Exelon Generation

Order No. EA-12-049

RS-13-025

February 28, 2013

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: 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)

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

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 requires submission of an Overall Integrated Plan by February 28, 2013. The NRC Interim Staff Guidance (ISG) (Reference 2) was issued August 29, 2012 which endorses industry guidance document NEI 12-06, Revision 0 (Reference 3) with clarifications and exceptions identified in Reference 2. Reference 3 provides direction regarding the content of this Overall Integrated Plan.

Reference 4 provided the EGC initial status report regarding mitigation strategies, as required by Reference 1.

The purpose of this letter is to provide the Overall Integrated Plan pursuant to Section IV, Condition C.1, of Reference 1. This letter confirms EGC has received Reference 2 and has an Overall Integrated Plan developed in accordance with the guidance for defining and deploying strategies that will enhance the ability to cope with conditions resulting from beyond-design-basis external events.

The information in the enclosure provides the Quad Cities Nuclear Power Station, Units 1 and 2 Overall Integrated Plan for mitigation strategies pursuant to Reference 3. The enclosed Integrated Plan is based on conceptual design information. Final design details and associated procedure guidance, as well as any revisions to the information contained in the Enclosure, will be provided in the 6-month Integrated Plan updates required by Reference 1.

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 February 2013.

Respectfully submitted,

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Director - Licensing & Regulatory Affairs
Exelon Generation Company, LLC

Enclosure:

1. Quad Cities Nuclear Power Station, Units 1 and 2 Mitigation Strategies (MS) Overall Integrated Plan

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Enclosure 1

Quad Cities Nuclear Power Station, Units 1 and 2

Mitigation Strategies (MS)

Overall Integrated Plan

(62 pages)

General Integrated Plan Elements BWR	
Site: Quad Cities Nuclear Power Station (QCNPS)	
Determine Applicable Extreme External Hazard **Ref: NEI 12-06 section 4.0 -9.0** **JLD-ISG-2012-01 section 1.0**	*Input the hazards applicable to the site; seismic, external flood, high winds, snow, ice, cold, high temps.* *Describe how NEI 12-06 sections 5 – 9 were applied and the basis for why the plant screened out for certain hazards.* Seismic events; external flooding; severe storms with high winds; snow, ice and extreme cold; and high temperatures were determined to be applicable Extreme External Hazards for Quad Cities Nuclear Power Station, per the guidance of NEI 12-06. **Seismic Hazard Assessment:** Per the Updated Final Safety Analysis Report (UFSAR) (Reference 1) Section 3.7, the seismic criteria (Safe Shutdown Earthquake) for Quad Cities Nuclear Power Station (QCNPS) is 0.24 g horizontal ground motion with a simultaneous vertical acceleration of 0.16 g. These values constitute the design basis of QCNPS. Per Reference 2, all sites will consider the seismic hazard. Thus the Quad Cities site screens in for an assessment for seismic hazard. **External Flood Hazard Assessment:** Per Quad Cities UFSAR (Reference 1, Section 3.4.1), the maximum flood elevation is 603'-0" at the site. This is above the grade elevation (594-6"). The maximum flood elevation is a rising river level event. Therefore, time is available to relocate equipment and stage necessary measures to support plant response to rising water levels. In accordance with NEI 12-06 section 6.2.1, Susceptibility to External Flooding, Quad Cities screens in for an assessment for external flood hazard. **Severe Storms with High Winds Hazard Assessment:** Per NEI 12-06 (Reference 2, Figure 7-2), Quad Cities is located in Region 1 (specifically, 41° 43' 46" north latitude and 90° 18' 40.2" west longitude) with respect to tornado probability. Thus, QCNPS screens in for an assessment for High Wind Hazard.

	Snow, Ice and Extreme Cold Hazard Assessment: QCNPS is located at 41° 43' 46" north latitude and 90° 18' 40.2" west longitude. The guidelines provided in NEI 12-06 section 8.2.1 generally include the need to consider extreme snowfall at plant sites above the 35th parallel, which includes the Quad Cities site. The Quad Cities site is located within the region characterized by EPRI as ice severity level 5 (NEI 12-06, Figure 8-2, Maximum Ice Storm Severity Maps). Consequently, the Quad Cities site is subject to severe icing conditions that could also cause catastrophic destruction to electrical transmission lines. Thus, the Quad Cities site screens in for an assessment for snow, ice, and extreme cold hazard. **High Temperatures Hazard Assessment:** The guidelines provided in NEI 12-06 (Reference 2, Section 9.2) include the need to consider high temperature at all plant sites in the lower 48 states. Extreme high temperatures are not expected to impact the utilization of off-site resources or the ability of personnel to implement the required FLEX strategies. Site industrial safety procedures currently address activities with a potential for heat stress to prevent adverse impacts on personnel. Thus, QCNPS screens in for an assessment for extreme High Temperature. References: 1) QCNPS UFSAR, Revision 11, October 2011 2) Diverse and Flexible Coping Strategies (FLEX) Implementation Guide, NEI 12-06, Revision 0, August 2012
Key Site assumptions to implement NEI 12-06 strategies. **Ref: NEI 12-06 section 3.2.1**	*Provide key assumptions associated with implementation of FLEX Strategies:* • Flood and seismic re-evaluations pursuant to the 10 CFR 50.54(f) letter of March 12, 2012 are not completed and therefore not assumed in this submittal. As the re-evaluations are completed, appropriate issues will be entered into the corrective action system and addressed on a schedule commensurate with other licensing bases changes. • Additional staff resources are assumed to begin arriving at hour 6 and fully staffed by 24 hours.

	• Plant initial response is the same as SBO. • No additional single failures of any SSC are assumed (beyond the initial failures that define the ELAP (Extended Loss of AC Power) / LUHS (Loss of Normal Access to the Ultimate Heat Sink) scenario in NEI 12-06). • Primary and secondary storage locations have not been selected. Once locations are finalized implementation routes will be defined. • Storage locations will be chosen in order to support the event timeline. • BWROG EOP Revision EPG/SAG Rev.3, containing items such as guidance to allow early venting and to maintain steam driven injection equipment available during emergency depressurization, is approved and implemented in time to support compliance date. • DC battery banks are available. AC and DC distribution systems are available. • Maximum environmental room temperatures for habitability or equipment availability are based on NUMARC 87-00 (Reference 2) guidance if other design basis information or industry guidance is not available. • This plan defines strategies capable of mitigating a simultaneous loss of all alternating current (ac) power and loss of normal access to the ultimate heat sink resulting from a beyond-design-basis event by providing adequate capability to maintain or restore core cooling, containment, and SFP cooling capabilities at all units on a site. Though specific strategies are being developed, due to the inability to anticipate all possible scenarios, the strategies are also diverse and flexible to encompass a wide range of possible conditions. These pre-planned strategies developed to protect the public health and safety will be incorporated into the unit emergency operating procedures in accordance with established EOP change processes, and their impact to the design basis capabilities of the unit evaluated under 10 CFR 50.59. The plant Technical Specifications contain the limiting conditions for normal unit operations to ensure that design safety features are available to respond to a design basis accident and direct the required actions to be taken when the limiting conditions are not met. The result of

	the beyond-design-basis event may place the plant in a condition where it cannot comply with certain Technical Specifications, and, as such, may warrant invocation of 10 CFR 50.54(x) and/or 10 CFR 73.55(p). References 1. Diverse and Flexible Coping Strategies (FLEX) Implementation Guide, NEI 12-06, Revision 0, August 2012 2. NUMARC 87-00, Revision 1, Guidelines and Technical Bases for NUMARC Initiatives Addressing Station Blackout at Light Water Reactors
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. **Ref: JLD-ISG-2012-01 NEI 12-06 13.1**	*Include a description of any alternatives to the guidance, and provide a milestone schedule of planned action.* Full conformance with JLD-ISG-2012-01 and NEI 12-06 is expected with no deviations.
Provide a sequence of events and identify any time constraint required for success including the technical basis for the time constraint. **Ref: NEI 12-06 section 3.2.1.7 JLD-ISG-2012-01 section 2.1**	*Strategies that have a time constraint to be successful should be identified with a technical basis and a justification provided that the time can reasonably be met (for example, a walk through of deployment).* *Describe in detail in this section the technical basis for the time constraint identified on the sequence of events timeline Attachment 1A* See Attachment 1A for sequence of events timeline. The times to complete actions in the Events Timeline are based on operating judgment, the conceptual designs, and the current supporting analyses. The final timeline will be time validated once detailed designs are completed and procedures are developed, and the results will be provided in a future six-month update. 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. Time Constraints Timeline item 11: 30 minutes, 125 VDC load shed complete - DC buses are readily available for operator access and breakers and governing procedures identify which breakers are required to be opened to effect a load shed. From the time that ELAP conditions are declared, it is reasonable to expect that operators can complete the DC bus load shed in approximately 25 minutes. Required load shedding must be accomplished within 30 minutes of the loss of the 125 VDC chargers in order to maintain long term battery loading within the capacity of the battery. Battery voltage must be available for continued use of ERVs (Electromatic Relief Valves) for RPV (Reactor Pressure Vessel) pressure control and cooldown to 150-250 psig. Timeline item 13: 60 minutes, Entry into ELAP - Time critical at a time greater than 1 hour. Time period of 1 hour is selected conservatively to ensure that ELAP entry conditions can be verified by control room staff and it is validated that emergency diesel generators (EDGs) are not available. One hour is a reasonable assumption for system operators to perform initial evaluation of the EDGs. Entry into ELAP provides guidance to operators to perform ELAP actions. Timeline item 15: 2 hours. Per preliminary GOTHIC Analysis, RCIC (Reactor Core Isolation Cooling) Room temperature reaches 150° at ~8 hours. This drives the actions to bypass the RCIC Room High Temperature Isolation Signal (bypassing RCIC High Temperature Isolation Signal is a simple activity, i.e., installation of four relay contact blocks). Timeline item 16: 3.7 hours. Based on preliminary MAAP (Modular Accident Analysis Program) Runs (and assuming early containment venting): Initiate use of Order EA-12-050 Reliable Hardened Containment Vent System (HCVS) per EOPs to maintain containment parameters below design limits and within the limits that allow continued use of RCIC. This early venting of the containment will be initiated such that peak Suppression Pool temperature remains below the maximum allowed for RCIC operation. BWROG RCIC System Operation in Prolonged Station

	Blackout – Feasibility Study (Reference 1) indicates that RCIC will remain functional as long as Suppression Pool temperature can be maintained less than approximately 230° F. The preliminary MAAP analysis performed for strategy development indicated a maximum Suppression Pool temperature of 222° F. 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. Timeline item 17: 4 hours, Reenergize both divisions of station 125 VDC and the 250 VDC battery chargers using a FLEX 480 VAC DG to supply power to both divisions of emergency 480 VAC. – Time critical after 7 hours. Battery durations have been preliminarily evaluated to last at least 7 hours. Alignment of FLEX DG will begin at approximately 1 hour. Three hours later the FLEX DG will be in service. Thus, within 4 hours the FLEX DGs can be in service to supply power to both divisions of Class 1E emergency 480 VAC. Timeline item 18: 4 hours, Transition from Phase 1 to Phase 2 for Containment Control and backup level control function by placing FLEX pumps in service to make up to the Suppression Chamber or Reactor Vessel – Based on preliminary MAAP analysis, this is time critical after ~40 hours, based on Suppression Pool level. Staging of the FLEX pumps will begin at approximately 1 hour. Three hours later the FLEX pumps will be in service (previously validated for B.5.b). Timeline item 19: ~4.6 hours, Reactor pressure control to keep from entering Unsafe Region of HCTL Curve - Using manual control of ERVs, initiate RPV blowdown in accordance with EOPs (to approximately 150 – 250 psig) to keep in the Safe Region of the HCTL curve. Time critical at the point of entering the Unsafe Region of the HCTL Curve. Timeline item 20: 7 hours. Per preliminary GOTHIC Analysis, RCIC (Reactor Core Isolation Cooling) Room temperature reaches 150° at ~8 hours. This drives the actions to provide alternate cooling to the RCIC Room.

	Timeline item 21: 12 hours. Spent Fuel Pool (SFP) makeup is not a time constraint with the initial condition of Mode 1 at 100% power, since the worst case fuel pool heat load conditions only exist during a refueling outage. Under non-outage conditions, the maximum SFP heat load is 20.6 MBTU/hr. Loss of SFP cooling with this heat load and an initial SFP temperature of 150 degrees F results in a time to boil of 14.4 hours, and 159.26 hours to the top of fuel. Therefore, completing the equipment line-up for initiating SFP makeup at 12 hours into the event ensures adequate cooling of the spent fuel is maintained. The worst case SFP heat load during an outage is 48.9 MBTU/hr. Loss of SFP cooling with this heat load and an initial SFP temperature of 150 degrees F results in a time to boil of 6.09 hours, and 67.09 hours to the top of fuel. With the entire core being located in the SFP, manpower resources normally allocated to aligning core cooling along with the Operations outage shift manpower can be allocated to aligning SFP makeup which ensures the system alignment can be established within 8 hours. Initiation at 8 hours into the event ensures adequate cooling of the spent fuel is maintained. 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 six-month update. <u>References:</u> 1. GE Task Report 0000-0143-0382-R1, RCIC System Operation in Prolonged Station Blackout – Feasibility Study, March 2012
Identify how strategies will be deployed in all modes. **Ref: NEI 12-06 section 13.1.6**	*Describe how the strategies will be deployed in all modes.* Deployment of FLEX is expected for all modes of operation. Transportation routes will be developed from the equipment storage area to the FLEX staging areas. An administrative program will be developed to ensure pathways remain clear or compensatory actions will be implemented to ensure all strategies can be deployed during all modes of operation. This administrative program will also ensure the strategies can be implemented in all modes by maintaining the portable FLEX equipment available to be deployed during all modes.

	Identification of storage and creation of the administrative program are open items. Closure of these items will be documented in a six-month update.

Provide a milestone schedule. This schedule should include:
• **Modifications timeline**
  o **Phase 1 Modifications**
  o **Phase 2 Modifications**
  o **Phase 3 Modifications**
• **Procedure guidance development complete**
  o **Strategies**
  o **Maintenance**
• **Storage plan (reasonable protection)**
• **Staffing analysis completion**
• **FLEX equipment acquisition timeline**
• **Training completion for the strategies**
• **Regional Response Centers operational**
 	
Ref: NEI 12-06 section 13.1
	The dates specifically required by the order are obligated or committed dates. Other dates are planned dates subject to change. Updates will be provided in the periodic (six month) status reports.
	
	See attached milestone schedule (Attachment 2).
	
	Exelon Generation Company, LLC (Exelon) fully expects to meet the site implementation / compliance dates provided in Order EA-12-049 with no exceptions. Any changes or additions to the plan interim milestone dates will be provided in a future six-month update.

Identify how the programmatic controls will be met. **Ref: NEI 12-06 section 11** **JLD-ISG-2012-01 section 6.0**	*Provide a description of the programmatic controls equipment protection, storage and deployment and equipment quality. See section 11 in NEI 12-06. Storage of equipment, 11.3, will be documented in later sections of this template and need not be included in this section.* *See section 6.0 of JLD-ISG-2012-01.* Quad Cities Nuclear Power Station will implement an administrative program for FLEX to establish responsibilities, and testing and maintenance requirements. A plant system designation will be assigned to FLEX equipment which requires configuration controls associated with systems. This will establish responsibilities, maintenance and testing requirements for all components associated with FLEX. Unique identification numbers will

	be assigned to all components added to the FLEX plant system. Equipment associated with these strategies will be procured as commercial equipment with design, storage, maintenance, testing, and configuration control as outlined in JLD-ISG-2012-01 section 6 and NEI 12-06 section 11. Installed structures, systems and components pursuant to 10CFR50.63(a) will continue to meet the augmented quality guidelines of Regulatory Guide 1.155, Station Blackout. Standard industry PMs (Preventative Maintenance) will be developed to establish maintenance and testing frequencies based on type of equipment and will be within EPRI guidelines. Testing procedures will be developed based on the industry PM templates and Exelon standards.
Describe training plan	*List training plans for affected organizations or describe the plan for training development.* Training materials for FLEX will be developed for all station staff involved in implementing FLEX strategies. For accredited training programs, the Systematic Approach to Training, SAT, will be used to determine training needs. For other station staff, a training overview will be developed per change management plan.
Describe Regional Response Center plan	Quad Cities Nuclear Power Station (QCNPS) has contractual agreements in place with the Strategic Alliance for FLEX Emergency Response (SAFER). The industry will establish two (2) Regional Response Centers (RRC) to support utilities during beyond design basis events. Each RRC will hold five (5) sets of equipment, four (4) of which will be able to be fully deployed when requested. The fifth set will have equipment in a maintenance cycle. Equipment will be moved from an RRC to a local Assembly Area, established by the SAFER team and the utility. Communications will be established between the affected nuclear site and the SAFER team and required equipment moved to the site as needed. First arriving equipment, as established during development of the nuclear site's playbook, will be delivered to the site within 24 hours from the initial request.
Notes: Exelon Generation Company, LLC (Exelon) has not finalized the engineering designs for compliance with NRC Order EA-12-049. 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 six-	

month update. This update will include any changes to the initial designs as submitted in this Integrated Plan.

Maintain Core Cooling

Determine Baseline coping capability with installed coping[1] modifications not including FLEX modifications, utilizing methods described in Table 3-1 of NEI 12-06:

- **RCIC/HPCI/IC**
- **Depressurize RPV for injection with portable injection source**
- **Sustained water source**

BWR Installed Equipment Phase 1:

Provide a general description of the coping strategies using installed equipment including modifications that are proposed to maintain core cooling. Identify methods (RCIC/HPCI/IC) and strategy(ies) utilized to achieve this coping time.

At the initiation of the event the operators will enter the QGAs (Quad Cities General Abnormal procedures) and QCOA 6100-03 (Loss of Offsite Power). The Flex Support Guidelines will be entered when there has been a determination that there has been a loss of all AC power (i.e., Emergency Diesel Generators, Station Blackout Diesel Generators and Reserve Auxiliary Transformers), with confirmation of no imminent return of any of these power sources to service.

Power Operations , Startup, and Hot Shutdown

Reactor Water Level Control

Initial reactor water level control would be accomplished using the RCIC System, which is independent of all AC power. HPCI (High Pressure Coolant Injection) would also initially be available to make the initial reactor water level recovery if required. Normal suction source for RCIC is the Contaminated Condensate Storage Tanks (CCSTs). Operation of the RCIC Turbine will result in a heat input to the Suppression Pool. There is no current method to remove heat from the Suppression Pool when AC power is not available. The CCSTs are not qualified for flood, seismic events and tornado/high winds. If the CCSTs are unavailable, RCIC suction will transfer automatically, or can be transferred manually, to the Suppression Pool. RCIC can be operated locally without dependence on DC power.

With continuous RCIC operation, preliminary MAAP analysis indicates Suppression Pool temperature reaches 230°F approximately 9 hours after event initiation. Preliminary MAAP analysis also indicates that with initiation of early venting of primary containment, the Suppression Pool temperature can be maintained at or below 230°F. A BWROG review of RCIC operation with elevated suction temperatures was conducted by GE Hitachi (Reference 1) following the events at Fukushima-Daiichi. The review indicated RCIC could continue to operate up to approximately 230°F suction temperature.

[1] Coping modifications consist of modifications installed to increase initial coping time, i.e., generators to preserve vital instruments or increase operating time on battery powered equipment.

Pressure Control

Initial pressure control would be accomplished using the Electromatic Relief Valves (ERVs). The ERVs would open as required (setpoints are 1115 and 1135 psig) to control RPV pressure. The valves would then be controlled manually to control pressure, with initiation of reactor depressurization occurring at ~10 minutes. The depressurization would be at less then 80 degrees per hour. The ERVs discharge to the Suppression Pool.

Venting of the containment will be initiated such that peak Suppression Pool temperature remains below the maximum allowed for RCIC operation. RCIC System Operation in Prolonged Station Blackout – Feasibility Study (Reference 1) indicates that RCIC will remain functional as long as Suppression Pool temperature can be maintained less than approximately 230° F. The preliminary MAAP analysis performed for strategy development indicated a maximum Suppression Pool temperature of 222° F. The Reliable Hardened Containment Vent (Order EA-12-050) would be actuated when drywell pressure reaches 25 psia, ensuring that Suppression Pool temperature stays below 230°F.

Operation of the RCIC System removes heat from the RPV. This heat removal will also be used to maintain RPV pressure. Operation of the RCIC turbine will result in a heat input to the Suppression Pool.

Overall Response

Preliminary MAAP analysis was utilized to evaluate overall response of installed systems per the system utilization described above. With RCIC injecting to the RPV, RCIC and ERVs controlling RPV pressure by rejecting steam to the Suppression Pool, and the Reliable Hardened Containment Vent actuated to ensure the Suppression Pool temperature stays below 230 °F, the level in the suppression pool would reach 11 feet (required level of RCIC NPSH) at 40 hours.

Although preliminary analysis shows that station 125 and 250 volt batteries would be lost at 7 hours, RCIC can be operated locally without DC power. In addition, local indication of RPV level and pressure that does not require power is available at the RCIC pump. Therefore, although ERV actuation would be lost at 7 hours, RCIC would continue to remove decay heat to the Suppression Pool and to provide Suppression Pool water to the RPV. The Reliable Hardened Containment Vent has a dedicated power supply.

Cold Shutdown and Refueling

When in Cold Shutdown and Refueling, many variables exist which impact the ability to cool the core. In the event of an ELAP during these Modes, installed plant systems cannot be relied upon to cool the core; thus, transition to Phase 2 will begin immediately. All efforts will be made to expeditiously provide core cooling and minimize heat-up and re-pressurization. Exelon has a program in place (Reference 2) to determine the time to boil for all conditions during shutdown periods. This time will be used to determine the time required to complete transition to Phase 2.

To accommodate the activities of vessel disassembly and refueling, water levels in the reactor vessel and the reactor cavity are often changed. The most limiting condition is the case in which the reactor head is removed and water level in the vessel is at or below the reactor vessel flange. If

an ELAP/LUHS occurs during this condition then (depending on the time after shutdown) boiling in the core may occur quite rapidly. Deploying and implementing portable FLEX pumps to supply injection flow must commence immediately from the time of the event. This should be plausible because more personnel are on site during outages to provide the necessary resources. Strategies for makeup water include deploying a FLEX pump to take suction from the Discharge Bay as described in the Phase 2 Core Cooling section. Guidance will be provided to ensure that sufficient area is available for deployment and that haul paths remain accessible without interference from outage equipment during refueling outages.

Analysis will be performed during development of the detailed design to validate that the plant modifications, selected equipment, and identified mitigating strategy can satisfy the safety function requirements of NEI 12-06. The results of this analysis will be provided during a scheduled six-month update. This update will include any changes to the initial designs and/or strategies as submitted in this Integrated Plan.

References:

1. GE Task Report 0000-0143-0382-R1, RCIC System Operation in Prolonged Station Blackout – Feasibility Study, March 2012
2. OU-AA-103, Shutdown Safety Management Program

Details:	
Provide a brief description of Procedures / Strategies / Guidelines	*Confirm that procedure/guidance exists or will be developed to support implementation.* QGA 100, RPV Control, provides direction to use RCIC and ERVs. Quad Cities Nuclear Power Station will use the industry developed guidance from the Owners Groups, EPRI and NEI Task team to develop site specific procedures or guidelines to address the criteria in NEI 12-06. These procedures and/or guidelines will support the existing symptom based command and control strategies in the current EOPs.
Identify modifications	No modifications are currently planned for Phase 1 Core Cooling.
Key Reactor Parameters	*List instrumentation credited for this coping evaluation.* **Reactor Water Level** 1(2)-0263-100A 1(2)-0263-100B 1(2)-0263-106A 1(2)-0263-106B 1(2)-0640-27

	Reactor Pressure 1(2)-0640-25A 1(2)-0640-25B 1(2)-0640-27 1(2)-1340-6 Quad Cities' evaluation of the FLEX strategy may identify additional parameters that are needed in order to support key actions identified in the plant procedures/guidance or to indicate imminent or actual core damage (NEI 12-06, Rev. 0, Section 3.2.1.10). Any differences will be communicated in a future six-month update following identification.

Notes:
Exelon Generation Company, LLC (Exelon) has not finalized the engineering designs for compliance with NRC Order EA-12-049. 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 six-month update. This update will include any changes to the initial designs as submitted in this Integrated Plan.

Maintain Core Cooling

BWR Portable Equipment Phase 2:

Provide a general description of the coping strategies using on-site portable equipment including modifications that are proposed to maintain core cooling. Identify methods (RCIC/HPCI/IC) and strategy(ies) utilized to achieve this coping time.

Quad Cities-specific inputs and the MAAP 4.0.5 computer code were used to calculate plant response to several scenarios to analyze this event.

To support continued RCIC operation, station personnel will line up portable equipment to supply makeup to the Suppression Pool and to reenergize the 125V and 250V DC Battery Chargers.

At the point that RCIC becomes unavailable, the FLEX pump will supply core cooling.

RPV Pressure Control

Quad Cities will use portable equipment to provide makeup to the Suppression Pool prior to the loss of NPSH to RCIC. Suppression Pool makeup will be established using portable pumps, with the pump suction from the Discharge Bay. Pump discharge will be directed through fire hoses routed from the area near the Discharge Bay either through the Turbine Building and Reactor Building or around the Protected Area access road to the east side of the Reactor Building and in through the ½ Trackway. At this location the hose can be connected to one of two proposed locations on each unit.

1. The first is a Storz connection on the "A" loop of RHR system piping between the inboard and outboard isolation valves for Drywell (DW) sprays. This connection is located on the northeast side of the DW at ground level (595'), and provides access to either the RPV or the Suppression Pool through installed RHR piping and AC-powered MOVs. Installation of the portable 480 VAC FLEX generator will allow manipulation of the necessary RHR valves.

2. The second is a Storz connection, to be installed on a currently existing blind flange, on the "B" loop of RHR system piping between the inboard and outboard isolation valves for DW sprays. The connection is located on the southeast side of the DW on the second floor (623'). This connection requires the hose to be run up the stairwell at the ½ Trackway. This connection also provides access to either the RPV or the Suppression Pool through installed RHR piping. Additional connection points will be evaluated in the detailed design process.

Connection of a FLEX pump via a hose to one of the proposed quick hose connections allows water from the Discharge Bay to be supplied directly to the Suppression Pool or to the RPV.

These connection points are in diverse locations, and the connection points and piping are qualified for the five BDBEEs that must be considered for implementation of FLEX. Additionally, these connections allow supplying both Unit 1 and Unit 2 simultaneously.

A portable 480 VAC diesel-powered FLEX generator will be connected to the safety-related AC distribution system at the 480 VAC level.

Maintain Core Cooling

BWR Portable Equipment Phase 2:

ERVs are also available to lower RPV pressure.

RPV Makeup

The primary injection method to the RPV is RCIC, whose primary water source is the Contaminated Condensate Storage Tank (CCST). When the CCST is unavailable, RCIC switches suction to the Suppression Pool. Eventually, increased Suppression Pool temperature or decreased Suppression Pool level can render the Suppression Pool unavailable as an RCIC suction source. Additionally, reactor pressure (i.e., decay heat) may become insufficient to drive the RCIC turbine. Therefore, an alternate makeup water source is required.

The alternate makeup water source for direct RPV injection involves using a FLEX pump and water from the Discharge Bay. The FLEX pump will take suction from the Discharge Bay. Pump discharge will be directed through fire hoses routed from the area near the Discharge Bay either through the turbine building and reactor building or around the Protected Area access road to the east side of the Reactor Building and in through the ½ Trackway. At this location the hose can be connected to one of the two proposed locations discussed above under RPV Pressure Control.

RCIC will continue to maintain RPV inventory and pressure control.

ERVs will continue to be available for RPV pressure control.

The FLEX pump(s) will continue to provide makeup to the Suppression Pool.

The FLEX pumps(s) will be available to provide makeup to the RPV in the event of loss of RCIC functionality.

It is expected that continued use of RCIC to provide makeup of RPV inventory, with the FLEX pump providing makeup to the Suppression Pool and available for injection into the RPV, will provide long-term core cooling without the need for offsite equipment.

Analysis will be performed during development of the detailed design to validate that the plant modifications, selected equipment, and identified mitigating strategy can satisfy the safety function requirements of NEI 12-06. The results of this analysis will be provided during a scheduled six-month update. This update will include any changes to the initial designs and/or strategies as submitted in this Integrated Plan.

References:

None

Maintain Core Cooling	
BWR Portable Equipment Phase 2:	
Details:	
Provide a brief description of Procedures / Strategies / Guidelines	*Confirm that procedure/guidance exists or will be developed to support implementation.* Quad Cities Nuclear Power Station will use the industry-developed guidance from the Owners Groups, EPRI and NEI Task team to develop site-specific procedures and/or guidelines to address the criteria in NEI 12-06. These procedures and/or guidelines will support the existing symptom-based command and control strategies in the current EOPs.
Identify modifications	*List modifications.* The location for the portable pump injection on the B division of RHR will be modified to a quick-disconnect (Storz fitting).
Key Reactor Parameters	*List instrumentation credited or recovered for this coping evaluation.* **Reactor Water Level** 1(2)-0263-100A 1(2)-0263-100B 1(2)-0263-106A 1(2)-0263-106B 1(2)-0640-27 1(2)-0263-113 **Reactor Pressure** 1(2)-0640-25A 1(2)-0640-25B 1(2)-0640-27 1(2)-1340-6 Quad Cities' evaluation of the FLEX strategy may identify additional parameters that are needed in order to support key actions identified in the plant procedures/guidance or to indicate imminent or actual core damage (NEI 12-06, Rev. 0, Section 3.2.1.10). Any differences will be communicated in a future six-month update following identification.
Storage / Protection of Equipment : **Describe storage / protection plan or schedule to determine storage requirements**	
Seismic	Structures to provide protection of FLEX equipment will be constructed to meet the requirements of NEI 12-06 Section 11. Schedule to construct permanent building is contained in Attachment 2, and will satisfy the site compliance date. Temporary locations will

Maintain Core Cooling	
BWR Portable Equipment Phase 2:	
	be used until building construction completion. 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.
Flooding Note: if stored below current flood level, then ensure procedures exist to move equipment prior to exceeding flood level	Structures to provide protection of FLEX equipment will be constructed to meet the requirements of NEI 12-06 Section 11. Schedule to construct permanent building is contained in Attachment 2, and will satisfy the site compliance date. Temporary locations will be used until building construction completion. 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. FLEX equipment can be stored below flood level at Quad Cities since sufficient warning time is available to relocate and/or deploy the equipment. Plant procedures/guidance will be developed to address the needed actions. FLEX equipment will be relocated to a position that is protected from the flood, either by barriers or by elevation, prior to the arrival of the potentially damaging flood levels. Both electrical and at least one mechanical FLEX connection locations will be above the flood plain.
Severe Storms with High Winds	Structures to provide protection of FLEX equipment will be constructed to meet the requirements of NEI 12-06 Section 11. Schedule to construct permanent building is contained in Attachment 2, and will satisfy the site compliance date. Temporary locations will be used until building construction completion. 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.
Snow, Ice, and Extreme Cold	Structures to provide protection of FLEX equipment will be constructed to meet the requirements of NEI 12-06 Section 11. Schedule to construct permanent building is contained in Attachment 2, and will satisfy the site compliance date. Temporary locations will be used until building construction completion. 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.
High Temperatures	Structures to provide protection of FLEX equipment will be constructed to meet the requirements of NEI 12-06 Section 11. Schedule to construct permanent building is contained in Attachment 2, and will satisfy the site compliance date. Temporary locations will be used until building construction completion. Procedures and programs will be developed to address storage structure requirements,

Maintain Core Cooling		
BWR Portable Equipment Phase 2:		
	haul path requirements, and FLEX equipment requirements relative to the external hazards applicable to Quad Cities.	
Deployment Conceptual Modification **(Attachment 3 contains Conceptual Sketches)**		
Strategy	**Modifications**	**Protection of connections**
Identify Strategy including how the equipment will be deployed to the point of use.	*Identify modifications*	*Identify how the connection is protected*
Storage location and structure have not been decided yet. The Flex Pumps will be brought to the area of the Discharge Bay. The suction of the pumps will be routed to the Discharge Bay; the discharge of the pumps will be routed to the RHR System of each unit. Water from the Discharge Bay will be injected into the RHR System. With injection being supplied to the RHR System, makeup to the Suppression Pool can begin when required, and makeup to the RPV will be available if necessary.	None.	The RHR connections are located inside the Reactor Building, which is a Safety Related, Seismic Class I structure.
Notes: Exelon Generation Company, LLC (Exelon) has not finalized the engineering designs for compliance with NRC Order EA-12-049. 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 six-month update. This update will include any changes to the initial designs as submitted in this Integrated Plan.		

Maintain Core Cooling	
BWR Portable Equipment Phase 3:	
Provide a general description of the coping strategies using phase 3 equipment including modifications that are proposed to maintain core cooling. Identify methods (RCIC/HPCI/IC)and strategy(ies) utilized to achieve this coping time. Phases 1 and 2 strategy will provide sufficient capability such that no additional Phase 3 strategies are required. Phase 3 equipment for Quad Cities Nuclear Power Station includes backup portable pumps and generators. The portable pumps will be capable of providing the necessary flow and pressure as outlined in Phase 2 response for Core Cooling and Heat Removal, RCS Inventory Control and Spent Fuel Pool Cooling. The portable generators will be capable of providing the necessary 480 volt power requirements as outlined in Phase 2 response for Safety Functions Support.	
Details:	
Provide a brief description of Procedures / Strategies / Guidelines	*Confirm that procedure/guidance exists or will be developed to support implementation.* Quad Cities Nuclear Power Station will use the industry developed guidance from the Owners Groups, EPRI and NEI Task team to develop site specific procedures or guidelines to address the criteria in NEI 12-06. These procedures and/or guidelines will support the existing symptom based command and control strategies in the current EOPs.
Identify modifications	*List modifications.* None.
Key Reactor Parameters	*List instrumentation credited or recovered for this coping evaluation.* Quad Cities' evaluation of the FLEX strategy may identify additional parameters that are needed in order to support key actions identified in the plant procedures/guidance or to indicate imminent or actual core damage (NEI 12-06, Rev. 0, Section 3.2.1.10). Any differences will be communicated in a future six-month update following identification.

Deployment Conceptual Modification **(Attachment 3 contains Conceptual Sketches)**		
Strategy	**Modifications**	**Protection of connections**
Identify Strategy including how the equipment will be deployed to the point of use.	*Identify modifications*	*Identify how the connection is protected*
None	None	None

Maintain Core Cooling
BWR Portable Equipment Phase 3:
Notes: Exelon Generation Company, LLC (Exelon) has not finalized the engineering designs for compliance with NRC Order EA-12-049. 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 six-month update. This update will include any changes to the initial designs as submitted in this Integrated Plan.

Maintain Containment

Determine Baseline coping capability with installed coping[2] modifications not including FLEX modifications, utilizing methods described in Table 3-1 of NEI 12-06:

- **Containment Venting or Alternate Heat Removal**
- **Hydrogen Igniters (Mark III containments only)**

BWR Installed Equipment Phase 1:

Provide a general description of the coping strategies using installed equipment including modifications that are proposed to maintain core cooling. Identify methods (containment vent or alternative / Hydrogen Igniters) and strategy(ies) utilized to achieve this coping time.

At the initiation of the event the operators will enter the QGAs (Quad Cities General Abnormal procedures) and QCOA 6100-03 (Loss of Offsite Power). The Flex Support Guidelines will be entered when it is determined that there has been a loss of all AC power (i.e., Emergency Diesel Generators, Station Blackout Diesel Generators and Reserve Auxiliary Transformers), with confirmation of no imminent return of any of these power sources to service.

Containment integrity is maintained by normal design features, such as the containment isolation valves. In accordance with NEI 12-06, the containment is assumed to be isolated following the event. The SBO event will cause the RPV to be isolated from the main condenser. Pressure in the RPV will be controlled by automatic and then manual actuation of the Electromatic Relief Valves (ERVs). ERV discharge is piped to the Suppression Pool, which will cause the containment, including the Suppression Pool to heat up and pressurize. Without AC power and without the use of containment venting, there is no current method to remove heat from the containment.

The strategy at Quad Cities for this BDBEE (Beyond Design Basis External Event) is to commence early containment venting at approximately four hours into the event. Venting containment will serve to limit containment pressure rise and Suppression Pool temperature rise, which will allow for long term operation of the RCIC System.

The containment design pressure is 56 psig (Reference 3). This pressure is not expected to be reached during the event as indicated by preliminary analysis, because Suppression Pool venting is initiated early on. Monitoring of Drywell pressure will be available via normal plant instrumentation.

During the time that Suppression Pool temperature is increasing, operators will reduce reactor pressure to approximately 150-250 psig, providing margin to the Unsafe Region of the heat capacity temperature limit (HCTL) curve (Reference 2). When Suppression Pool temperature reaches the Unsafe Region of the HCTL, RPV emergency depressurization is required. In accordance with EPGs and per BWR Owners' Group (BWROG) guidance, the QGAs will be revised to allow termination of RPV emergency depressurization at a pressure that will allow continued RCIC operation.

[2] Coping modifications consist of modifications installed to increase initial coping time, i.e., generators to preserve vital instruments or increase operating time on battery powered equipment.

The Reliable Hardened Containment Vent modification (Order EA-12-050) provides the ability to operate the required components for at least 24 hours (Reference 1).

Preliminary MAAP analysis shows that with early containment venting employed, Suppression Pool temperature does not exceed 230° F and HCTL is reached at approximately 4.6 hours.

References:

1. RS-13-116, Exelon Generation Company, QCNPS's Overall Integrated Plan in Response to March 12, 2012 Commission Order Modifying Licenses with Regard to Requirements for Reliable Hardened Containment Vents (Order EA-12-050), 2/28/2013.
2. QGA 200, Primary Containment Control, Revision 9.
3. Quad Cities UFSAR, Revision 11, October 2011.

Details:	
Provide a brief description of Procedures / Strategies / Guidelines	*Confirm that procedure/guidance exists or will be developed to support implementation.* Quad Cities Nuclear Power Station will use the industry developed guidance from the Owners Groups, EPRI and NEI Task team to develop site specific procedures or guidelines to address the criteria in NEI 12-06. These procedures and/or guidelines will support the existing symptom based command and control strategies in the current EOPs.
Identify modifications	*List modifications.* Reliable Hardened Containment Vent Modification (Order EA-12-050)
Key Containment Parameters	*List instrumentation credited for this coping evaluation.* DW Pressure — PI 1(2)-1640-19 Suppression Pool Temp — TR 1(2)-1640-200B 1(2)-1640-9 Suppression Pool Pressure — PI 1(2)-1640-20 Quad Cities' evaluation of the FLEX strategy may identify additional parameters that are needed in order to support key actions identified in the plant procedures/guidance or to indicate imminent or actual core damage (NEI 12-06, Rev. 0, Section

	3.2.1.10). Any differences will be communicated in a future six-month update following identification.

Notes:

Exelon Generation Company, LLC (Exelon) has not finalized the engineering designs for compliance with NRC Order EA-12-049. 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 six-month update. This update will include any changes to the initial designs as submitted in this Integrated Plan.

Maintain Containment

BWR Portable Equipment Phase 2:

Provide a general description of the coping strategies using on-site portable equipment including modifications that are proposed to maintain core cooling. Identify methods (containment vent or alternative / Hydrogen Igniters) and strategy(ies) utilized to achieve this coping time.

The primary strategy for maintaining containment integrity is to continue venting the containment using the Suppression Pool Reliable Hardened Containment Vent (Order EA-12-050).

Station personnel will line up portable equipment to supply makeup to the Suppression Pool and/or the RPV and to reenergize 480VAC load centers for the purpose of re-energizing the battery chargers.

With containment venting in progress, makeup to the Suppression Pool is required to replace inventory lost through the Suppression Pool vent. Without injection, Suppression Pool level will reach 11 feet approximately 40 hours from the beginning of the event. To ensure Suppression Pool level remains above 11 feet, makeup to the Suppression Pool will be initiated. Preliminary analysis indicates that this level constitutes adequate NPSH for RCIC.

Suppression Pool Makeup:

Quad Cities will use portable equipment to provide makeup to the Suppression Pool prior to the loss of NPSH to RCIC. Suppression Pool makeup will be established using portable pumps, with the pump suction from the Discharge Bay. Pump discharge will be directed through fire hoses routed from the area near the Discharge Bay either through the turbine building and Reactor Building or around the Protected Area access road to the east side of the Reactor Building and in through the ½ Trackway. At this location the hose can be connected to one of two proposed locations.

1. The first is a Storz connection on the "A" loop of RHR system piping between the inboard and outboard isolation valves for DW sprays. This connection is located on the northeast side of the DW at ground level (595 feet), and provides access to either the RPV or the Suppression Pool through installed RHR piping and AC-powered MOVs. Installation of the portable AC generator will allow manipulation of the necessary RHR valves.

2. The second is a Storz connection, to be installed on a currently existing blind flange, on the "B" loop of RHR system piping between the inboard and outboard isolation valves for DW sprays. The connection is located on the southeast side of the DW on the second floor (623 feet). This connection requires the hose to be run up the stairwell at the ½ Trackway. This connection also provides access to either the RPV or the Suppression Pool through installed RHR piping. This connection will also be modified to provide the option of connecting on the ground floor (595 feet).

Connection of a FLEX pump via a hose to one of the proposed quick hose connections allows water from the Discharge Bay to be supplied directly to the Suppression Pool or to the RPV.

These connection points are in diverse locations, and the connection points and piping are qualified

Maintain Containment	
BWR Portable Equipment Phase 2:	
for the five BDBEEs that must be considered for implementation of FLEX. Additionally, these connections allow supplying both Unit 1 and Unit 2 simultaneously. A portable 480 VAC diesel-powered FLEX generator will be connected to the safety-related AC distribution system at the 480 VAC bus. This strategy is described in Safety Support Function Phase 2. Reference(s): None	
Details:	
Provide a brief description of Procedures / Strategies / Guidelines	*Confirm that procedure/guidance exists or will be developed to support implementation.* Quad Cities Nuclear Power Station will use the industry developed guidance from the Owners Groups, EPRI and NEI Task team to develop site specific procedures or guidelines to address the criteria in NEI 12-06. These procedures and/or guidelines will support the existing symptom based command and control strategies in the current EOPs.
Identify modifications	*List modifications.* Reliable Hardened Containment Vent Modification (Order EA-12-050) The location for the portable pump injection on the B division of RHR will be modified to a quick-disconnect (Storz fitting).
Key Containment Parameters	*List instrumentation credited or recovered for this coping evaluation.* Containment Pressure: 1(2)-1640-12, 1(2)-1640-13A, 1(2)-1640-13B, 1(2)-2540-9A, 1(2)-2540-9B, PI 1(2)-1640-19 Suppression Pool Level: 1(20-1640-13A, 1(2)-1640-13B Suppression Pool Temp: TR 1(2)-1640-200B, 1(2)-1640-9

Maintain Containment	
BWR Portable Equipment Phase 2:	
	Suppression Pool Pressure PI 1(2)-1640-20 Quad Cities' evaluation of the FLEX strategy may identify additional parameters that are needed in order to support key actions identified in the plant procedures/guidance or to indicate imminent or actual core damage (NEI 12-06, Rev. 0, Section 3.2.1.10). Any differences will be communicated in a future six-month update following identification.
Storage / Protection of Equipment : **Describe storage / protection plan or schedule to determine storage requirements**	
Seismic	Structures to provide protection of FLEX equipment will be constructed to meet the requirements of NEI 12-06 Section 11. Schedule to construct permanent building is contained in Attachment 2, and will satisfy the site compliance date. Temporary locations will be used until building construction completion. 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.
Flooding Note: if stored below current flood level, then ensure procedures exist to move equipment prior to exceeding flood level.	Structures to provide protection of FLEX equipment will be constructed to meet the requirements of NEI 12-06 Section 11. Schedule to construct permanent building is contained in Attachment 2, and will satisfy the site compliance date. Temporary locations will be used until building construction completion. 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. FLEX equipment can be stored below flood level at Quad Cities since sufficient warning time is available to relocate and/or deploy the equipment. Plant procedures/guidance will be developed to address the needed actions. FLEX equipment will be relocated to a position that is protected from the flood, either by barriers or by elevation, prior to the arrival of the potentially damaging flood levels. Both electrical and at least one mechanical FLEX connection locations will be above the flood plain.
Severe Storms with High Winds	Structures to provide protection of FLEX equipment will be constructed to meet the requirements of NEI 12-06 Section 11. Schedule to construct permanent building is contained in Attachment 2, and will satisfy the site compliance date. Temporary locations will be used until building construction completion. Procedures and programs will be developed to address storage structure requirements,

Maintain Containment	
BWR Portable Equipment Phase 2:	
	haul path requirements, and FLEX equipment requirements relative to the external hazards applicable to Quad Cities.
Snow, Ice, and Extreme Cold	Structures to provide protection of FLEX equipment will be constructed to meet the requirements of NEI 12-06 Section 11. Schedule to construct permanent building is contained in Attachment 2, and will satisfy the site compliance date. Temporary locations will be used until building construction completion. 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.
High Temperatures	Structures to provide protection of FLEX equipment will be constructed to meet the requirements of NEI 12-06 Section 11. Schedule to construct permanent building is contained in Attachment 2, and will satisfy the site compliance date. Temporary locations will be used until building construction completion. 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.

Deployment Conceptual Design
(Attachment 3 contains Conceptual Sketches)

Strategy	**Modifications**	**Protection of connections**
Identify Strategy including how the equipment will be deployed to the point of use.	*Identify modifications.*	*Identify how the connection is protected.*
Storage location and structure have not been decided yet. The Flex Pumps will be brought to the area of the Discharge Bay. The suction of the pumps will be routed to the Discharge Bay; the discharge of the pumps will be routed to the RHR System of each unit. Water from the Discharge Bay will be injected into the RHR System. With injection being supplied to the RHR System, makeup to the Suppression Pool can begin when required, and makeup to the RPV will be available if necessary.	None.	The RHR connections are located inside the Reactor Building, which is a Safety Related, Seismic Class I structure.

Maintain Containment
BWR Portable Equipment Phase 2:
Notes: Exelon Generation Company, LLC (Exelon) has not finalized the engineering designs for compliance with NRC Order EA-12-049. 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 six-month update. This update will include any changes to the initial designs as submitted in this Integrated Plan.

Maintain Containment	
BWR Portable Equipment Phase 3:	
Provide a general description of the coping strategies using phase 3 equipment including modifications that are proposed to maintain containment. Identify methods (containment vent or alternative / Hydrogen Igniters) and strategy(ies) utilized to achieve this coping time. Phases 1 and 2 strategy will provide sufficient capability such that no additional Phase 3 strategies are required. Phase 3 equipment for Quad Cities Nuclear Power Station includes backup portable pumps and generators. The portable pumps will be capable of providing the necessary flow and pressure as outlines in Phase 2 response for Core Cooling and Heat Removal, RCS Inventory Control and Spent Fuel Pool Cooling. The portable generators will be capable of providing the necessary 480 volt power requirements as outlined in Phase 2 response for Safety Functions Support.	
Details:	
Provide a brief description of Procedures / Strategies / Guidelines	*Confirm that procedure/guidance exists or will be developed to support implementation.* Quad Cities Nuclear Power Station will use the industry developed guidance from the Owners Groups, EPRI and NEI Task team to develop site specific procedures or guidelines to address the criteria in NEI 12-06. These procedures and/or guidelines will support the existing symptom based command and control strategies in the current EOPs.
Identify modifications	*List modifications.* None
Key Containment Parameters	*List instrumentation credited or recovered for this coping evaluation.* Quad Cities' evaluation of the FLEX strategy may identify additional parameters that are needed in order to support key actions identified in the plant procedures/guidance or to indicate imminent or actual core damage (NEI 12-06, Rev. 0, Section 3.2.1.10). Any differences will be communicated in a future six-month update following identification.

Deployment Conceptual Design **(Attachment 3 contains Conceptual Sketches)**		
Strategy	**Modifications**	**Protection of connections**
Identify Strategy including how the equipment will be deployed to the point of use.	*Identify modifications.*	*Identify how the connection is protected.*
None	None	None

Maintain Containment
BWR Portable Equipment Phase 3:
Notes: Exelon Generation Company, LLC (Exelon) has not finalized the engineering designs for compliance with NRC Order EA-12-049. 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 six-month update. This update will include any changes to the initial designs as submitted in this Integrated Plan.

Maintain Spent Fuel Pool Cooling
Determine Baseline coping capability with installed coping[3] modifications not including FLEX modifications, utilizing methods described in Table 3-1 of NEI 12-06: • Fuel in the SFP will be cooled by convection and evaporative cooling of the water in the SFP • Once SFP temperature reaches 212F, the fuel will be cooled by boiling heat transfer
BWR Installed Equipment Phase 1:
Provide a general description of the coping strategies using installed equipment including modifications that are proposed to maintain spent fuel pool cooling. Identify methods (makeup with portable injection source)and strategy(ies) utilized to achieve this coping time. There are no Phase 1 actions required at this time that need to be addressed. Spent Fuel Pool (SFP) makeup is not a time constraint with the initial condition of Mode 1 at 100% power, since the worst case fuel pool heat load conditions only exist during a refueling outage. Under non-outage conditions, the maximum SFP heat load is 20.6 MBTU/hr. Loss of SFP cooling with this heat load and an initial SFP temperature of 150 degrees F results in a time to boil of 14.4 hours, and 159.26 hours to the top of fuel. Therefore, completing the equipment line-up for initiating SFP makeup at 12 hours into the event ensures adequate cooling of the spent fuel is maintained. The worst case SFP heat load during an outage is 48.9 MBTU/hr. Loss of SFP cooling with this heat load and an initial SFP temperature of 150 degrees F results in a time to boil of 6.09 hours, and 67.09 hours to the top of fuel. With the entire core being located in the SFP, manpower resources normally allocated to aligning core cooling along with the Operations outage shift manpower can be allocated to aligning SFP make-up which ensures the system alignment can be established within 8 hours. Initiation at 8 hours into the event ensures adequate cooling of the spent fuel is maintained. 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 six-month update. <u>References:</u> None

Details:	
Provide a brief description of Procedures / Strategies / Guidelines	N/A
Identify any equipment	Spent Fuel Pool Level Instrumentation (Order EA 12-051)

[3] Coping modifications consist of modifications installed to increase initial coping time, i.e., generators to preserve vital instruments or increase operating time on battery powered equipment.

modifications	
Key SFP Parameter	Per EA 12-051 Quad Cities' evaluation of the FLEX strategy may identify additional parameters that are needed in order to support key actions identified in the plant procedures/guidance or to indicate imminent or actual core damage (NEI 12-06, Rev. 0, Section 3.2.1.10). Any differences will be communicated in a future six-month update following identification.

Notes:
Exelon Generation Company, LLC (Exelon) has not finalized the engineering designs for compliance with NRC Order EA-12-049. 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 six-month update. This update will include any changes to the initial designs as submitted in this Integrated Plan.

Maintain Spent Fuel Pool Cooling

BWR Portable Equipment Phase 2:

Provide a general description of the coping strategies using on-site portable equipment including modifications that are proposed to maintain spent fuel pool cooling. Identify methods (makeup with portable injection source) and strategy(ies) utilized to achieve this coping time.

SFP Makeup

Two diesel driven portable pumps (Flex Pumps) will take suction on the Discharge Bay and discharge into the Unit 1 and Unit 2 RHR Systems. The injection into RHR will be used to provide makeup to the Spent Fuel Pools when required through the Fuel Pool Assist connection. Use of this connection will require a modification to allow a hose connection around a spool piece, and seismic qualification of the Fuel Pool Assist piping.

Assuming that the Flex Pumps will be in place and connected to the RHR System of each unit within 4 hours, ample time is available to provide makeup to the Spent Fuel Pools to maintain inventory.

Diversity is provided through the ability to connect to either the division A or the division B RHR loop.

In addition, makeup to the Spent Fuel Pool can be provided by running hoses from the FLEX pumps up one of the Reactor Building stairwells to the refuel floor.

SFP Spray

The primary method of spraying the SFP is to run hoses from the FLEX pumps up one of the Reactor Building stairwells to the refuel floor and attach spray nozzles to the hose and direct the spray into the fuel pool. In addition, if the Fire Header can be pressurized, hoses connected to the stand-pipe on the Refuel Floor can be used to add water to the fuel pools or, with spray nozzles, to spray into the fuel pool.

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 six-month update.

References:
None

Schedule:	
Provide a brief description of Procedures / Strategies / Guidelines	*Confirm that procedure/guidance exists or will be developed to support implementation.* Quad Cities Nuclear Power Station will use the industry developed guidance from the Owners Groups, EPRI and NEI Task team to develop site specific procedures or guidelines to address the criteria in NEI 12-06. These procedures and/or guidelines will support the existing symptom based command and control strategies in the current EOPs.
Identify modifications	*List modifications.*

Maintain Spent Fuel Pool Cooling	
BWR Portable Equipment Phase 2:	
	The location for the portable pump injection on the B division of RHR will be modified to include a quick hose disconnect. Valve or hose quick disconnects will be provided for RHR fuel pool assist around spool piece. The spent fuel pool cooling assist piping will be seismically qualified. Spent Fuel Pool Level Instrumentation (Order EA 12-051)
Key SFP Parameter	Per Spent Fuel Pool Level Instrumentation (Order EA 12-051) Quad Cities' evaluation of the FLEX strategy may identify additional parameters that are needed in order to support key actions identified in the plant procedures/guidance or to indicate imminent or actual core damage (NEI 12-06, Rev. 0, Section 3.2.1.10). Any differences will be communicated in a future six-month update following identification.
Storage / Protection of Equipment : **Describe storage / protection plan or schedule to determine storage requirements**	
Seismic	Structures to provide protection of FLEX equipment will be constructed to meet the requirements of NEI 12-06 Section 11. Schedule to construct permanent building is contained in Attachment 2, and will satisfy the site compliance date. Temporary locations will be used until building construction completion. 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.
Flooding Note: if stored below current flood level, then ensure procedures exist to move equipment prior to exceeding flood level.	Structures to provide protection of FLEX equipment will be constructed to meet the requirements of NEI 12-06 Section 11. Schedule to construct permanent building is contained in Attachment 2, and will satisfy the site compliance date. Temporary locations will be used until building construction completion. 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. FLEX equipment can be stored below flood level at Quad Cities since sufficient warning time is available to relocate and/or deploy the equipment. Plant procedures/guidance will be developed to address the needed actions. FLEX equipment will be relocated to a position that is protected from the flood, either by barriers or by elevation,

Maintain Spent Fuel Pool Cooling	
BWR Portable Equipment Phase 2:	
	prior to the arrival of the potentially damaging flood levels. Both electrical and at least one mechanical FLEX connection locations will be above the flood plain.
Severe Storms with High Winds	Structures to provide protection of FLEX equipment will be constructed to meet the requirements of NEI 12-06 Section 11. Schedule to construct permanent building is contained in Attachment 2, and will satisfy the site compliance date. Temporary locations will be used until building construction completion. 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.
Snow, Ice, and Extreme Cold	Structures to provide protection of FLEX equipment will be constructed to meet the requirements of NEI 12-06 Section 11. Schedule to construct permanent building is contained in Attachment 2, and will satisfy the site compliance date. Temporary locations will be used until building construction completion. 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.
High Temperatures	Structures to provide protection of FLEX equipment will be constructed to meet the requirements of NEI 12-06 Section 11. Schedule to construct permanent building is contained in Attachment 2, and will satisfy the site compliance date. Temporary locations will be used until building construction completion. 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.

Deployment Conceptual Design
(Attachment 3 contains Conceptual Sketches)

Strategy	**Modifications**	**Protection of connections**
Identify Strategy including how the equipment will be deployed to the point of use.	*Identify modifications.*	*Identify how the connection is protected.*
Storage location and structure have not been decided yet. The Flex Pumps will be brought to the area of the Discharge Bay. The suction of the pumps will be routed to the Discharge Bay; the discharge of the pumps will be routed to the RHR System of each unit. Water from the Discharge	None	The RHR connections are located inside the Reactor Building, which is a Safety Related, Seismic Class I structure.

Maintain Spent Fuel Pool Cooling		
BWR Portable Equipment Phase 2:		
Bay will be injected into the RHR System. With injection being supplied to the RHR System, makeup to the Suppression Pool can begin when required, and makeup to the RPV will be available if necessary.		
Notes: Exelon Generation Company, LLC (Exelon) has not finalized the engineering designs for compliance with NRC Order EA-12-049. 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 six-month update. This update will include any changes to the initial designs as submitted in this Integrated Plan.		

Maintain Spent Fuel Pool Cooling	
BWR Portable Equipment Phase 3:	
Provide a general description of the coping strategies using phase 3 equipment including modifications that are proposed to maintain spent fuel pool cooling. Identify methods (makeup with portable injection source)and strategy(ies) utilized to achieve this coping time. Phases 1 and 2 strategy will provide sufficient capability such that no additional Phase 3 strategies are required. Phase 3 equipment for Quad Cities Nuclear Power Station includes backup portable pumps and generators. The portable pumps will be capable of providing the necessary flow and pressure as outlines in Phase 2 response for Core Cooling and Heat Removal, RCS Inventory Control and Spent Fuel Pool Cooling. The portable generators will be capable of providing the necessary 480 volt power requirements as outlined in Phase 2 response for Safety Functions Support.	
Schedule:	
Provide a brief description of Procedures / Strategies / Guidelines	*Confirm that procedure/guidance exists or will be developed to support implementation.* Quad Cities Nuclear Power Station will use the industry developed guidance from the Owners Groups, EPRI and NEI Task team to develop site specific procedures or guidelines to address the criteria in NEI 12-06. These procedures and/or guidelines will support the existing symptom based command and control strategies in the current EOPs.
Identify modifications	*List modifications.* None.
Key SFP Parameter	Quad Cities' evaluation of the FLEX strategy may identify additional parameters that are needed in order to support key actions identified in the plant procedures/guidance or to indicate imminent or actual core damage (NEI 12-06, Rev. 0, Section 3.2.1.10). Any differences will be communicated in a future six-month update following identification.

Deployment Conceptual Design **(Attachment 3 contains Conceptual Sketches)**		
Strategy	**Modifications**	**Protection of connections**
Identify Strategy including how the equipment will be deployed to the point of use.	*Identify modifications.*	*Identify how the connection is protected.*
None.	None.	None.

Maintain Spent Fuel Pool Cooling
BWR Portable Equipment Phase 3:
Notes: Exelon Generation Company, LLC (Exelon) has not finalized the engineering designs for compliance with NRC Order EA-12-049. 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 six-month update. This update will include any changes to the initial designs as submitted in this Integrated Plan.

Safety Functions Support
Determine Baseline coping capability with installed coping[4] modifications not including FLEX modifications.
BWR Installed Equipment Phase 1
DC Power Safety Related 250VDC and 125VDC Bus voltage will be maintained by their associated batteries until the portable 480V FLEX generators are placed in service to reenergize the battery chargers. 125 DC load shedding will be accomplished in accordance with QOA 6900-07, Loss of A.C. Power to the 125 VDC Battery Chargers with Simultaneous Loss of Auxiliary Electrical Power. A preliminary analysis indicates that station batteries will last beyond seven hours, assuming load shed activities are completed within the initial 30 minutes following the loss of AC power. RCIC Room Habitability Per preliminary GOTHIC Analysis, RCIC Room temperature will not exceed 150 degrees for ~8 hours. Main Control Room Habitability There are no Phase 1 actions required at this time that need to be addressed. Battery Room Ventilation There are no Phase 1 actions required at this time that need to be addressed. Refuel Floor Area Habitability There are no Phase 1 actions required at this time that need to be addressed.
Details:

Provide a brief description of Procedures / Strategies / Guidelines	*Confirm that procedure/guidance exists or will be developed to support implementation.* Quad Cities Nuclear Power Station will use the industry developed guidance from the Owners Groups, EPRI and NEI Task team to

[4] Coping modifications consist of modifications installed to increase initial coping time, i.e., generators to preserve vital instruments or increase operating time on battery powered equipment.

	develop site specific procedures or guidelines to address the criteria in NEI 12-06. These procedures and/or guidelines will support the existing symptom based command and control strategies in the current EOPs.
Identify modifications	*List modifications and describe how they support coping time.* There are currently no modifications planned in this area.
Key Parameters	Battery voltage can be monitored in the MCR (1(2)-8340-1 and 1(2)-8340-2). Quad Cities' evaluation of the FLEX strategy may identify additional parameters that are needed in order to support key actions identified in the plant procedures/guidance or to indicate imminent or actual core damage (NEI 12-06, Rev. 0, Section 3.2.1.10). Any differences will be communicated in a future six-month update following identification.
Notes: Exelon Generation Company, LLC (Exelon) has not finalized the engineering designs for compliance with NRC Order EA-12-049. 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 six-month update. This update will include any changes to the initial designs as submitted in this Integrated Plan.	

Safety Functions Support
BWR Portable Equipment Phase 2

Provide a general description of the coping strategies using on-site portable equipment including station modifications that are proposed to maintain and/or support safety functions. Identify methods and strategy(ies) utilized to achieve coping times.

Electrical System Support and DC Battery availability

The 480VAC power distribution system provides power to Essential Safety Systems (ESS) buses at QCNPS. The ESS buses provide power to critical loads for achieving and maintaining safe shutdown, such as battery chargers and instrument panels. Upon an ELAP, these services would be lost.

The electrical strategy conceptual design contains features to expedite and simplify implementation, and may not be required in order to meet the event timeline for maintaining the safety function requirements of NEI 12-06. The following modifications are being proposed to connect a portable generator to provide power to critical loads:

1. Primary strategy
   Install a seismically qualified, fused disconnect panel in the vicinity of Bus 18(28) to allow for quick connection to a staged 480 VAC diesel-powered generator. See Attachment 3 for a conceptual drawing of this modification.

2. Alternate strategy
   Install a second seismically qualified, fused disconnect panel in the vicinity of Bus 19(29) to allow for quick connection to a staged 480 VAC diesel-powered generator. See Attachment 3 for a conceptual drawing of this modification.

The divisions fed by Buses 18(28) and 19(29) are designed to be cross-connected such that each fused disconnect panel can feed all necessary loads.

RCIC Room Habitability

QCNPS intends to maintain RCIC Room habitability. Habitability conditions will be evaluated and a strategy will be developed to maintain RCIC habitability. Preliminary GOTHIC analysis indicates that alternate cooling provided to Units 1 and 2 RCIC within eight hours will ensure RCIC Room temperature does not exceed 150°F.

Main Control Room Habitability

QCNPS intends to maintain Operational command and control within the Main Control Room. Habitability conditions will be evaluated and a strategy will be developed to maintain Main Control Room habitability. The strategy and associated support analyses will be provided in a future six-month update. In accordance with QOA 5750-15, Complete Loss of Control Room HVAC, alternate cooling consisting of providing an alternate air flow to the MCR via a pre-staged portable fan is implemented to maintain the Main Control Room temperature below 120°F (Reference 1).

Safety Functions Support	
BWR Portable Equipment Phase 2	
Battery Room Ventilation It is expected that the rise in temperature in the Safety Related Battery Rooms due to the loss of ventilation will not adversely affect the functionality of the batteries. Alternate ventilation will be provided to address hydrogen generation and cold weather, as required. Fuel Oil Supply to Portable Equipment Fuel oil to Flex Pumps and Generators will be supplied by the quantity of fuel in the tanks located on the skids of the portable equipment. This will then be supplemented by fuel tanks contained on the back of the Flex Truck. When required, fuel can then be pumped from the EDG Fuel Storage Day Tanks by accessing the tanks via tank access covers. A detailed fuel oil supply plan will be developed. References: 1 M. RICHTER LETTER TO DR. T. MURLEY, DATED 18 MAY 90, REVISED RESPONSE TO SBO RULE FOR DRESDEN AND QUAD CITIES STATIONS Quad Cities SER for SBO, dated December 11, 1990.	
Details:	
Provide a brief description of Procedures / Strategies / Guidelines	*Confirm that procedure/guidance exists or will be developed to support implementation with a description of the procedure / strategy / guideline.* QOA 5750-15, Complete Loss Of Control Room HVAC, provides guidance for alternate cooling to the MCR and the Auxiliary Electric Room. Quad Cities Nuclear Power Station will use the industry developed guidance from the Owners Groups, EPRI and NEI Task team to develop site specific procedures or guidelines to address the criteria in NEI 12-06. These procedures and/or guidelines will support the existing symptom based command and control strategies in the current EOPs.
Identify modifications	Fused disconnect panel installation near Bus 18 (28) with associated cabling to provide for connection of a portable AC generator. (see Attachment 3) Fused disconnect panel installation near Bus 19 (29) with associated cabling to provide for connection of a portable AC generator. (see Attachment 3)
Key Parameters	*List instrumentation credited or recovered for this coping evaluation.*

Safety Functions Support	
BWR Portable Equipment Phase 2	
	Quad Cities' evaluation of the FLEX strategy may identify additional parameters that are needed in order to support key actions identified in the plant procedures/guidance or to indicate imminent or actual core damage (NEI 12-06, Rev. 0, Section 3.2.1.10). Any differences will be communicated in a future six-month update following identification.
Storage / Protection of Equipment : **Describe storage / protection plan or schedule to determine storage requirements**	
Seismic	Structures to provide protection of FLEX equipment will be constructed to meet the requirements of NEI 12-06 Section 11. Schedule to construct permanent building is contained in Attachment 2, and will satisfy the site compliance date. Temporary locations will be used until building construction completion. 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.
Flooding Note: if stored below current flood level, then ensure procedures exist to move equipment prior to exceeding flood level.	Structures to provide protection of FLEX equipment will be constructed to meet the requirements of NEI 12-06 Section 11. Schedule to construct permanent building is contained in Attachment 2, and will satisfy the site compliance date. Temporary locations will be used until building construction completion. 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. FLEX equipment can be stored below flood level at Quad Cities since sufficient warning time is available to relocate and/or deploy the equipment. Plant procedures/guidance will be developed to address the needed actions. FLEX equipment will be relocated to a position that is protected from the flood, either by barriers or by elevation, prior to the arrival of the potentially damaging flood levels. Both electrical and at least one mechanical FLEX connection locations will be above the flood plain.
Severe Storms with High Winds	Structures to provide protection of FLEX equipment will be constructed to meet the requirements of NEI 12-06 Section 11. Schedule to construct permanent building is contained in Attachment 2, and will satisfy the site compliance date. Temporary locations will be used until building construction completion. Procedures and programs will be developed to address storage structure requirements, haul path requirements,

Safety Functions Support		
BWR Portable Equipment Phase 2		
	and FLEX equipment requirements relative to the external hazards applicable to Quad Cities.	
Snow, Ice, and Extreme Cold	Structures to provide protection of FLEX equipment will be constructed to meet the requirements of NEI 12-06 Section 11. Schedule to construct permanent building is contained in Attachment 2, and will satisfy the site compliance date. Temporary locations will be used until building construction completion. 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.	
High Temperatures	Structures to provide protection of FLEX equipment will be constructed to meet the requirements of NEI 12-06 Section 11. Schedule to construct permanent building is contained in Attachment 2, and will satisfy the site compliance date. Temporary locations will be used until building construction completion. 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.	
Deployment Conceptual Design (Attachment 3 contains Conceptual Sketches)		
Strategy	**Modifications**	**Protection of connections**
Identify Strategy including how the equipment will be deployed to the point of use.	*Identify modifications.*	*Identify how the connection is protected.*
The portable generators will be staged near the 18(28) and 19(29) MCCs, with permanently installed quick disconnects and associated breakers to supply power to the 480V load centers.	None.	The quick disconnects will be located in the Turbine Building, which is a seismically qualified structure.
In the event of a flood event which would prevent direct access to the EDG Fuel Storage Tanks, fuel oil would be obtained from the EDG Day Tanks.	A detailed fuel supply plan will be developed and modifications installed if required.	The Units 1 and 2 EDG Day Tanks are in the Turbine Building, and the Unit ½ EDG Day Tank is in the Reactor Building, both of which are seismically qualified structures.

Safety Functions Support
BWR Portable Equipment Phase 2
Notes: Exelon Generation Company, LLC (Exelon) has not finalized the engineering designs for compliance with NRC Order EA-12-049. 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 six-month update. This update will include any changes to the initial designs as submitted in this Integrated Plan.

Safety Functions Support
BWR Portable Equipment Phase 3
Phases 1 and 2 strategy will provide sufficient capability such that no additional Phase 3 strategies are required. Phase 3 equipment for Quad Cities Nuclear Power Station includes backup portable pumps and generators. The portable pumps will be capable of providing the necessary flow and pressure as outlines in Phase 2 response for Core Cooling and Heat Removal, RCS Inventory Control and Spent Fuel Pool Cooling. The portable generators will be capable of providing the necessary 480 volt power requirements as outlined in Phase 2 response for Safety Functions Support.

Details:	
Provide a brief description of Procedures / Strategies / Guidelines	Quad Cities Nuclear Power Station will use the industry developed guidance from the Owners Groups, EPRI and NEI Task team to develop site specific procedures or guidelines to address the criteria in NEI 12-06. These procedures and/or guidelines will support the existing symptom based command and control strategies in the current EOPs.
Identify modifications	None
Key Parameters	Quad Cities' evaluation of the FLEX strategy may identify additional parameters that are needed in order to support key actions identified in the plant procedures/guidance or to indicate imminent or actual core damage (NEI 12-06, Rev. 0, Section 3.2.1.10). Any differences will be communicated in a future six-month update following identification.

Deployment Conceptual Design **(Attachment 3 contains Conceptual Sketches)**		
Strategy	**Modifications**	**Protection of connections**
Identify Strategy including how the equipment will be deployed to the point of use.	*Identify modifications.*	*Identify how the connection is protected.*
None.	None.	None.

Notes:
Exelon Generation Company, LLC (Exelon) has not finalized the engineering designs for compliance with NRC Order EA-12-049. 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 six-month update. This update will include any

Safety Functions Support
BWR Portable Equipment Phase 3
changes to the initial designs as submitted in this Integrated Plan.

BWR Portable Equipment Phase 2							
Use and (potential / flexibility) diverse uses						*Performance Criteria*	*Maintenance*
List portable equipment	Core	Containment	SFP	Instrumentation	Accessibility		Maintenance / PM requirements
Three (3) low pressure high capacity self prime pump	**X**	**X**	**X**			1343 gpm, 270 psia	Equipment maintenance and testing will be performed in accordance with the industry templates, as outlined in JLD-ISG-2012-01, section 6, and NEI 12-06, section 11.
Three hose trailers	**X**	**X**	**X**			Contain hoses and fittings necessary for strategies associated with portable pumps.	Equipment maintenance and testing will be performed in accordance with the industry templates, as outlined in JLD-ISG-2012-01 section 6 and NEI 12-06 section 11.
Three (3) 480 VAC Diesel powered Generator	**X**			**X**	**X**	These items have not been obtained at the time of submittal of this Integrated Plan.	Equipment maintenance and testing will be performed in accordance with the industry templates, as outlined in JLD-ISG-2012-01 section 6 and NEI 12-06 section 11.

BWR Portable Equipment Phase 2							
Use and (potential / flexibility) diverse uses						*Performance Criteria*	*Maintenance*
List portable equipment	Core	Containment	SFP	Instrumentation	Accessibility		Maintenance / PM requirements
Heavy Duty truck					**X**	Similar to F-750 with on-board fuel tanks for refueling portable equipment. Used to transport portable equipment and clear debris.	Equipment maintenance and testing will be performed in accordance with the industry templates, as outlined in JLD-ISG-2012-01 section 6 and NEI 12-06 section 11.
Six (6) Industrial blower					**X**	42" 120V, 2-speed fan 13,300 CFM ON HIGH AND 9,500 CFM ON LOW	Equipment maintenance and testing will be performed in accordance with the industry templates, as outlined in JLD-ISG-2012-01 section 6 and NEI 12-06 section 11.
Ten (10) Portable fans with flexible ducting					**X**	115V 5200 cfm	Equipment maintenance and testing will be performed in accordance with the industry templates, as outlined in JLD-ISG-2012-01

BWR Portable Equipment Phase 2							
Use and (potential / flexibility) diverse uses						*Performance Criteria*	*Maintenance*
List portable equipment	Core	Containment	SFP	Instrumentation	Accessibility		Maintenance / PM requirements
							section 6 and NEI 12-06 section 11.
Six (6) 120/240V Portable AC Generators					**X**	5.5 kW	Equipment maintenance and testing will be performed in accordance with the industry templates, as outlined in JLD-ISG-2012-01 section 6 and NEI 12-06 section 11.
Three (3) Dewatering pumps – diesel driven					**X**		Equipment maintenance and testing will be performed in accordance with the industry templates, as outlined in JLD-ISG-2012-01 section 6 and NEI 12-06 section 11.

BWR Portable Equipment Phase 3							
Use and (potential / flexibility) diverse uses						*Performance Criteria*	*Notes*
List portable equipment	Core	Containment	SFP	Instrumentation	Accessibility		
Note: The RRC equipment has not been procured at the time of this submittal. Once the SAFER committee determines the equipment specifications for bid, updates will be made as necessary to this table. The Phase 3 portable equipment table will be updated once all of the equipment has been procured and placed in inventory.							
Medium Voltage Diesel Generator	**X**	**X**	**X**	**X**	**X**	2 MW output at 4160 Vac, three phase	• Generator must be common commercially available. • Must run on diesel fuel.
Low Voltage Diesel Generator	**X**	**X**	**X**	**X**	**X**	500 kW output at 480 Vac, three phase	• Generator must be common commercially available. • Must run on diesel fuel.
Low Pressure Pump	**X**	**X**	**X**			300 psi shutoff head, 2500 gpm max flow	None
Low Pressure Pump	**X**		**X**			500 psi shutoff head, 500 gpm max flow	None

BWR Portable Equipment Phase 3							
Use and (potential / flexibility) diverse uses						*Performance Criteria*	*Notes*
List portable equipment	Core	Containment	SFP	Instrumentation	Accessibility		
Low Pressure Pump					**X**	110 psi shutoff head, 400 gpm max flow submersible	None
Low Pressure Pump	**X**	**X**				150 psi shutoff head, 5000 gpm max flow	None
Air Compressor		**X**				120 psi minimum pressure, 2000 scfm	None

Phase 3 Response Equipment/Commodities	
Item	**Notes**
Radiation Protection Equipment • Survey instruments • Dosimetry • Off-site monitoring/sampling	The RRC will not stock this type of equipment but this equipment will be requested from site-to-site and utility-to-utility on an as required basis.
Commodities • Food • Potable water	The RRC will not stock these commodities but they will be requested from site-to-site and utility-to-utility on an as-required basis.
Fuel Requirements • Diesel Fuel	300 – 500 gallon bladders that can be delivered by air
Heavy Equipment • Transportation equipment • Debris clearing equipment	• TBD during site specific playbook development • Redundant Phase 2 equipment to be located at RRC

Attachment 1A
Sequence of Events Timeline

Action item	Elapsed Time	Action	Time Constraint Y/N [5]	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 SBO. EOP entry conditions; Low Reactor water level and High Reactor pressure	N	QGA 100 RPV Control QCOA 6100-03 Loss of Offsite Power QCOA 6100-04 Station Blackout
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

[5] Instructions: Provide justification in the remarks 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

				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.
7	~5 mins	Attempt to manually start emergency diesel generators (U1, U2 and 1/2)	N	QCOA 6100-03 Loss of Offsite Power. No success will occur from this action.
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 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 Preliminary MAAP run (prior to 160°F Suppress Pool Temp). 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. 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.
14	~60 mins	Equipment Operators dispatched to begin setup/connection of FLEX equipment (480VAC	N	DC coping analysis shows

		generators to power battery chargers and FLEX pump).		the following DC battery capabilities: 125 VDC / 8 hrs 250 VDC / 7 hrs
15	2 hours	Defeat RCIC High area temperature isolations	Y	QCOP 1300-10. This action is critical at 8 hours when RCIC Room temperature reaches 150°F, per preliminary Gothic analysis.
16	3.7 hrs	Initiate early containment venting strategy at a DW pressure of ~25 psia. 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	~3.7 hrs is projected via preliminary MAAP analysis as when DW pressure reaches 25 psia.
17	4 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 ~7 hrs.
18	4 hrs	FLEX pumps connected and alignment for Suppression Pool injection established.	Y	With RCIC operating, first needed injection path is projected to be the Suppression Pool due to inventory loss through the containment vent path. Time sensitive due to need to maintain Suppression Pool level for adequate RCIC NPSH.
19	~4.6 hrs	Heat Capacity Temperature Limit (HCTL) curve projected to be exceeded via preliminary MAAP analysis, RPV blowdown to ~200 psig required. RPV pressure now maintained in 150-250 psig range to support RCIC operation.	Y	RPV blowdown stops at ~200 psig in RPV to preserve RCIC operation.

				Modified blowdown supported by BWROG changes to Emergency Procedure Guidelines (EPGs).
20	7 hrs	Provide alternate cooling to the RCIC room.	Y	Procedure to be developed.
21	12 hrs	Begin makeup to SFP with the FLEX pump to maintain level above top of fuel.	Y	The current worst case SFP heat load scenario shows a time-to-boil of 14.4 hours. The time to reach top of fuel is 159.26 hours.
22	24 hrs	Initial equipment from Regional Response Center becomes available.	N	Per NEI 12-06, section 12 (RRC).
23	24 -72 hrs	Continue to maintain critical functions of core cooling (via RCIC), containment (via opening of Reliable Hardened Containment Vent and FLEX pump injection to suppression pool) and SFP cooling (FLEX pump injection to SFP). Utilize initial RRC equipment in spare capacity.	N	Not time critical/sensitive since Phase 2 actions result in indefinite coping times for all safety functions.

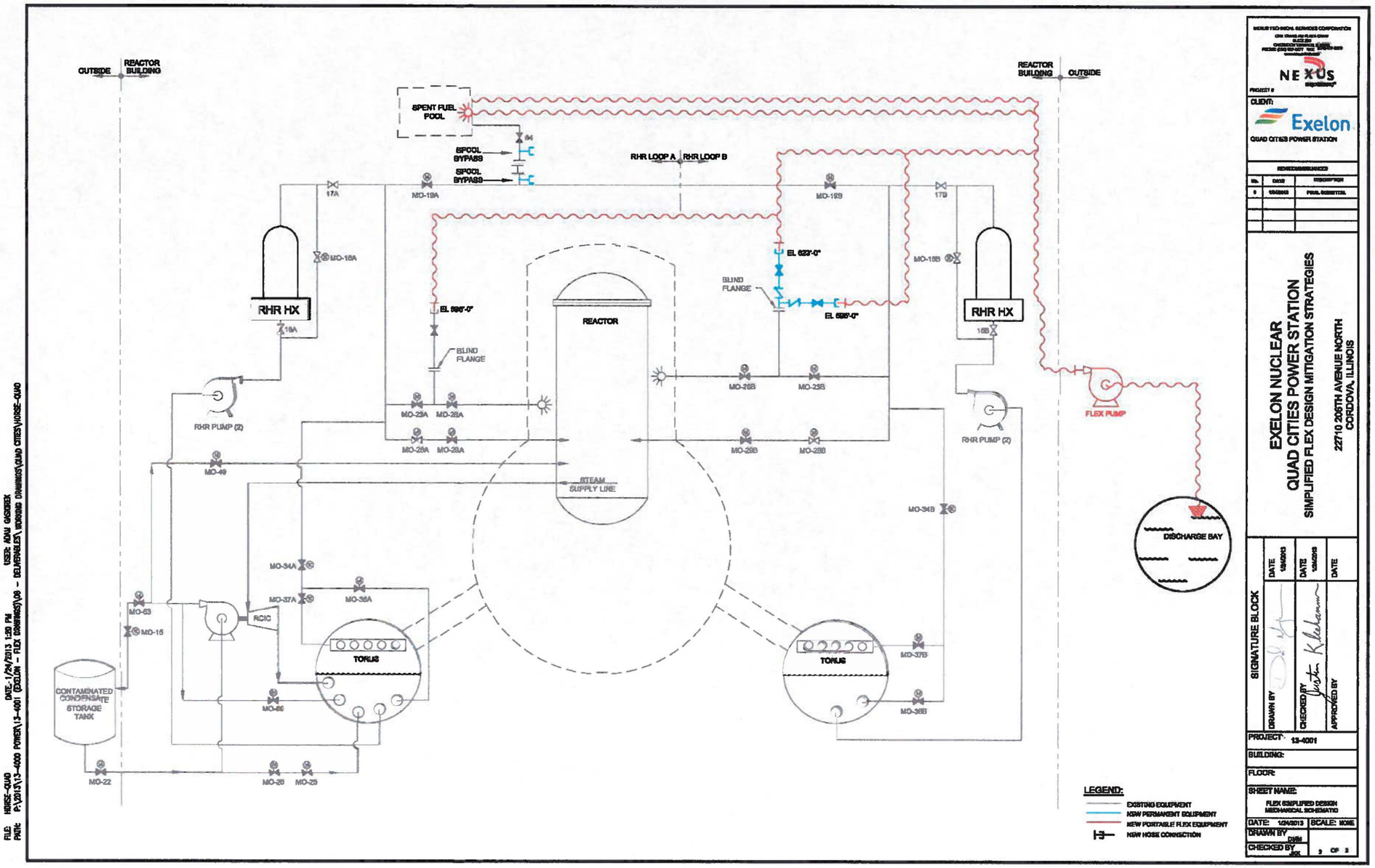
Attachment 2
Milestone Schedule

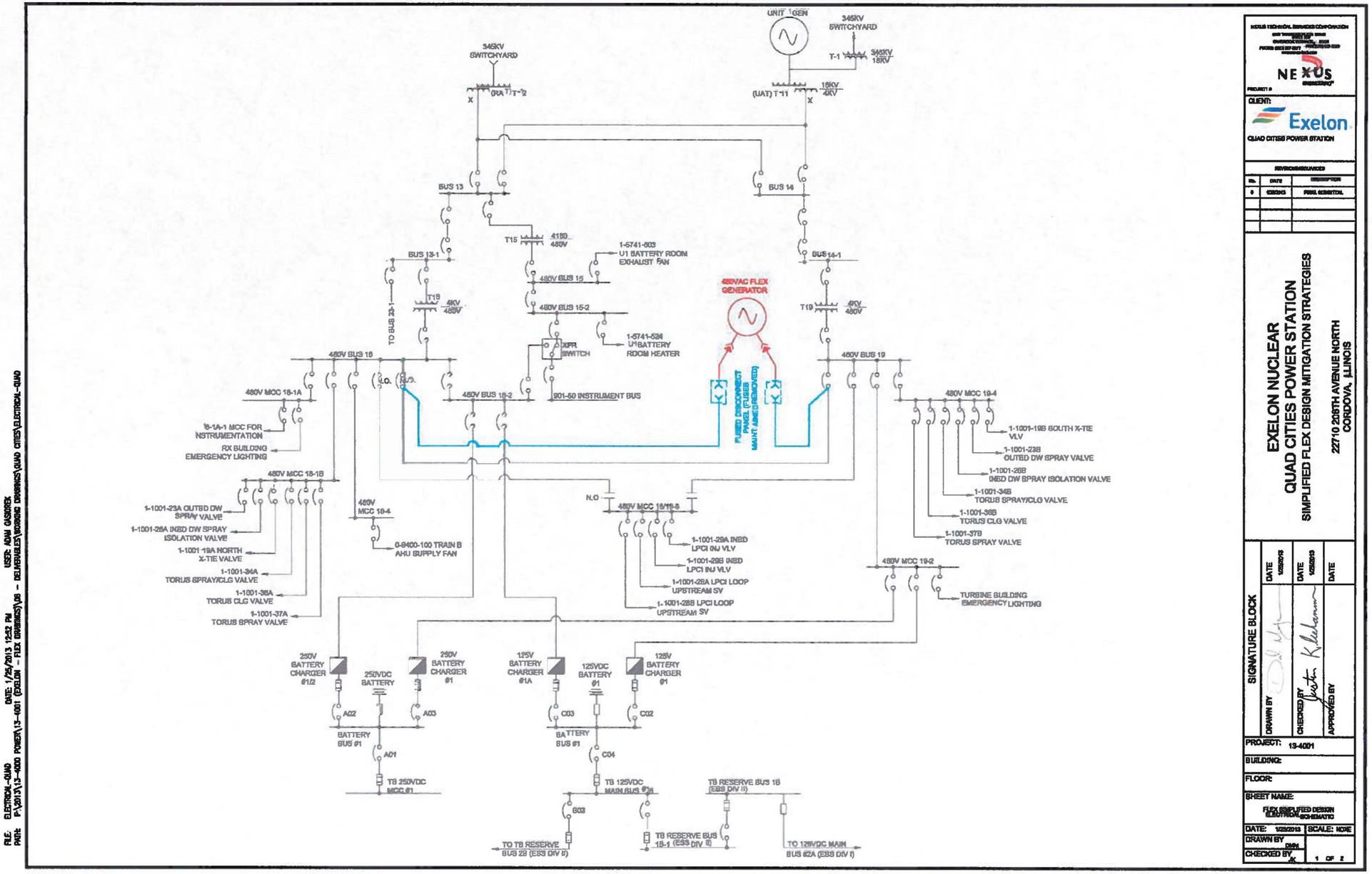
Original Target Completion Date		Activity	Status {Include date changes in this column}
		Submit 60 Day Status Report	Complete
		Submit Overall Integrated Implementation Plan	Complete
		Contract with RRC	Complete
Recurring action, August and February		Submit 6 month updates	Ongoing
Unit 1	**Unit 2**	**Modification Development**	
Feb 2014	Mar 2015	• Phase 2 modifications	Note 1
Feb 2014	Mar 2015	• Phase 3 modifications	Note 1
Unit 1	**Unit 2**	**Modification Implementation**	
Apr 2015	Apr 2016	• Phase 2 modifications	Note 1
Apr 2015	Apr 2016	• Phase 3 modifications	Note 1
		Procedure development	
Apr 2015		• Strategy procedures	Note 1
Apr 2015		• Maintenance procedures	Note 1
Nov 2014		Staffing analysis	Note 1
Apr 2015		Storage Plan and construction	Note 1
Apr 2015		FLEX equipment acquisition	Note 1
Apr 2015		Training completion	Note 1
Dec 2014		Regional Response Center Operational	(will be a standard date from RRC)
Apr 2015		Unit 1 Implementation date	Note 1
Apr 2016		Unit 2 Implementation date	Note 1

Note(s):

1) Exelon will update the status of ongoing and future milestones in the Integrated Plan for QCNPS during a scheduled six month update. This update will include any changes to the milestone schedule as submitted in the February 28, 2013 Integrated Plan.

Attachment 3
Conceptual Sketches




UNIT 1 GEN
345KV SWITCHYARD
T-1
345KV 18KV
(UAT) T-11
18KV 4KV
X
345KV SWITCHYARD
(RAT) T-12
BUS 13
BUS 14
T15
4160 480V
BUS 13-1
BUS 14-1
1-6741-603 U1 BATTERY ROOM EXHAUST FAN
480V BUS 15
480VAC FLEX GENERATOR
T19
4KV 480V
480V BUS 15-2
1-6741-524 U1BATTERY ROOM HEATER
XFR SWITCH
TO BUS 23-1
480V BUS 18
480V BUS 19
480V BUS 18-2
901-50 INSTRUMENT BUS
FUSED DISCONNECT PANEL (FUSES MAINT. ARE REMOVED)
480V MCC 18-1A
18-1A-1 MCC FOR INSTRUMENTATION
RX BUILDING EMERGENCY LIGHTING
480V MCC 18-1B
1-1001-23A OUTBD DW SPRAY VALVE
1-1001-28A INBD DW SPRAY ISOLATION VALVE
1-1001-19A NORTH X-TIE VALVE
1-1001-34A TORUS SPRAY/CLG VALVE
1-1001-36A TORUS CLG VALVE
1-1001-37A TORUS SPRAY VALVE
480V MCC 18-4
0-9400-100 TRAIN B AHU SUPPLY FAN
N.O
480V MCC 18/18-5
1-1001-29A INBD LPCI INJ VLV
1-1001-29B INBD LPCI INJ VLV
1-1001-28A LPCI LOOP UPSTREAM SV
1-1001-28B LPCI LOOP UPSTREAM SV
480V MCC 19-4
1-1001-19B SOUTH X-TIE VLV
1-1001-23B OUTBD DW SPRAY VALVE
1-1001-28B INBD DW SPRAY ISOLATION VALVE
1-1001-34B TORUS SPRAY/CLG VALVE
1-1001-36B TORUS CLG VALVE
1-1001-37B TORUS SPRAY VALVE
480V MCC 19-2
TURBINE BUILDING EMERGENCY LIGHTING
250V BATTERY CHARGER #1/2
250VDC BATTERY
250V BATTERY CHARGER #1
A02
A03
A01
BATTERY BUS #1
TB 250VDC MCC #1
125V BATTERY CHARGER #1A
125VDC BATTERY #1
125V BATTERY CHARGER #1
C03
C02
C04
BATTERY BUS #1
TB 125VDC MAIN BUS #1B
B03
TO TB RESERVE BUS 2B (ESS DIV II)
TB RESERVE BUS 18-1 (ESS DIV II)
TB RESERVE BUS 1B (ESS DIV II)
TO 125VDC MAIN BUS #2A (ESS DIV I)
FILE: ELECTRICAL-QUAD
PATH: P:\2013\13-4000 POWER\13-4001 (EXELON - FLEX DRAWINGS)\DELIVERABLES\WORKING DRAWINGS\QUAD CITIES\ELECTRICAL-QUAD
DATE: 1/25/2013 12:52 PM
USER: ADAM GASIOREK
NEXUS
CLIENT:
Exelon
QUAD CITIES POWER STATION
REVISIONS/ISSUANCES
NO. DATE DESCRIPTION
0 1/28/2013 FINAL SUBMITTAL
EXELON NUCLEAR
QUAD CITIES POWER STATION
SIMPLIFIED FLEX DESIGN MITIGATION STRATEGIES
22710 206TH AVENUE NORTH
CORDOVA, ILLINOIS
SIGNATURE BLOCK
DRAWN BY
DATE 1/28/2013
CHECKED BY
DATE 1/28/2013
APPROVED BY
DATE
PROJECT: 13-4001
BUILDING:
FLOOR:
SHEET NAME:
FLEX SIMPLIFIED DESIGN ELECTRICAL SCHEMATIC
DATE: 1/28/2013
SCALE: NONE
DRAWN BY DMM
CHECKED BY
1 OF 2