



UNITED STATES  
NUCLEAR REGULATORY COMMISSION  
WASHINGTON, D.C. 20555-0001

July 24, 2014

Mr. Michael J. Pacilio  
President and Chief Nuclear Officer  
Exelon Generation Company, LLC  
4300 Winfield Road  
Warrenville, IL 60555

SUBJECT: BYRON STATION, UNITS 1 AND 2 - PLAN FOR THE ONSITE AUDIT REGARDING IMPLEMENTATION OF MITIGATING STRATEGIES AND RELIABLE SPENT FUEL INSTRUMENTATION RELATED TO ORDERS EA-12-049 AND EA-12-051 (TAC NOS. MF0872, MF0873, MF0893, AND MF0894)

Dear Mr. Pacilio:

On March 12, 2012, the U.S. Nuclear Regulatory Commission (NRC) issued Order EA-12-049, "Order Modifying Licenses with Regard to Requirements for Mitigation Strategies for Beyond Design-Basis External Events" and Order EA-12-051, "Order to Modify Licenses With Regard To Reliable Spent Fuel Pool Instrumentation," (Agencywide Documents Access and Management System (ADAMS) Accession Nos. ML12054A736 and ML12054A679, respectively). The orders require holders of operating reactor licenses and construction permits issued under Title 10 of the *Code of Federal Regulations* Part 50 to submit for review, Overall Integrated Plans (OIPs) including descriptions of how compliance with the requirements of Attachment 2 of each order will be achieved.

By letter dated February 28, 2013 (ADAMS Accession No. ML13060A364), Exelon Generation Company, LLC ( Exelon, the licensee) submitted its OIP for Byron Station, Units 1 and 2 (Byron) in response to Order EA-12-049. By letters dated August 28, 2013, and February 28, 2014 (ADAMS Accession Nos. ML13241A279 and ML14059A425, respectively), the licensee submitted its first two six-month updates to the OIP. By letter dated August 28, 2013 (ADAMS Accession No. ML13234A503), the NRC notified all licensees and construction permit holders that the staff is conducting audits of their responses to Order EA-12-049 in accordance with NRC Office of Nuclear Reactor Regulation (NRR) Instruction LIC-111, "Regulatory Audits" (ADAMS Accession No. ML082900195). This audit process led to the issuance of the Byron interim staff evaluation (ISE) and audit report (ADAMS Accession No. ML13225A595) on December 17, 2013, and continues with in-office and onsite portions of this audit.

By letter dated March 5, 2013 (ADAMS Accession No. ML13063A265), the licensee submitted its OIP for Byron in response to Order EA-12-051. By letter dated June 07, 2013 (ADAMS Accession No. ML13134A093), the NRC staff sent a request for additional information (RAI) to the licensee. By letters dated July 03, 2013, August 28, 2013, and February 28, 2014 (ADAMS Accession Nos. ML13186A006, ML13241A239, and ML14062A057, respectively), the licensee submitted its RAI responses and first two six-month updates to the OIP.

The NRC staff's review to date led to the issuance of the Byron ISE and RAI dated November 04, 2013 (ADAMS Accession No. ML13275A305). By letter dated March 26, 2014 (ADAMS

M. Pacilio

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Accession No. ML14083A620), the NRC notified all licensees and construction permit holders that the staff is conducting in-office and onsite audits of their responses to Order EA-12-051 in accordance with NRC NRR Office Instruction LIC-111, as discussed above.

The ongoing audit process, to include the in-office and onsite portions, allows the staff to assess whether it has enough information to make a safety evaluation of the Integrated Plans. The audit allows the staff to review open and confirmatory items from the mitigation strategies ISE, RAI responses from the spent fuel pool instrumentation ISE, the licensee's integrated plans, and other audit questions. Additionally, the staff gains a better understanding of submitted information, identifies additional information necessary for the licensee to supplement its plan, and identifies any staff potential concerns. The audit's onsite portion will occur prior to declarations of compliance for the first unit at each site.

This document outlines the on-site audit process that occurs after ISE issuance as licensees provide new or updated information via periodic updates, update audit information on e-portals, provide preliminary Overall Program Documents/Final Integrated Plans, and continue in-office audit communications with staff while proceeding towards compliance with the orders.

The staff plans to conduct an onsite audit at Byron in accordance with the enclosed audit plan from August 18 - 21, 2014.

If you have any questions, please contact me at 301-415-3204 or by e-mail at [john.hughey@nrc.gov](mailto:john.hughey@nrc.gov).

Sincerely,

A handwritten signature in black ink that reads "John D. Hughey". The signature is written in a cursive style with a large, sweeping "H" and "y".

John Hughey, Project Manager  
Orders Management Branch  
Japan Lessons-Learned Division  
Office of Nuclear Reactor Regulation

Docket Nos.: 50-454 and 50-455

Enclosure:  
Audit plan

cc w/encl: Distribution via Listserv

**Audit Plan  
Byron Station, Units 1 and 2**

**BACKGROUND AND AUDIT BASIS**

On March 12, 2012, the U.S. Nuclear Regulatory Commission (NRC) issued Order EA-12-049, "Order Modifying Licenses with Regard to Requirements for Mitigation Strategies for Beyond Design-Basis External Events" and Order EA-12-051, "Order to Modify Licenses With Regard To Reliable Spent Fuel Pool Instrumentation," (Agencywide Documents Access and Management System (ADAMS) Accession Nos. ML12054A736 and ML12054A679, respectively). Order EA-12-049 directs licensees to develop, implement, and maintain guidance and strategies to maintain or restore core cooling, containment, and spent fuel pool (SFP) cooling capabilities in the event of a beyond-design-basis external event (BDBEE). Order EA-12-051 requires, in part, that all operating reactor sites have a reliable means of remotely monitoring wide-range SFP levels to support effective prioritization of event mitigation and recovery actions in the event of a BDBEE. The orders require holders of operating reactor licenses and construction permits issued under Title 10 of the *Code of Federal Regulations* Part 50 to submit for review, Overall Integrated Plans (OIPs) including descriptions of how compliance with the requirements of Attachment 2 of each order will be achieved.

By letter dated February 28, 2013 (ADAMS Accession No. ML13060A364), Exelon Generation Company, LLC (Exelon, the licensee) submitted its OIP for Byron Station, Units 1 and 2 (Byron) in response to Order EA-12-049. By letters dated August 28, 2013, and February 28, 2014 (ADAMS Accession Nos. ML13241A279 and ML14059A425, respectively), the licensee submitted its first two six-month updates to the OIP. By letter dated August 28, 2013 (ADAMS Accession No. ML13234A503), the NRC notified all licensees and construction permit holders that the staff is conducting audits of their responses to Order EA-12-049 in accordance with NRC Office of Nuclear Reactor Regulation (NRR) Instruction LIC-111, "Regulatory Audits" (ADAMS Accession No. ML082900195). The purpose of the staff's audit is to determine the extent to which the licensees are proceeding on a path towards successful implementation of the actions needed to achieve full compliance with the order. This audit process led to the issuance of the Byron interim staff evaluation (ISE) and audit report (ADAMS Accession No. ML13225A595) on December 17, 2013, and continues with in-office and onsite portions of this audit.

By letter dated March 5, 2013 (ADAMS Accession No. ML13063A265), the licensee submitted its OIP for Byron in response to Order EA-12-051. By letter dated June 07, 2013 (ADAMS Accession No. ML13134A093), the NRC staff sent a request for additional information (RAI) to the licensee. By letters dated July 03, 2013, August 28, 2013, and February 28, 2014 (ADAMS Accession Nos. ML13186A006, ML13241A239, and ML14062A057, respectively), the licensee submitted its RAI responses and first two six-month updates to the OIP. The NRC staff's review to date led to the issuance of the Byron ISE and RAI dated November 04, 2013 (ADAMS Accession No. ML13275A305). By letter dated March 26, 2014 (ADAMS Accession No. ML14083A620), the NRC notified all licensees and construction permit holders that the staff is conducting in-office and onsite audits of their responses to Order EA-12-051 in accordance with NRC NRR Office Instruction LIC-111, as discussed above.

Enclosure

The ongoing audit process, to include the in-office and onsite portions, allows the staff to assess whether it has enough information to make a safety evaluation of the Integrated Plans. The audit allows the staff to review open and confirmatory items from the mitigation strategies ISE, RAI responses from the spent fuel pool instrumentation (SFPI) ISE, the licensee's integrated plans, and other audit questions. Additionally, the staff gains a better understanding of submitted information, identifies additional information necessary for the licensee to supplement its plan, and identifies any staff potential concerns. The audit's onsite portion will occur prior to declarations of compliance for the first unit at each site.

This document outlines the onsite audit process that occurs after ISE issuance as licensees provide new or updated information via periodic updates, update audit information on e-portals, provide preliminary Overall Program Documents (OPDs)/Final Integrated Plans (FIPs), and continue in-office audit communications with staff while proceeding towards compliance with the orders.

Following the licensee's declarations of order compliance, the NRC staff will evaluate the OIPs as supplemented, the resulting site-specific OPDs/FIPs, and, as appropriate, other licensee submittals based on the requirements in the orders. For Order EA-12-049, the staff will make a safety determination regarding order compliance using the Nuclear Energy Institute (NEI) guidance document NEI 12-06, "Diverse and Flexible Coping Strategies (FLEX) Implementation Guide" issued in August, 2012 (ADAMS Accession No. ML12242A378), as endorsed by NRC interim staff guidance (ISG) 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'" (ADAMS Accession No. ML12229A174) as providing one acceptable means of meeting the order requirements. For Order EA-12-051, the staff will make a safety determination regarding order compliance using the NEI guidance document NEI 12-02, "Industry Guidance for Compliance with NRC Order EA-12-051, 'To Modify Licenses with Regard to Reliable Spent Fuel Pool Instrumentation'" (ADAMS Accession No. ML12240A307), as endorsed, with exceptions and clarifications, by NRC ISG JLD-ISG-2012-03 "Compliance with Order EA-12-051, 'Reliable Spent Fuel Pool Instrumentation'" (ADAMS Accession No. ML12221A339) as providing one acceptable means of meeting the order requirements. Should the licensee propose an alternative strategy or other method deviating from the guidance, additional staff review will be required to evaluate if the alternative strategy complies with the applicable order.

### AUDIT SCOPE

As discussed, onsite audits will be performed per NRR Office Instruction LIC-111, "Regulatory Audits," to support the development of safety evaluations. Site-specific OIPs and OPDs/FIPs rely on equipment and procedures that apply to all units at a site, therefore, audits will be planned to support the "first unit at each site." On-site audits for subsequent units at a site will be on an as-needed basis.

The purpose of the audits is to obtain and review information responsive to the Byron OIPs, as supplemented, open and confirmatory items from the mitigation strategies ISE, RAI responses from the SFPI ISE, and to observe and gain a better understanding of the basis for the site's overall programs to ensure the licensee is on the correct path for compliance with the Mitigation

Strategies and Spent Fuel Pool Instrumentation orders. These may include, but are not limited to:

- Onsite review and discussion for the basis and approach for detailed analysis and calculations (Orders EA-12-049, EA-12-051);
- Walk-throughs of strategies and laydown of equipment to assess feasibility, timing, and effectiveness of a given mitigating strategy or integration of several strategies (Order EA-12-049);
- Storage, protection, access, and deployment feasibility and practicality for onsite portable equipment (Order EA-12-049);
- Evaluation of staging, access, and deployment of offsite resources to include Regional Response Center (RRC) provided equipment (Order EA-12-049); and
- Review dimensions and sizing of the SFP area, placement of the SFP level instrumentation, and applicable mounting methods and design criteria (Order EA-12-051).

**NRC AUDIT TEAM**

<b>Title</b>	<b>Team Member</b>
Team Lead / Project Manager	John Hughey
Technical Support	Joshua Miller
Technical Support	On Yee
Technical Support	Matthew McConnell

**LOGISTICS**

The audit will be conducted onsite at Byron on August 18 - 21, 2014. Entrance and exit briefings will be held with the licensee at the beginning and end of the audit, respectively, as well as daily briefings of team activities. Additional details will be addressed over the phone. A more detailed schedule is provided below.

A private conference room is requested for NRC audit team use with access to audit documentation upon arrival and as needed.

## DELIVERABLES

An audit report/summary will be issued to the licensee within 45 days from the end of the audit.

## INFORMATION NEEDS

- Materials/documentation provided in responses to open or confirmatory items and RAIs in the ISEs;
- OPD/FIP (current version), operator procedures, FLEX Support Guidelines (FSGs), operator training plans, RRC (SAFER) Byron Response Plan; and
- Materials/documentation for staff audit questions and/or licensee OIP identified open items as listed in the Part 2 table below

To provide supplemental input to the ongoing audit of documents submitted to the NRC and made available via e-portal, the onsite audit will have three components: 1) a review of the overall mitigating strategies for the site, including, if needed, walk-throughs of strategies and equipment laydown of select portions; 2) a review of material relating to open or confirmatory items and RAIs from the ISEs, staff audit questions, and licensee open items; and 3) additional specific issues requested by NRC technical reviewers related to preparation of a safety evaluation. Each part is described in more detail below:

### Part 1 - Overall Mitigating Strategies and Program Review:

During the onsite audit, please be prepared to conduct a tabletop discussion of the site's integrated mitigating strategies and SFP instrumentation compliance program. This discussion should address the individual components of the plans, as well as the integrated implementation of the strategies including a timeline. The licensee team presenting this should include necessary representatives from site management, engineering, training, and operations that were responsible for program development, and will be responsible for training and execution.

Following the tabletop discussion, please be prepared to conduct walk-throughs of procedures and demonstrations of equipment as deemed necessary by NRC audit team members. Include representatives from engineering and operations that will be responsible for training and execution. At this time we expect, at a minimum, to walk-through the items below. Based on the tabletop presentations and audit activities, this list may change.

**WALK-THROUGH LIST:**

1. Walk-through a sample of strategies that will be delineated by specific NRC technical staff audit team members
2. Walk-through of portable (FLEX) diesel generator (DG) procedures, to include power supply pathways, areas where manual actions are required, and electrical isolation
3. Walk-through of building access procedures, to include any unique access control devices
4. Strategy walk-through of transfer routes from staging and storage areas to deployment locations for both onsite and offsite equipment
5. Strategy walk-through for core cooling and reactor coolant system (RCS) inventory, to include portable pumping equipment, flow paths, and water storage locations and the related reactor systems analysis and calculations
6. Walk-through of communications enhancements
7. Walk-through of SFP area, SFP instrumentation locations, and related equipment mounting areas

**Part 2 – Specific Technical Review Items:**

During the visit, the following audit items will be addressed from the licensee's ISEs (open items (OI), confirmatory items (CI), and SFPI RAIs; audit question list (AQ); licensee OIP, as supplemented, open items; and draft safety evaluation (SE) additional questions. Please provide documents or demonstrations as needed to respond to each item.

<b>Audit Item Reference</b>	<b>Item Description</b>
ISE OI 3.2.1.8.A	Core Subcriticality - The NRC staff has not endorsed the industry-proposed position paper regarding boron mixing. The licensee has indicated that Byron is planning on following this methodology. Thus, further resolution of this issue will be necessary in the next phase of the audit process.
ISE CI 3.1.1.1.A	Storage & Protection of FLEX equipment – Confirm final design of FLEX storage structure conforms to NEI 12-06, Sections 5.3.1, 7.3.1, and 8.3.1 for storage considerations for the hazards applicable to Byron.
ISE CI 3.1.1.3.A	Procedural Interface Considerations (Seismic) – Confirm procedure for measuring key instruments at containment penetrations using portable instrument.
ISE CI 3.1.1.4.A	Off-Site Resources – Confirm RRC local staging area and method of transportation to the site in future 6-month update.
ISE CI 3.1.5.1.A	Protection of Equipment (High Temperature) – Confirm FLEX storage structure will maintain FLEX equipment at a temperature range to ensure its likely function when called upon.

Audit Item Reference	Item Description
ISE CI 3.1.5.3.A	Deployment of Equipment (High Temperature) – Confirm that the effects of high temperature on FLEX equipment have been evaluated in the locations they are intended to operate.
ISE CI 3.2.1.A	RCS cooling & RCS inventory control - Specify which analysis performed in WCAP-17601 is being applied to Byron. Additionally, justify the use of that analysis by identifying and evaluating the important parameters and assumptions demonstrating that they are representative of Byron and appropriate for simulating the ELAP transient.
ISE CI 3.2.1.1.B	ELAP Analysis – Confirm calculations to verify no nitrogen injection into RCS during depressurization.
ISE CI 3.2.1.1.C	Confirm analysis for secondary side [steam Generator] (SG) fouling due to the use of abnormal water sources ( [Refueling Water Storage Tank] (RWST), well water, [service water] (SX) water)
ISE CI 3.2.1.1.D	Complete analysis for length of time prior to depletion of the RWST and determine whether additional boration equipment is needed for Phase 3 coping strategy.
ISE CI 3.2.1.2.B	Reactor Coolant Pump (RCP) Seal Leakage - In some plant designs, the cold legs could experience temperatures as high as 580 °F before cooldown commences. This is beyond the qualification temperature (550 °F) of the O-rings used in the RCP seals. For those Westinghouse designs, a discussion should be provided to justify that (1) the integrity of the associated O-rings will be maintained at the temperature conditions experienced during the ELAP event, and (2) the seal leakage rate of 21 gpm/seal used in the ELAP is adequate and acceptable.
ISE CI 3.2.1.2.E	RCP Seal Leakage Rates – The licensee is requested to provide the manufacturer and model number of the RCP seals and discuss whether or not the RCP and seal combination complies with a seal leakage model described in WCAP-17601.
ISE CI 3.2.1.3.A	Decay Heat - Verify that the Integrated Plan update provides the details of the WCAP 17601-P methodology to include the values of certain key parameters used to determine the decay heat levels. Address the adequacy of the values used.
ISE CI 3.2.1.4.A	Initial Values for Key Plant Parameters and Assumptions – Confirm WCAP-17601-P analyses are bounding for Byron for strategy response or verify plant-specific analyses if more restrictive limits are used due to more restrictive plant specific limits.
ISE CI 3.2.1.4.B	Initial Values for Key Plant Parameters and Assumptions – Confirm calculations to validate 8 hours run time limit on DDAF pump batteries and DDAF room temp for pump operation and human occupancy. Also, confirm site phase 2 staffing study confirms the required time can be met for refilling diesel day tank.
ISE CI 3.2.1.5.A	Monitoring Instruments and Control – Confirm additional parameters evaluated for use in plant procedures/guidance or to indicate imminent or actual core damage.
ISE CI 3.2.1.6.A	Sequence of Events – Confirm that the final timeline has been time validated after detailed designs are completed and procedures are developed. The results may be provided in a future 6-month update.
ISE CI 3.2.1.6.B	Sequence of Events – Confirm analysis to validate Phase 2 pump capacities.

Audit Item Reference	Item Description
ISE CI 3.2.1.9.A	Use of portable pumps – Confirm final design of strategies meets “use of portable pumps” guideline in NEI 12-06 Section 3.2.2 Guideline 13.
ISE CI 3.2.2.A	SFP cooling – Verify procedure for SFP makeup via gravity drain; confirm verification of timeline for performing the strategy; and confirm evaluation of SFP area for steam and condensation affects.
ISE CI 3.2.3.A	Containment – Confirm containment reanalysis supports no Phase 1, 2, and 3 mitigation strategies are required because containment pressure and temperature are maintained within acceptable limits.
ISE CI 3.2.3.B	Containment – Confirm evaluation performed for the need to monitor containment temperature.
ISE CI 3.2.4.1.A	Equipment cooling – Confirm modification has been performed to prevent [diesel-driven auxiliary feedwater] (DDAF) pump from overheating due to cooling water recirculation flow paths within the SX system cycling and overheating the pump within 1 hour.
ISE CI 3.2.4.2.A	Ventilation, Equipment Cooling - Confirm that adequate ventilation is provided in the battery rooms to limit the potential hydrogen buildup during battery charging to less than the hydrogen combustibility limits.
ISE CI 3.2.4.2.B	A discussion is needed on the extreme high/low temperatures effects of the battery’s capability to perform its function for the duration of the ELAP event and hydrogen gas ventilation during recharging batteries during Phase 2 and 3.
ISE CI 3.2.4.3.A	Heat Tracing – Confirm that potential adverse impacts from a loss of heat tracing and normal heating on any equipment credited for ELAP mitigation are adequately addressed. In particular, ensure an RCS inventory and source of borated water is available for a BDBEE associated with extreme cold, ice, and snow.
ISE CI 3.2.4.4.A	Communications - Confirm that upgrades to the site’s communications systems have been completed.
ISE CI 3.2.4.8.A	Electrical Power Sources / Isolation and interactions – confirm class 1E equipment is protected from faults in portable/FLEX equipment and multiple sources do not attempt to power electrical buses.
ISE CI 3.2.4.9.A	Portable Equipment Fuel - Confirm that complete analysis of fuel usage requirements has been developed after the specific FLEX equipment is identified and the fuel usage is determined. A discussion is needed on maintaining the quality of fuel stored in the tanks for extended periods of time
ISE CI 3.2.4.10.A	Load reduction to conserve [direct current] dc power – Confirm sizing calculations for FLEX generators and details of load shedding.
AQ - 2	Deployment of portable equipment (seismic). The licensee’s plan provides a means to move FLEX equipment, but does not provide any information on how the means to move the FLEX equipment is reasonably protected from the event. Discuss the level of protection afforded the truck to demonstrate conformance to NEI 12-06, Section 5.3.1, consideration 5, and Section 7.3.2, consideration 4.

Audit Item Reference	Item Description
AQ - 3	Procedural interface considerations (seismic): Confirm that a reference source and guidance for operators to obtain necessary instrument readings to support implementation of the strategies will be developed as discussed in to NEI 12-06, Section 5.3.3, consideration 1.
AQ - 20	<p>Sequence of events of the ELAP analysis - portable equipment for phases 2 and 3. The PWR Portable Equipment Table for Phases 2 and 3 on pages 55-60 of 67 of the OIP list several pumps. For Phase 2, the table lists 3 high head pumps of 40 gpm at 1500 psia for injection to the RCS, 3 medium head pumps of 300 gpm at 300 psia for injection to the SGs, and 2 general usage self prime pumps of 1100 gpm at 500 ft head. For Phase 3, diesel high pressure positive displacement pumps of 1000-3000 psi shutoff head and 60 gpm capacity, a low pressure pump of 300 psi shutoff head and 2500 gpm maximum flow, a low pressure pump of 500 psi shutoff head and 500 gpm maximum flow, and a low pressure pump of 150 psi shutoff head and 5000 gpm maximum flow.</p> <p>a. Specify the required times for the operator to realign each of the above discussed pumps and confirm that the required times are consistent with the results of the ELAP analysis.</p> <p>b. A number of pump capacities and pressures are identified as the requirements given in WCAP-17601-P. Discuss the analyses that are used to justify the listed flow rates and corresponding pressures of the portable pumps are valid for use at Byron.</p> <p>The information requested for the above items should include a discussion of the computer codes/methods and assumptions used in the analyses, and address the adequacy of the computer codes/methods and assumptions. If the decay heat model used is not the ANS 5.1-1979 + 2 sigma model, discuss the model and address its adequacy for use.</p>
AQ - 21	<p>Operator Actions. Attachment 1A of the Byron OIP lists the operator actions and associated completion times to mitigate the consequences of ELAP.</p> <p>Discuss how the plant specific guidance, mitigation strategies, and the associated administrative controls will be developed and implemented to assure that the required operator actions are consistent with that assumed in the ELAP analysis and can be reasonably achievable within the required completion times.</p>

Audit Item Reference	Item Description
AQ - 27	<p>Ventilation: Provide a discussion on the impact of elevated temperatures, as a result of loss of ventilation and/or cooling, on support equipment being credited as part of the ELAP strategies (e.g., support equipment in the turbine driven auxiliary feedwater pump rooms). In your response, specify whether the initial temperature condition assumed the worst-case outside temperature with the plant operating at full power. Provide the list of support components that are located in the pump rooms that are necessary to ensure successful operation of required pumps. Also provide the qualification level for temperature and pressure for these support components for the duration that the pumps are assumed to perform its mitigating strategies function.</p>
AQ - 32	<p>Accessibility: The Byron OIP omits discussion of the use of communication equipment to support FLEX strategy implementation. Discuss how Byron conforms to the guidance of NEI 12-06, Section 3.2.2, guideline (8).</p>
AQ - 33	<p>Accessibility: The Byron OIP omits discussion of the development of guidance and strategies with regard to access to the Protected Area and internal locked areas. Discuss how Byron will comply with NEI 12-06, Section 3.2.2, guideline (9).</p>
AQ - 35	<p>Water sources: The licensee states it will obtain water from the essential service water (SX) system, yet the assumptions state a loss of normal access to the Ultimate Heat Sink. The licensee states transfer from the condensate storage tank to SX is lost when AC power is lost. Provide additional information regarding water supply to the diesel driven auxiliary feedwater pump, and whether it is qualified to survive seismic, high winds, and flooding events.</p>
AQ - 37	<p>Electrical isolations and interactions. Page 59 of 67, in the Byron OIP, includes a table that lists additional equipment (Medium Voltage and Low Voltage Diesel Generators) for Phase 3; however, this equipment is not discussed in the body of the Integrated Plan. Furthermore, the licensee noted that additional Phase 3 equipment is not needed beyond Phase 2. Describe the purpose of the Medium Voltage and Low Voltage Diesel Generators identified in the table and when they would be used.</p>
AQ - 40	<p>Load Reduction to conserve DC power: Page 5 of the Byron OIP states that “[t]he EC calculation shows the DC bus 112 voltage will be below acceptable values after 3.6 hours without operator action.” Provide the minimum voltage that must be maintained and the basis for the minimum voltage on the DC bus.</p>

Audit Item Reference	Item Description
AQ - 41	<p>Load reduction to conserve DC power:            Page 48 of 67, in the Byron OIP, states that DC power is required to maintain control of Engineered Safety Features equipment and vital instrumentation. Battery chargers are de-energized during a BDBEE leading to loss of DC power and associated functions. The present 125VDC battery coping time is approximately 3 hours 36 minutes, without load shedding and can be extended to 5 hours 40 minutes with deep load shedding consistent with procedure BCA 0.0. Loss of all AC Power.</p> <p>a. Provide the direct current (DC) load profile for the mitigating strategies to maintain core cooling, containment, and spent fuel pool cooling during all modes of operation.</p> <p>b. Provide a detailed discussion on the loads that will be shed from the DC bus, the equipment location (or location where the required action needs to be taken), and the required operator actions needed to be performed and the time to complete each action. In your response, explain which functions are lost as a result of shedding each load and discuss any impact on defense in depth and redundancy.</p> <p>i. Are there any plant components that will change state if vital AC or DC is lost (i.e. de-energized) during this evolution of DC load shed? When the operators manipulate DC breakers to load shed, will plant components actuate, de-energize pumps, etc.? The NRC staff is particularly interested that a safety hazard is not created, such as de-energizing the DC powered seal oil pump for the main generator, which would allow the hydrogen to escape to the atmosphere, which may cause an explosion or fire, and may be compounded by high heat from the main turbine bearings if not cooled.</p>
AQ - 44	<p>Maintenance and Test:            Page 7 of 67, in the Byron OIP notes that Byron will implement an administrative program for FLEX to establish responsibilities, and testing &amp; maintenance requirements. The licensee further stated that standard industry PMs 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.</p> <p>Provide details of the maintenance and testing plan for electrical equipment that is credited for events that require mitigating strategies. The NRC staff seeks to understand how Regulatory Guidance documents, IEEE Standards, manufacturer recommendations, etc. will be utilized to establish the maintenance and testing programs for the portable/FLEX electrical equipment, especially for batteries and diesel generators.</p>

Audit Item Reference	Item Description
AQ - 54	The sequence of events timeline indicates that between 30 minutes and 3.6 hours, FLEX 480V AC generators will be connected and supplying power to battery chargers. Please provide adequate justification that the FLEX generators will be connected within the intended times, even under ELAP scenarios involving seismic/aftershocks, high winds, large debris, etc.
AQ - 55	Off-site resources: The Byron OIP contains insufficient information regarding conformance to items 2 through 10 of NEI 12-06, Section 12.2. Provide additional discussion regarding how Byron will conform with NEI 12-06, Section 12.2, items 2 through 10.
OIP - 1	Primary and secondary storage locations have not been selected yet; once locations are finalized implementation strategies and routes will be assessed for hazard impact.
OIP - 2	The final timeline will be validated once detailed designs are completed and procedures are developed.
OIP - 3	Identification of storage area and creation of the administrative program.
OIP - 4	Develop an administrative program for FLEX responsibilities, and testing and maintenance.
OIP - 7	Develop the storage structure conceptual design.
OIP - 10	Procedure development for Initial spent fuel pool make-up with gravity drain from the RWST.
OIP - 11	Initial calculations were used to determine the fuel pool timelines. Formal calculations will be performed to validate this information during development of the spent fuel pool cooling strategy detailed design.
SFPI RAI 2	Please provide a clearly labeled sketch or marked-up plant drawing of the plan view of the SFP area, depicting the SFP inside dimensions, the planned locations/placement of the primary and back-up SFP level sensor, and the proposed routing of the cables that will extend from the sensors toward the location of the read-out/display device.
SFPI RAI 8	Please provide the following: a) A description of how the two channels of the proposed level measurement system meet this requirement [for separation] so that the potential for a common cause event to adversely affect both channels is minimized to the extent practicable. b) Further information on how each level measurement system, consisting of level sensor electronics, cabling, and readout devices will be designed and installed to address independence through the application and selection of independent power sources, the use of physical and spatial separation, independence of signals sent to the location(s) of the readout devices, and the independence of the displays.

Audit Item Reference	Item Description
SE #1	<p>1. (RCS Venting) The generic analysis in WCAP-17601-P strictly addressed ELAP coping time without consideration of the actions directed by a site's mitigating strategies. WCAP-17792-P extends these analytical results through explicit consideration of mitigating strategies involving RCS makeup and boration. In support of the RCS makeup and boration strategies proposed therein, a generic recommendation is made that Pressurized-Water Reactors vent the RCS while makeup is being provided. Please provide the following information in regard to this topic:</p> <ul style="list-style-type: none"> <li>a. Will the mitigating strategy include venting of the RCS?</li> <li>b. If so, please provide the following information: <ul style="list-style-type: none"> <li>i. The vent path to be used and the means for its opening and closure.</li> <li>ii. The criteria for opening the vent path.</li> <li>iii. The criteria for closing the vent path.</li> <li>iv. Clarification as to whether the vent path could experience two-phase or single-phase liquid flow during an ELAP. If two-phase or liquid flow is a possibility, please clarify whether the vent path is designed to ensure isolation capability after relieving two-phase or liquid flow.</li> <li>v. If relief of two-phase or liquid flow is to be avoided, please discuss the availability of instrumentation or other means that would ensure that the vent path is isolated prior to departing from single-phase steam flow.</li> <li>vi. If a pressurizer power operated relief valve (PORV) is to be used for RCS venting, please clarify whether the associated block valve would be available (or the timeline by which it could be repowered) in the case that the PORV were to stick open. If applicable, please further explain why opening the pressurizer PORV is justified under ELAP conditions if the associated block valve would not be available.</li> <li>vii. If a pressurizer PORV is to be used for RCS venting, please clarify whether FLEX RCS makeup pumps and FLEX steam generator makeup pumps will both be available prior to opening the PORV. If they will not both be available, please provide justification.</li> </ul> </li> <li>c. If RCS venting will not be used, please provide the following information: <ul style="list-style-type: none"> <li>i. The expected RCS temperature and pressure after the necessary quantity of borated makeup has been added to an unvented RCS.</li> <li>ii. Adequate justification that the potential impacts of unvented makeup will not adversely affect the proposed mitigating strategy (e.g., FLEX pump discharge pressures will not be challenged, plant will not reach water solid condition, adequate boric acid can be injected, increased RCS leakage will not adversely affect the integrated plan timeline, etc.).</li> </ul> </li> </ul>

Audit Item Reference	Item Description
SE #2	<p>NSAL-14-1 - On February 10, 2014, Westinghouse issued Nuclear Safety Advisory Letter (NSAL)-14-1, informing licensees of plants with standard Westinghouse RCP seals that 21 gpm may not be a conservative leakage rate for ELAP analysis. This value had been previously used in the ELAP analysis referenced by many Westinghouse Pressurized-Water Reactors, including the generic reference analysis in WCAP-17601-P. Therefore, please clarify whether the assumption of 21 gpm of seal leakage per RCP (at 550 degrees F, 2250 psia) remains valid in light of the issues identified in NSAL-14-1. In so doing, please identify the specifics of the seal leak off line design and #1 seal faceplate material relative to the categories in NSAL-14-1 and identify the corresponding presumed leakage rate from NSAL-14-1 that is deemed applicable.</p>
SE #4	<p>Please provide adequate basis that calculations performed with the NOTRUMP code (e.g., those in WCAP-17601-P, WCAP-17792-P) are adequate to demonstrate that criteria associated with the analysis of an ELAP event (e.g., avoidance of reflux cooling, promotion of boric acid mixing) are satisfied. NRC staff confirmatory analysis suggests that the need for implementing certain mitigating strategies for providing core cooling and adequate shutdown margin may occur sooner than predicted in NOTRUMP simulations.</p>
SE #5	<p>Time to reflux cooling: Please clarify whether procedural guidance for the timing of providing makeup to the reactor coolant system is based on analysis in WCAP-17792-P, pages 3-10 through 3-16. Although the NRC staff recognizes that plant operators require leeway to control pumps and equipment in response to plant indications and other symptoms, the NRC staff considers it prudent that equipment alignments proceed as outlined in the integrated plan to the extent possible. Therefore, please provide justification if the operators would delay the alignment of the FLEX RCS makeup pump(s) beyond the time specified in the integrated plan based on initial indications that the reactor coolant pump seal leakage is lower than the value assumed in the ELAP analysis.</p>
SE #6	<p>Verify that appropriate human factors are applied for the implementation of the FLEX strategies.</p>

Audit Item Reference	Item Description
SE #7	<p>RCP seal leakage: Section 4.4.1 of WCAP-17601 states, in part, that, “The NRC Information Notice (IN) 2005-14 has accepted the use of a 21 gpm assumption in deterministic analyses to develop coping analyses to show compliance with Appendix R. Given that the 50.63 station blackout transient is similar with regard to seal performance, the 21 gpm should also be acceptable for developing ELAP strategies; this has not been called into question by the NRC in inspections (e.g., Component Design Basis Inspections).”</p> <p>It is stated in IN 2005-14 that, “For the Westinghouse RCP seals, as discussed in a recently submitted document on RCP seal performance, a leakage rate of 21 gpm per RCP may be assumed in the licensee’s safe shutdown assessment following the loss of all RCP seal cooling. Assumed leakage rates greater than 21 gpm are only warranted if the increase seal leakage is postulated as a result of deviations from seal vendor recommendations.”</p> <p>It is also stated in IN 2005-14 that, “Even if seal cooling is not reestablished, degradation of the seals for leakage rate to significantly increase is not expected for an indefinite period of time if the RCPs are secured before the seal temperature exceeds 235 degrees F. Restoration of seal cooling may result in cold thermal shock of the seal and possibly cause increased seal leakage.”</p> <p>Address the applicability of the above statements from IN 2005-14 to the ELAP analysis.</p>
SE #8	Additional SFPI question – confirm Electro Magnetic Compatibility compliance.

Part 3 – Specific Topics for Discussion:

1. Draft of Byron OPD/FIP
2. Reactor systems analyses to include a discussion of applicability to WCAP-17601-P, boron mixing, WCAP-17792-P, and NSAL 14-1
3. Training
4. Portable (FLEX) equipment maintenance and testing
5. RRC (SAFER) Response Plan for Byron

### **Proposed Schedule**

#### **Onsite Day 1, Monday, August 18, 2014**

- 1430 Check in at site; Badging
- 1600 Entrance meeting
- 1615 NRC Audit Team meeting
- 1630 Team lead debrief/next day planning with licensee

#### **Onsite Day 2, Tuesday, August 19, 2014**

- 0800 Licensee presentation of strategies
- 1030 NRC Audit Team Activities:
  - Technical area break-out discussions between NRC and licensee staff in the areas of reactor systems, electrical, balance-of-plant/structures, SFPI, and others
  - Review documents relating to open or confirmatory items, RAIs, codes, analyses, etc.
- 1200 Lunch
- 1300 Continue NRC Audit Team Activities
- 1600 NRC Audit Team meeting
- 1630 Team lead daily debrief/next day planning with licensee

#### **Onsite Day 3, Wednesday, August 20, 2014**

- 0800 Check in at site; meet with Senior Resident/Resident
- 0830 Dosimetry and whole body count for Radiological controlled area entrance
- 0900 NRC Mitigating Strategies/SFPI walk-throughs with licensee:
- 1200 Lunch
- 1300 Continue NRC Audit Team Activities
- 1600 NRC Audit Team meeting
- 1630 Team lead daily debrief/next day planning with licensee

**Onsite Day 4, Thursday, August 21, 2014**

0800 Continue NRC Audit Team Activities

1200 Lunch

1300 Continue NRC Audit Team Activities

1400 NRC Audit Team meeting

1500 NRC/Licensee pre-exit meeting

1530 NRC/Licensee exit meeting

1600 Audit closeout/departure

Accession No. ML14083A620), the NRC notified all licensees and construction permit holders that the staff is conducting in-office and onsite audits of their responses to Order EA-12-051 in accordance with NRC NRR Office Instruction LIC-111 as discussed above.

The ongoing audit process, to include the in-office and onsite portions, allows the staff to assess whether it has enough information to make a safety evaluation of the Integrated Plans. The audit allows the staff to review open and confirmatory items from the mitigation strategies ISE, RAI responses from the spent fuel pool instrumentation ISE, the licensee's integrated plans, and other audit questions. Additionally, the staff gains a better understanding of submitted information, identifies additional information necessary for the licensee to supplement its plan, and identifies any staff potential concerns. The audit's onsite portion will occur prior to declarations of compliance for the first unit at each site.

This document outlines the on-site audit process that occurs after ISE issuance as licensees provide new or updated information via periodic updates, update audit information on e-portals, provide preliminary Overall Program Documents/Final Integrated Plans, and continue in-office audit communications with staff while proceeding towards compliance with the orders.

The staff plans to conduct an onsite audit at Byron in accordance with the enclosed audit plan from August 18 - 21, 2014.

If you have any questions, please contact me at 301-415-3204 or by e-mail at john.hughey@nrc.gov.

Sincerely,  
*/RA/*  
John Hughey, Project Manager  
Orders Management Branch  
Japan Lessons-Learned Division  
Office of Nuclear Reactor Regulation

Docket Nos.: 50-454 and 50-455  
Enclosure:  
Audit plan  
cc w/encl: Distribution via Listserv

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**ADAMS Accession No. ML14198A559**

OFFICE	NRR/JLD/JOMB/PM	NRR/JLD/LA	NRR/JLD/JCBB/BC	NRR/JLD/AD
NAME	JHughey	SLent	SBailey (BTitus for)	JMcHale
DATE	07/23/14	07/22/14	07/23/14	07/24/14
OFFICE	NRR/JLD/JOMB/BC	NRR/JLD/JOMB/PM		
NAME	JBowen (MHalter for)	JHughey		
DATE	07/23/14	07/24/14		

OFFICIAL AGENCY RECORD