Quad Cities Station relative to NEI 12-06, Rev. 0, Section 3.2.1.5, Reactor Coolant Inventory Loss. QCOP 0050-08, FLEX Electrical Isolation provides direction to isolate Recirc Pump Seals upon restoration of 480VAC via the FLEX Generators.
3.2.1.3.A.	Confirmatory Item Need gap analysis between results of the licensee's analysis results and those of BWROG document NEDC-33771 P. Results are presented in 6- month update; however, there is no analysis of the relevance of differences.	Complete this Update. Closed during Site FLEX Audit 1/29/15 The generic MAAP response template is Calc. QC-MISC-013, (MAAP analysis to support FLEX Initial Strategy). The current MAAP 4.0.5 calculations were performed to estimate the containment pressure and temperature response to a variety of extended Station Blackout (SBO) events. Case 6 was the specific MAAP run selected to represent the scenario as described in Attachment 1A of the August 2014 6-month update to the overall integrated plan.
3.2.1.3.B.	Confirmatory Item Licensee plans further review and analysis to ensure suppression pool temperature will support RCIC operation.	Complete this Update. Closed during Site FLEX Audit 1/29/15 Evaluation of RCIC NPSH under ELAP conditions has been performed as documented in QDC 1300-M-2074 and QC-MISC-013, Rev. 2. Additional supporting information is provided in BWROG-TP-14-018, Beyond Design Basis RCIC Elevated Temperature Functionality Assessment.
3.2.1.3.C.	Confirmatory Item Need identification of the minimum voltage required for the dc buses and the basis of that determination.	Complete See February 2014 Six-Month update. Closed during Site FLEX Audit 1/29/15 The minimum voltage required for DC Buses and basis is contained in Quad Cities UFSAR Section 8.3.2. UFSAR 8.3.2. defines 105 VDC as the limiting voltage for the 125 VDC battery, and 210 VDC for the 250 VDC battery. These are the values that were utilized for the FLEX event analyses. Calculations QDC-8300-E-2100, Rev. 0 and QDC-8350-E-2101, Rev. 0 are for the 125 and 250 Volt systems respectively. There is not a specific limiting component.

3.2.1.4.A.	Confirmatory Item Water quality issue and guidance on priority of water source usage need to be addressed.	Complete this Update. Closed during Site FLEX Audit 1/29/15 Procedure QCOP 0050-12, "FLEX RCIC System Operation" provides guidance on using available water sources for injection into the RPV using RCIC. The water for phase 1 operations will be Torus water or/and CCST water if available (the CCSTs tanks are not seismic or tornado proof). These are the normal water sources used for RPV makeup via RCIC. Phase 2 operations will use the deep well or river water. Due to the use of raw water the core inlet filters could become blocked not allowing sufficient flow for adequate core cooling. Raising the water level to the point that water enters the core via passages in the moisture separators will assure core cooling. Quad Cities incorporated EPG Rev. 3 guidance into the station EOPs (QGAs), to allow RPV water level to be controlled high enough to facilitate top-down cooling via spillover at the moisture separators if necessary.
3.2.1.4.B.	Confirmatory Item Need completion of current evaluation of FLEX generator sizing calculation.	Complete this Update. Closed during Site FLEX Audit 1/29/15 Calculation QDC-7300-E-2099, Rev. 0 contains the basis of the FLEX Generator sizing including the list of plant loads. This calculation also includes key excerpts of the Cummins Diesel Specifications.
3.2.1.4.C.	Confirmatory Item Need design and working pressure of hoses and fittings.	Complete this Update. Closed during Site FLEX Audit 1/29/15 The lowest rated pressure identified for the components being deployed to support FLEX injection is 225 psig and that current FLEX flow models show that these components would be exposed to less than 200 psig at all times. Procedure 0050-06, FLEX RPV, Suppression Pool, and Spent Fuel Pool Level Control, has been revised to assure a dead head condition does not exist. In addition a relief valve has been added to the discharge piping at the well head.
3.2.1.6.A.	Confirmatory Item Licensee identified protection of equipment for Hardened Vent is to Order EA-13-109 (Reference 22). Explain if this is equivalent to Order EA-12-049, as Order EA-13-109 does not require protection from external events.	Complete this Update. Closed during Site FLEX Audit 1/29/15 All credited Phase 2 FLEX equipment, including equipment needed for the Hardened Vent (Order EA-13-109) would be protected in the robust storage building. The Quad Cities EA 13-109 Phase 1 OIP, June 2014, identified and screened in all external events from EA 12-049. Part 2, page 24, identifies handling of portable equipment.

		Portable equipment is to be deployed as per EA 12-049, and connections protected as per EA 12-049. Detailed design of the HCVS system started January 2015, with a parameter of operation without portable equipment for 24 hours. The portable equipment for HCVS operation beyond 24 hours will be stored in the FLEX building and protected in the same manner as equipment protected under EA 12-049.
3.2.2.A.	Confirmatory Item The licensee identified modifications and procedures for SFP cooling are in development.	Complete this Update. Closed during Site FLEX Audit 1/29/15 The Fuel Pool FLEX connection has been installed and QCOP 0050-04, FLEX Refuel Floor Actions, and QCOP 0050-05, 06 provide direction for hose deployment and establishing restoration of water to the spent fuel pool. Approved FSGs: QCOP 0050-04 FLEX Refuel Floor Actions, QCOP 0050-05 FLEX Hose Deployment, and QCOP 0050-06 FLEX RPV, Suppression Pool, Spent Fuel Pool Level Control, all have elements that support habitability of the area and actions to supply the SFPs with makeup.
3.2.4.2.A.	Confirmatory Item Modifications to restore RCIC room cooling are being developed by the licensee.	Complete See August 2014 Six-Month update. Closed during Site FLEX Audit 1/29/15 U1 ECCS Room Cooler FLEX connection has been installed. U2 ECCS Room Cooler is scheduled to be installed during Q2R23. QCOP 0050-17, FLEX RCIC Room Cooler Lineup, will provide direction for use.
3.2.4.2.B.	Confirmatory Item Modifications to restore ventilation to the battery rooms via use of the portable FLEX generators to address hydrogen and cold weather are being developed by the licensee.	Complete See August 2004 Six-Month update. Closed during Site FLEX Audit 1/29/15 Calculation 2014-05860, Battery and Charger Room Heat Up for FLEX Evaluation, has been accepted by the site under EC 399874. The results report that battery electrolyte temperature reaches 67°F in Unit 1 in 4 hours and 65°F in Unit 2 in 4 hours. Unit 1 will reach 65°F in 6 hours, which is enough time for FLEX deployment with no need for a compensating action to mitigate cold temperature in Unit 1 and Unit 2. This is reflected in the Quad Cities FLEX program document. EC 394892, Modify the Battery Room Exhaust Fan Electrical Supply from Emergency Lighting Cabinets, has been installed. Procedure QCOP 0050-10, FLEX Battery Room Ventilation, implements starting the fan, and displaced air is made up from the Turbine Building through the door to the Battery Room. The function of the fan is to prevent hydrogen buildup, and the

		modification allows powering the fan by a source that will survive a BDBEE.
3.2.4.4.A.	Confirmatory Item Procedures for emergency lighting are to be developed for deployment of hands free flashlights.	Complete this Update. Closed during Site FLEX Audit 1/29/15 QCOP 0050 procedures to be used for ELAP event response provide direction for the use of the Appendix R tools which includes hands free flashlights. Additionally, Equipment Operators are provided hands free hard hat lights as part of their normal complement of equipment for job performance, and there are staged flashlights in the Operations Ready Room. The equipment purchased for the initial Fukushima response includes bar lights.
3.2.4.4.B.	Confirmatory Item Confirm upgrades to communication system that resulted from the licensee communications assessment. (ADAMS Accession Nos. ML 12306A 199 and ML13056A 135.)	Complete this Update. Closed during Site FLEX Audit 1/29/15 Communications upgrades are being implemented consistent with the guidance contained in Exelon Position Paper "BDBEE Communications Strategy and Equipment Readiness, dated 12/19/14.
3.2.4.5.A.	Confirmatory Item Verify completion of drafted procedures for protected and internal locked area access.	Complete this Update. Closed during Site FLEX Audit 1/29/15 QCOP 0050 procedures to be used for ELAP event response provide direction for the use of the Appendix R tools which includes necessary keys for access. SY-QC-101-411, Active Vehicle Barrier System/Motorized Gate Manual Operation, provides direction for opening vehicle access points to the protected area without any power available.
3.2.4.6.B.	Confirmatory Item Site industrial procedures and identification of protective clothing, ice vests/packs, bottled water, etc. is needed.	Complete See February 2014 Six-Month update Closed during Site FLEX Audit 1/29/15 Per the February 2014 6-month update, ML14059A432, Procedure SA-AA-111, HEAT STRESS CONTROL, addresses use of protective clothing, cooling garments and water use for rehydration and addresses protecting employees from adverse effects of performing work in high temperature environments. QCOS 0010-03, Safe Shutdown Equipment Inspection, documents some of the equipment that is maintained available including ice vests. Additionally, personal habitability supplies identified as part of the station FLEX response are being maintained via use of the storeroom inventory process.

3.2.4.6.C.	Confirmatory Item Need to address the use of appropriate human performance aids (e.g., component marking, connection schematics, installation sketches, photographs, etc.) which shall be included in the FLEX guidance implementing the FLEX strategies.	Complete this Update. Closed during Site FLEX Audit 1/29/15 QCOP 0050 procedures to be used for ELAP event response contain attachments that include HU tools such as layout diagrams, illustrations, and drawings to provide visual directions as well as written directions. Components used within the FLEX response procedures will be designated using reflective green FLEX stickers, similar to Appendix R response or B.5.b response. OP-QC-116-101-1001 has been implemented to document component labeling requirements for FLEX equipment.
3.2.4.8.A.	Confirmatory Item The licensee did not provide any information regarding loading/sizing calculations of portable diesel generators(s) and strategy for electrical isolation for FLEX electrical generators from installed plant equipment.	Complete this Update. Closed during Site FLEX Audit 1/29/15 QCOP 0050-08, FLEX Electrical Restoration, provides direction for electrical isolation and generator connection and operation. Loading evaluation performed by calculation QDC-7800-E-2099. This calculation does assume that load shed has been completed per QCOP 0050-08, FLEX Electrical Restoration.
3.2.4.9.A.	Confirmatory Item Need detailed fuel plan including fuel storage tank, truck, and day tank volumes and how fuel quality is maintained in the day tanks and in portable FLEX equipment.	Complete this Update. Closed during Site FLEX Audit 1/29/15 The detailed fuel oil plan has been completed, EC 399944, FLEX Fuel Oil Plan, and QCOP 0050-13, FLEX Generator/Pump Refueling, has been issued.
3.2.4.10.A.	Confirmatory Item Need detailed battery load profile for all mitigating strategies and a detailed discussion of loads that will be shed, how they will be shed, and what are the effects of the load shed.	Complete this Update. Closed during Site FLEX Audit 1/29/15 Quad 1/23/15: Battery load profiles have been evaluated and documented in Calculations QDC-8300-E-2100 and QDC-8350-E-2102. QCOP 0050-01 and 02, Unit 1(2) FLEX DC Load Shed, have been issued to provide procedural guidance for performance of the FLEX load shed of both the 125V and 250V batteries
3.4.A.	Confirmatory Item Procedures for interface with the NSRC need to be developed.	Complete this Update. Closed during Site FLEX Audit 1/29/15 QCOP 0050-16, FLEX National SAFER Response Center Interface, has been issued to provide direction for the use of NSRC equipment in support of the Quad Cities Station FLEX strategy. The SAFER Playbook has been developed and contains details of the equipment that will be provided and delivery methods.

NRC FLEX Audit Report Open Items

3.1.1.2.B	Confirmatory Item A postulated downstream dam failure from a seismic event is still being evaluated.	Complete this update See Changes to Compliance Method Section 4, Change 4 - Seismic Water Source Alternative Approach
AQ 28-B	The licensee stated that it can mitigate the effects of an ELAP indefinitely using phase two portable equipment and utilizing the Phase 3 NSRC equipment as back-up for reliability if needed. However, for a seismic event the licensee only has one seismically qualified well pump, and there is no NSRC equipment that can substitute for the well pump. Although there will be a spare well pump at the site, the replacement time of 72 hours	Complete this Update See Changes to Compliance Method Section 4, Change 4 - Seismic Water Source Alternative Approach
AQ 49-B, SE 3-E	Provide details of the maintenance and testing plan for portable/FLEX electrical equipment that is credited for events that require mitigating strategies. Please describe how Regulatory Guidance documents, IEEE Standards, manufacturer recommendations, etc. will be used to establish the maintenance and testing programs for the portable/FLEX electrical equipment, especially for batteries and diesel generators.	Complete this Update The Site specific Quad Cities FLEX Program Document which contains Preventative Maintenance actions and Surveillances has been completed.
SE 9-E	For a design basis Mississippi River flood, most of the site will have several feet of water. The license's plan is to remove the drywell heads, and the RPV heads, and flood the refueling cavity, connecting both RPVs and both SFPs. There will be a loss of all AC power due to the flood. Gasoline powered pumps will be used to refill the refueling cavity. Please provide an assessment of the reliability of this action, including the timeline for getting to cold shutdown and removing the heads and flooding the refueling cavity, the reliability of offsite power to perform these actions, the availability of backup power supplies, and the availability of critical equipment such as the crane for head removal and stud	Complete this Update Timeline for getting to cold shutdown and removing the heads and flooding the refueling cavity: UFSAR Section 3.4.1.1 provides the design basis flooding scenario and mitigation efforts and includes the timeline for getting to cold shutdown and removing the heads and flooding the refueling cavity. These mitigation steps will be initiated a minimum of three days prior to the predicted arrival of a flood of elevation 594.5 feet or greater, and both units will be shut down and decay heat will be removed using the normal procedures as specified for the RHR system. Quad Cities Station utilizes a 96-hour warning time per procedure, QCOA 0010-16, Flood Emergency Procedure, in which plant actions are taken in response to a Design Basis River Flood prior to flood waters reaching plant grade. The UFSAR flood mitigation timeline was time validated during the NRC On-site Flooding Walkdown Audit (July 9-11, 2013), and this timeline validation is described in the NRC

	detensioners.	Flooding Walkdown Audit Report of February 21, 2014. Reliability of offsite power to perform flood mitigation actions for a design basis flood: Quad Cities Station has 5 diverse overhead 345KV Lines that are connected to the station switchyard as part of a "Ring Bus" configuration. The Lines are designated as Line 0401, 0402, 0403, 0404, 0405, respectively, and originate from diverse locations geographically both to the East in Illinois as well as to the West in Iowa. Additionally, there are two independent Reserve Aux Transformers connected to the Ring Bus, designated as T-12 and T-22, which provide the normal source of power for the Division 1 4KV and 480VAC electrical distribution systems and are capable of providing power for the entire on-site AC Electrical Distribution System via fast transfer in the case of a Main Generator trip event. Given this switchyard configuration it would require a Grid Event that simultaneously de-energized all 5 overhead 345KV Lines, or a simultaneous failure of both T-12 and T-22 in order for there to be a complete loss of offsite power to the station AC Electrical Distribution System. Based on this, a Mississippi River flooding event that originates upstream of Quad Cities Station does not present the threat of causing a complete loss of offsite power to Quad Cities Station during the 96-hour warning time (QCOA 0010-16, Flood Emergency Procedure) in which plant actions are taken in response to a Design Basis River Flood prior to flood waters reaching plant grade. Availability of backup power supplies: Backup on-site power supplies capable of powering the reactor building overhead crane (OHC) and stud detensioners can be provided by use of AC power from the station Emergency Diesel Generators (3 total), and SBOs (2 total). Furthermore portable FLEX generators are also capable of powering the OHC and stud detensioners. Availability of critical equipment such as the crane for head removal: During the NRC Flooding Walkdown Audit at Quad Cities (Exit on July 11, 2013), an observation was noted that the reactor building overhead crane is a single point vulnerability. The NRC requested how reliability of the reactor building overhead crane is assured. In that Audit the following response was provided: The site reviewed the available crane performance metrics. Based on a review of the system health report and crane performance over the past three years, the crane was determined to be a very reliable piece of equipment with all applicable system health windows being green. While reviewing the performance metrics, the restricted mode limit

		switches were one single point vulnerability identified where the station decided that a contingency work-order was warranted to help assure the capability to promptly repair the crane if required in the flooding event. Availability of critical equipment such as stud detensioners:. The Station maintains at all times on the refuel floor four (4) reactor head detensioners for reactor head disassembly used in refueling outages. Spare detensioners are available from other Exelon sites which are within a 2 to 4 hours driving distance. Current Industry efforts concerning FLEX mitigation during flooding scenarios: The planned Rev. 1 to NEI 12-06 will add Appendix G, Mitigating Strategies Flood Hazard Information (MSFHI). The planned Appendix G contains options for a "targeted mitigation strategy," for coping with floods. As such, Quad Cities plans to follow the industry efforts in the development and implementation of Appendix G; this will support any future changes to mitigating a FLEX/ELAP event during a design basis river flood scenario. In addition, Rev. 1 to NEI 12-06 will add Appendix E, Validation. This Appendix will modify the validation process to include flooding actions validation. This will also include validation of actions that need to be performed during the flood warning time period. As such, Quad Cities plans to follow the industry efforts in the development and implementation of Appendix E; this will support any future changes to the flooding timeline, warning time, and any time constraints.
SE 10-E	Final robust FLEX building configuration - Current plan using one robust building with N equipment and one commercial building with the +1 equipment is an Alternate Strategy approach to NEI Guidelines NEI 12-06.	Complete this update See Section 4, Changes to Compliance Method, Change 2 - Storage, Maintenance and Testing Alternate Approach

NOTE: The status of all of ISE Open and Confirmatory items are updated in this Six-Month Update based on information contained in the Quad Cities NRC FLEX Audit of January 29, 2015, and its associated Report (Reference 16)

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. Quad Cites 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.
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. NRC Order EA-13-109, "Issuance of Order to Modify Licenses with Regard to reliable Hardened Containment Vents Capable of Operation Under Severe Accident Conditions," dated June 6, 2013.
4. Quad Cities Nuclear Power Station, Units 1 and 2 First 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," dated August 28, 2013.
5. Quad Cites Nuclear Power Station's Request for Relaxation from NRC Order EA-12-049, "Order Modifying Licenses With Regard To Requirements for Mitigation Strategies for Beyond-Design-Basis External Events," dated February 27, 2014.
6. RCIC Pump and Turbine Durability Evaluation – Pinch Point Study, February 2013, 0000-0155-1545-RO, DRF 0000-0155-1541, Revision 0.
7. Quad Cities Nuclear Power Station, Units 1 and 2 – Interim Staff Evaluation Relating to Overall Integrated Plan in Response to Order EA-12-049 (Mitigation Strategies) (TAC NOS.MF 1048 and MF 1049), dated November 22, 2013.
8. Quad Cities Nuclear Power Station, Units 1 and 2 Second 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," dated February 28, 2014.
9. NRC Approval of Exelon/Quad Cities Request for Relaxation from NRC Order EA-12-049, dated April 15, 2014 (ADAMS Accession No. ML14071A531).
10. Quad Cities Nuclear Power Station, Units 1 and 2 Third 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," dated August 28, 2014.
11. Quad Cities MAAP Analysis to Support FLEX Initial Strategy, QC-MISC-013 Rev. 2, dated February 14, 2014.
12. Quad Cities Nuclear Power Station, Units 1 and 2 Fourth 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," dated February 27, 2015.
13. Quad Cites Nuclear Power Station's Request for Relaxation from NRC Order EA-12-049, "Order Modifying Licenses With Regard To Requirements for Mitigation Strategies for Beyond-Design-Basis External Events," dated March 4, 2015 (ADAMS Accession No. ML 15064A090).

14. Quad Cites Nuclear Power Station's Request for Relaxation from NRC Order EA-12-049, "Order Modifying Licenses With Regard To Requirements for Mitigation Strategies for Beyond-Design-Basis External Events," dated March 6, 2015 (ADAMS Accession No. ML 15068A064).
15. NRC Approval of Exelon/Quad Cities Unit 1 Request for Relaxation from NRC Order EA-12-049, dated March 11, 2015 (ADAMS Accession No. ML 15068A206).
16. NRC Report for the Onsite Audit regarding Implementation of Mitigating Strategies and Reliable Spent Fuel Pool Instrumentation related to Orders EA-12-049 and EA-12-51, dated June 25, 2015 (ADAMS Accession No. ML15156B134).

9 Attachments

1. Quad Cities Station Sequence of Events Timeline

Attachment 1

Quad Cities Station

Sequence of Events Timeline

Action item	Elapsed Time	Action	Time Constraint Y/N [1]	Remarks / Applicability
1	0	Event Starts.	NA	Plant at 100% power
2	0	Reactor Scram and SBO.	NA	Event Initiation
3	0 min	Group I isolation due to loss of power to instrumentation.	N	Loss of AC power causes Group 1 isolation due to loss of power to trip system [UFSAR 7.3.2.2]
4	~2 min	Operating crew enters applicable EOPs and abnormal procedures for LOOP. EOP entry conditions; Low Reactor water level and High Reactor pressure.	N	QGA 100 RPV Control QCOA 6100-03 Loss of Offsite Power
5	~2 min	RCIC Manually started and injects to restore level to normal operating band.	N	Reactor operator initiates or verifies initiation of reactor water level restoration with steam driven high pressure injection. [UFSAR Section 1.2.2.5] QGA 100 RPV Control QCOP 1300-02 RCIC System Manual Startup This is not time critical because if not completed automatic initiation will occur at the Low-Low level setpoint.
6	~2 min	ERV valves operation is monitored and manual operation initiated to control RPV pressure.	N	QGA 100 RPV Control QCOP 0203-01 Reactor Pressure Control Using Manual Relief Valve Actuation. Not time critical as automatic cycling of ERVs is controlling RPV pressure and manual control stabilizes system operation but does not impact key function control.

[1] Instructions: Provide justification in the remark column if No or NA is selected for Time Constraint. If YES, include technical basis discussion as required by NEI 12-06, Section 3.2.1.7

Action item	Elapsed Time	Action	Time Constraint Y/N [1]	Remarks / Applicability
7	~5 mins	Attempt to manually start emergency diesel generators (U1, U2 and 1/2), and enter SBO procedure.	N	QCOA 6100-03 Loss of Offsite Power. No success will occur from this action. QCOA 6100-04, Station Blackout
8	~5 mins	DC load shedding initiated per QCOA 6100-03.	N	QOA 6900-07 Loss of AC Power to the 125 VDC Battery Charger with Simultaneous Loss of Auxiliary Electric Power. Initiation of load shedding is not time critical – completion of load shedding is time critical.
9	~5 mins	Reactor Operator control RPV level with RCIC.	N	QGA 100, RPV Control QCOP 1300-02 This action controls the system operation to maintain parameters within the EOP specified band and is not time critical as system operation will continue without this action.
10	10 mins	Commence RPV depressurization using ERVs at less than or equal to 80 deg F per hour.	N	QCOP 0203-01 Not time critical as initiation of depressurization controls the RPV pressure prior to EOP directed operation due to HCTL of suppression chamber temperature requiring an emergency depressurization.
11	30 mins	DC load shedding completed.	Y	QOA 6900-07
12	30 mins	Defeat RCIC Low Pressure Isolation Logic.	N	Not time critical since RPV depressurization will be stopped prior to the RCIC Low Pressure Isolation setpoint per QGA 100 (in accordance with EPG Rev 3). QCOP 1300-10
13	~60 mins	Control Room crew has assessed SBO and plant conditions and declares an Extended Loss of AC Power (ELAP) event.	Y	Time sensitive in that decision drives timeline for setup of FLEX equipment and early venting. QCOA 6100-04

Action item	Elapsed Time	Action	Time Constraint Y/N [1]	Remarks / Applicability
14	~60 mins	Equipment Operators dispatched to begin setup/connection of FLEX equipment (480VAC generators to power battery chargers and FLEX pump), and commence FLEX DC load shed.	Y	QCOP 0050-01, 02 QCOP 0050-05, 07 DC coping analysis shows the following DC battery capabilities: 125 VDC / 10 hrs 250 VDC / 9 hrs
15	90 mins	FLEX DC load shed complete.	Y	DC coping analysis assumes FLEX load shed is complete by 90 minutes. Therefore, this action is time critical.
16	2 hours	Defeat RCIC High area temperature isolations.	Y	QCOP 1300-10. This action is critical at 8.7 hours when RCIC room temperature reaches 150°F, per Gothic analysis. The RCIC room temperature does not reach 180F in the first 72 hours.
17	5 hrs	480VAC FLEX generators connected to the Safety Related Busses. This supplies battery chargers for 125VDC (Div. 1 and 2) and 250VDC buses.	Y	Restore AC power to battery chargers prior to loss of each battery at: 125 VDC / 10 hrs 250 VDC / 9 hrs
18	5 hrs	FLEX pumps connected and alignment for suppression pool injection established.	N	QCOP 0050-06 This action becomes time critical when early containment venting is initiated.
19	~5.3 hrs	Initiate early containment venting strategy at a Containment pressure of 10 psig. Open the Reliable Hardened Containment Vent from the wetwell to maintain suppression pool temperatures less than ~230 deg F to support long term RCIC operation.	Y	QGA 200, Primary Containment Control (EPG Rev 3) ~5.3 hrs is projected via MAAP analysis as when Containment pressure reaches 10 psig.

Action item	Elapsed Time	Action	Time Constraint Y/N [1]	Remarks / Applicability
20	~5.5 hrs	Heat Capacity Temperature Limit (HCTL) curve projected to be exceeded via MAAP analysis, RPV blowdown to ~200 psig required. RPV pressure now maintained 150-250 psig range to support RCIC operation.	Y	QGA 200 (EPG Rev 3) RPV blowdown stops at ~200 psig in RPV to preserve RCIC operation.
21	~5.5 hrs	FLEX pumps connected and alignment for RPV injection established.	N	QCOP 0050-06 RPV blowdown is completed and RCIC is shut down.
22	12 hrs	Begin makeup to SFP with the FLEX pump to maintain level above top of fuel.	Y	QCOP 0050-06 QGA 300, Secondary Containment Control (EPG Rev 3) The worst case SFP heat load scenario shows a time-to-boil of 13.5 hours. The time to reach top of fuel is 147 hours.
23	24 hrs	Initial equipment from National SAFER Response Center becomes available.	N	Per NEI 12-06, Section 12 (NSRC).
24	24 -72 hrs	Continue to maintain critical functions of core cooling (via FLEX pump injection), containment control, and SFP cooling (FLEX pump injection to SFP). Utilize initial NSRC equipment in spare capacity.	N	Not time critical/sensitive since Phase 2 actions result in indefinite coping times for all safety functions.