



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

March 17, 2015

Mr. Bryan C. Hanson
President and Chief Nuclear Officer
Exelon Generation Company, LLC
4300 Winfield Road
Warrenville, IL 60555

SUBJECT: LIMERICK GENERATING STATION, UNITS 1 AND 2 - REPORT FOR THE
AUDIT REGARDING IMPLEMENTATION OF MITIGATING STRATEGIES AND
RELIABLE SPENT FUEL POOL INSTRUMENTATION RELATED TO ORDERS
EA-12-049 AND EA-12-051 (TAC NOS. MF0847, MF0848, MF0854, AND
MF0855)

Dear Mr. Hanson:

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. ML13060A127), Exelon Generation Company, LLC (Exelon, the licensee) submitted its OIP for Limerick Generating Station, Units 1 and 2 (LGS) in response to Order EA-12-049. By letters dated August 28, 2013, February 28, 2014 and August 28, 2014 (ADAMS Accession Nos. ML13240A266, ML14059A219 and ML14241A285, respectively), the licensee submitted its first three 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) Office Instruction LIC-111, "Regulatory Audits" (ADAMS Accession No. ML082900195). This audit process led to the issuance of the LGS interim staff evaluation (ISE) (ADAMS Accession No. ML13337A600) on January 10, 2014, and continues with in-office and onsite portions of this audit.

By letter dated February 28, 2013 (ADAMS Accession No. ML13059A391), the licensee submitted its OIP for LGS in response to Order EA-12-051. By letter dated June 24, 2013 (ADAMS Accession No. ML13171A315), the NRC staff sent a request for additional information (RAI) to the licensee. By letters dated July 18, 2013, August 28, 2013, February 28, 2014 and August 28, 2014 (ADAMS Accession Nos. ML13199A485, ML13241A037, ML14059A223, and ML14241A291, respectively), the licensee submitted its RAI responses and first three six-month updates to the OIP. The NRC staff's review of these submittals led to the issuance of the LGS ISE and RAI dated October 23, 2013 (ADAMS Accession No. ML13273A538). 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.

The ongoing audits allow 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 and updated information, audit information provided on ePortals, and preliminary Overall Program Documents/Final Integrated Plans while identifying additional information necessary for the licensee to supplement its plan and staff potential concerns.

In support of the ongoing audit of the licensee's OIPs as supplemented, the NRC staff conducted an onsite audit at LGS from October 27 - 30, 2014, per the audit plan dated October 9, 2014 (ADAMS Accession No. ML14279A272). The purpose of the onsite portion of the audit was to provide the NRC staff the opportunity to continue the audit review and gain key insights most easily obtained at the plant as to whether the licensee is on the correct path for compliance with the Mitigation Strategies and SFPI orders. The onsite activities included detailed analysis and calculation discussion, walk-throughs of strategies and equipment laydown, visualization of portable equipment storage and deployment, review of staging and deployment of offsite equipment, and review of installation details for SFPI equipment.

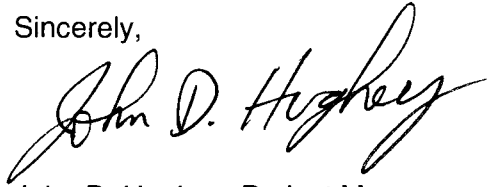
The enclosed audit report provides a summary of the activities for the onsite audit portion. Additionally, this report contains an attachment listing all open onsite audit items currently under NRC staff review.

B. Hanson

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If you have any questions, please contact me at 301-415-3204 or by e-mail at 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 initial "J".

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

Docket Nos.: 50-352 and 50-353

Enclosure:
Audit report

cc w/encl: Distribution via Listserv



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

AUDIT REPORT BY THE OFFICE OF NUCLEAR REACTOR REGULATION
RELATED TO ORDERS EA-12-049 AND EA-12-051 MODIFYING LICENSES
WITH REGARD TO REQUIREMENTS FOR
MITIGATION STRATEGIES FOR BEYOND-DESIGN-BASIS EXTERNAL EVENTS
AND RELIABLE SPENT FUEL POOL INSTRUMENTATION
EXELON GENERATION COMPANY, LLC
LIMERICK GENERATING STATION, UNITS 1 AND 2
DOCKET NOS. 50-352 and 50-353

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. ML13060A127), Exelon Generation Company, LLC (Exelon, the licensee) submitted its OIP for Limerick Generating Station, Units 1 and 2 (LGS) in response to Order EA-12-049. By letters dated August 28, 2013, February 28, 2014 and August 28, 2014 (ADAMS Accession Nos. ML13240A266, ML14059A219 and ML14241A285, respectively), the licensee submitted its first three 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

Enclosure

to Order EA-12-049 in accordance with NRC Office of Nuclear Reactor Regulation (NRR) Office Instruction LIC-111, "Regulatory Audits" (ADAMS Accession No. ML082900195). This audit process led to the issuance of the LGS interim staff evaluation (ISE) (ADAMS Accession No. ML13337A600) on January 10, 2014, and continues with in-office and onsite portions of this audit.

By letter dated February 28, 2013 (ADAMS Accession No. ML13059A391), the licensee submitted its OIP for LGS in response to Order EA-12-051. By letter dated June 24, 2013 (ADAMS Accession No. ML13171A315), the NRC staff sent a request for additional information (RAI) to the licensee. By letters dated July 18, 2013, August 28, 2013, February 28, 2014 and August 28, 2014 (ADAMS Accession Nos. ML13199A485, ML13241A037, ML14059A223, and ML14241A291, respectively), the licensee submitted its RAI responses and first three six-month updates to the OIP. The NRC staff's review of these submittals led to the issuance of the LGS ISE and RAI dated October 23, 2013 (ADAMS Accession No. ML13273A538). 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.

The ongoing audits allow the staff to review open and confirmatory items from the mitigation strategies (MS) 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 and updated information, audit information provided on ePortals, and preliminary Overall Program Documents (OPDs)/Final Integrated Plans (FIPs) while identifying additional information necessary for the licensee to supplement its plan and address staff potential concerns.

In support of the ongoing audit of the licensee's OIPs, as supplemented, the NRC staff conducted an onsite audit at LGS from October 27 - 30, 2014, per the audit plan dated October 9, 2014 (ADAMS Accession No. ML14279A272). The purpose of the onsite portion of the audit was to provide the NRC staff the opportunity to continue the audit review and gain key insights most easily obtained at the plant as to whether the licensee is on the correct path for compliance with the MS and SFPI orders. The onsite activities included detailed analysis and calculation discussion, walk-throughs of strategies and equipment laydown, visualization of portable equipment storage and deployment, review of staging and deployment of offsite equipment, and review of installation details for SFPI equipment.

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 using the Nuclear Energy Institute (NEI) developed 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 Japan Lessons-Learned Directorate (JLD) 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). For Order EA-12-051, the staff will make a safety determination using the NEI developed guidance document NEI 12-02, Revision 1, "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 for compliance, additional staff review will be required to evaluate the alternative strategy in reference to the applicable order.

AUDIT ACTIVITIES

The onsite audit was conducted at the LGS facility from October 27, 2014, through October 30, 2014. The NRC audit team staff was as follows:

Title	Team Member	Organization
Team Lead/Project Manager	John Hughey	NRR/JLD
Technical Support – Containment	Bruce Heida	NRR/JLD
Technical Support – Electrical	Kerby Scales	NRR/JLD
Technical Support – Reactor Systems	Matthew Hardgrove	NRR/JLD
Technical Support – Balance of Plant	Garry Armstrong	NRR/JLD
Technical Support – SFPI	Stephen Wyman	NRR/JLD
Supplemental Support	Richard Montgomery	Region I/Resident Inspector

The NRC staff executed the onsite portion of the audit per the three part approach discussed in the October 9, 2014, plan, to include conducting a tabletop discussion of the site's integrated mitigating strategies compliance program, a review of specific technical review items, and discussion of specific program topics. Activities that were planned to support the above included detailed analysis and calculation discussions, walk-throughs of strategies and equipment laydown, visualization of portable equipment storage and deployment, staging and deployment of offsite equipment, and physical sizing and placement of SFPI equipment.

AUDIT SUMMARY

1.0 Entrance Meeting (October 27, 2014)

At the onsite audit entrance meeting, the NRC staff audit team introduced itself followed by introductions from the licensee's staff. The NRC audit team provided a brief overview of the audit's objectives and anticipated schedule.

2.0 Integrated Mitigating Strategies Compliance Program Overview

Per the audit plan and as an introduction to the site's program, the licensee provided a presentation to the NRC audit team describing the site's strategies to meet the NRC orders. The licensee presented a review of its strategy to maintain core cooling, containment, and SFP cooling in the event of a BDBEE, and the plant modifications being done in order to implement the strategies. Also reviewed were the design and location of the storage facilities for the FLEX equipment, the interface with the National Strategic Alliance for FLEX Emergency Response (SAFER), and the SFPI modification.

3.0 Onsite Audit Technical Discussion Topics

Based on the audit plan, and with a particular emphasis on the Part 2 "Specific Technical Review Items," the NRC staff technical reviewers conducted interviews with licensee technical staff, site walk-downs, and detailed document review for the items listed in the plan. Results of these technical reviews and any additional review items needed from the licensee are documented in the audit item status table in Attachment 3, as discussed in the Conclusion Section below.

3.1 Reactor Systems Technical Discussions and Walk-Downs

- a. NRC staff met with licensee staff and confirmed that the licensee had performed evaluations to demonstrate that the amount of leakage from the reactor core isolation cooling (RCIC) pump seals is acceptable.
- b. NRC staff reviewed the licensee's use of the Modular Accident Analysis Program (MAAP) and the licensee's documentation confirming that MAAP was appropriately applied.
- c. NRC staff reviewed the licensee's analyses regarding the containment heat up rate under Extended Loss of all alternating current (ac) Power (ELAP) conditions and confirmed that the associated impacts were appropriately evaluated.
- d. NRC staff confirmed that the licensee adequately evaluated the ability to align make up water sources for RCIC operation under ELAP conditions.
- e. NRC staff performed plant walk-throughs of the mitigating strategies to provide core cooling and reactor coolant system (RCS) inventory makeup, including portable pumping equipment, flow paths, and water storage locations.
- f. NRC staff reviewed the licensee's evaluations regarding the use of raw makeup water in the RCS and the reactor core to confirm that debris blockage will not impact core cooling.

3.2 Balance of Plant Technical Discussions and Walk-Downs

- a. NRC staff reviewed the licensee's evaluations regarding portable FLEX equipment fuel consumption requirements and the strategy to provide adequate fuel supplies and confirm acceptable fuel quality.
- b. NRC staff confirmed that the strategy was developed and supporting analyses completed to demonstrate that control room habitability conditions will be maintained during ELAP conditions. The licensee issued LGS corrective action item ACT-1340416-46-16 to track development and issuance of a plant procedure to establish alternate control room ventilation.

3.3 Electrical Technical Discussions and Walk-Downs

- a. NRC staff confirmed satisfactory completion of the calculations and specifications regarding the technical basis for the selection and size of the portable FLEX generators and the procedures supporting ELAP coping strategies.
- b. NRC staff reviewed direct current (dc) bus voltage calculations and load shedding strategy details to confirm that the determined minimum dc bus voltage provides sufficient operating voltages at the associated device terminals to ensure proper operation in support of the mitigating strategies.
- c. NRC staff performed walkdowns of the vital battery rooms, auxiliary equipment rooms, 4160V switchgear room, inverter room, and the 217 foot elevation reactor enclosure to confirm the adequacy of the load shedding strategy and associated FLEX support guideline (FSG) procedures.
- d. NRC staff reviewed FSG procedures to confirm that appropriate actions are included to ensure adequate battery room ventilation under ELAP conditions.
- e. NRC staff reviewed procedures and plant drawings and performed walkdowns to confirm that electrical isolation has been addressed such that Class 1E equipment is protected from faults in portable FLEX equipment and that multiple sources do not attempt to power electrical buses.
- f. NRC staff performed walkdowns of portable FLEX equipment staging areas and cable routes including vital battery rooms, auxiliary equipment rooms, diesel bay rooms, the 4160V switchgear room, inverter room and the 217 foot elevation reactor enclosure to confirm the feasibility of required manual actions.

3.4 SFPI Technical Discussions and Walk-Downs

- a. NRC staff walked down the location of the primary and backup SFPI level sensors, cable routing paths, level indicators and electrical junction boxes. NRC staff identified that the primary and back up cable routing paths do not have adequate separation at 2 electrical junction box locations on the refueling floor. During ongoing audit activities, LGS provided additional information stating that the junction boxes have been relocated to provide a separation of approximately 13 feet. The NRC staff determined that relocation of the junction boxes resolves the staff's concern.
- b. NRC staff discussed Electro Magnetic Compatibility (EMC) with the licensee during the onsite SFPI walkdown. The licensee issued LGS corrective action item ACT-1340416-46-39 to track implementation of training for Operations Department personnel related to EMC impacts on the SFPI components. In addition, corrective action item ACT-1340416-46-40 was issued to ensure that SFPI modification acceptance testing includes provisions to test/measure EMC performance/interference following installation of the SFPI system.

3.5 Containment and Ventilation Discussions and Walk-Downs

- a. NRC staff verified that the calculated equipment room temperatures reached with natural ventilation under ELAP conditions are below the qualified temperature of electrical equipment relied upon for RCIC operation.
- b. NRC staff reviewed the LGS containment venting strategy. The licensee provided information for review during the onsite audit regarding the implementation of venting procedures as well as anticipatory containment venting. Containment vent path requirement compliance will be completed by LGS as part of Order EA-13-109, "Order to Modify Licenses with Regard to Reliable Hardened Containment Vents Capable of Operation Under Severe Accident Conditions" (ADAMS Accession No. ML13143A334). Guidance to address potential negative pressure conditions in primary containment are being developed and tracked by LGS corrective action item ACT-2402801-01.

3.6 FLEX Equipment Storage Configuration Discussions and Walk-Downs

The LGS site includes 2 separate protected areas (PAs). One PA includes the main power block and associated structures and a second PA is established at the spray pond (SP) and SP pump house. The LGS FLEX storage configuration consists of 3 storage buildings with one building located in each of the 2 site PAs and the third building located outside of the PAs in the site owner controlled area (SOCA). Each of the FLEX storage buildings located in the PAs store a total of N sets of equipment between the 2 buildings that fully protect against all BDBEEs. All of the FLEX equipment stored in the SP PA Flex building (N_{SP} -building) is required for the SP PA location. Similarly, all of the FLEX equipment stored in the power block PA building (N_{PB} -building) is required for the power block PA location. The FLEX equipment stored in both the N_{SP} -building and the N_{PB} -building is required to provide the LGS mitigating strategies site capability (N capability). The +1 FLEX equipment will be stored in a commercial, American Society of Civil Engineers (ASCE) 7-10 designed, non-tornado protected building (+1-building) located outside of the PA.

NRC staff identified that the LGS N_{SP} -building, the N_{PB} -building and the +1-building FLEX equipment storage configuration is not consistent with the tornado wind/missile hazard reasonable protection configurations described in the NEI guidance contained in Section 7.3.1 of NEI 12-06, Rev. 0. Section 7.3.1.1.a describes a configuration where all FLEX equipment (N+1) is reasonably protected in a structure designed to withstand the tornado wind/missile hazard. The +1 building is not hardened against tornado hazards and, therefore, does not meet the guidance contained in NEI 12-06, Rev. 0, Section 7.3.1.1.a.

NEI 12-06, Rev. 0, Sections 7.3.1.1.b and 7.3.1.1.c describe configurations where FLEX equipment is reasonably protected against tornado hazards by an adequate separation distance and orientation. The NRC position is that configuration 7.3.1.1.b and 7.3.1.1.c require N sets of equipment to be stored in each diverse location. The N-buildings in the SP and power block PAs store only the FLEX equipment required for the associated PA. No equipment from one PA N-building is credited as deployable or relevant to the other PA. The +1-building does not store N sets of FLEX equipment and is not credited to be sufficiently separated from the other N_{SP} and N_{PB} -buildings to afford reasonable tornado protection. Therefore, the LGS FLEX

equipment storage configuration does not meet the guidance contained in NEI 12-06, Rev. 0, Section 7.3.1.1.b or 7.3.1.1.c.

NEI 12-06, Rev. 0, Section 11.3.3 states the following:

FLEX mitigation equipment should be stored in a location or locations informed by evaluations performed per Sections 5 through 9 such that no one external event can reasonably fail the site FLEX capability (N).

NEI 12-06, Rev. 0, Section 10.1, "Aggregation of FLEX Strategies," includes the following:

Provision of at least N+1 sets of portable on-site equipment stored in diverse locations or in structures designed to reasonably protect from applicable BDBEES is essential to provide reasonable assurance that N sets of FLEX equipment will remain deployable to assure success of the FLEX strategies.

Per the guidance above, it is essential to reasonably protect N+1 sets of FLEX equipment from all applicable BDBEES to reasonably assure that N sets (FLEX capability, per section 11.3.3) will remain deployable after the BDBEE. The LGS FLEX equipment storage configuration does not protect the +1 set of FLEX equipment from the applicable BDBEE tornado hazard. Therefore, the LGS FLEX equipment storage configuration does not meet the guidance contained in NEI 12-06, Rev. 0, Section 10.1, in that it only affords reasonable protection from all applicable BDBEES for N sets of FLEX equipment, not N+1 sets, as stipulated in the NEI guidance, as described above.

The NRC staff further identified that the LGS FLEX storage configuration would not support the maintenance and testing provisions contained in Section 11.5.3 of NEI 12-06, Rev. 0. Specifically, section 11.5.3.b states:

Portable equipment may be unavailable for 90 days provided that the site FLEX capability (N) is available.

Should an item of FLEX equipment be made unavailable in the N-building, the site FLEX capability (N) would no longer be available to mitigate a tornado related BDBEE. The corresponding +1 item of FLEX equipment is not considered to be reasonably protected against the tornado hazard, and therefore, is not reasonably assured to be available or remain deployable to assure success of the FLEX strategies. In addition, the LGS mitigating strategies do not include provisions for deployment path debris removal from the +1-building and PA access under ELAP conditions in the time frame required to implement the FLEX strategies. The remaining functional and deployable FLEX equipment, reasonably protected in the LGS N_{SP}-building and the N_{PB}-building, would be less than the site FLEX capability (N). Therefore, the LGS FLEX equipment storage configuration would not meet the condition included in NEI 12-06, Rev. 0, Section 11.5.3.b (site Flex capability (N) is available) stipulated for the allowance of the 90-day portable equipment unavailability.

NRC staff communicated to the licensee that the LGS FLEX storage configuration is not consistent with guidance contained in NEI 12-06, Rev. 0. Further consideration of the LGS FLEX storage configuration by the NRC staff would require that the licensee propose the

configuration as an alternative to the guidance of NEI 12-06, Rev. 0, accompanied with appropriate justification. Associated audit item OIP - 4 will remain open.

3.7 Other Technical Discussion Areas and Walk-Downs

- a. NRC staff confirmed that the power block PA FLEX storage building (N_{PB}-building) and associated deployment path are located above the LGS site design basis flood elevation and will not be impacted by a local intense precipitation (LIP) event. The SP PA FLEX storage building (N_{SP}-building) and associated deployment path are also located above the site design-basis flood elevation. The N_{SP}-building and deployment path areas are subject to a LIP event, but will not be adversely impacted as they are located on an elevated, inclined location and will quickly dissipate any LIP flooding. The +1-building is located above the site design-basis flood elevation and will not be impacted by a LIP event. However, the path from the +1-building to the PA deployment areas can be impacted by a LIP event. The current LGS FLEX strategy does not credit utilizing +1 equipment before phase 3, and any LIP flooding will have dissipated by that time. Since the current LGS FLEX equipment storage configuration is not considered to be resolved by NRC staff (see Section 3.6 above), final resolution of the FLEX storage configuration may require deployability from the +1-building. Therefore, associated audit item CI 3.1.2.2.A will remain open.
- b. NRC staff reviewed the LGS SAFER Playbook input file and the licensee issued LGS corrective action item ACT-1340416-46-38 to track completion and issuance of the playbook.
- c. NRC staff discussed the LGS FLEX sequence of events timeline with the licensee. LGS is continuing to finalize procedures and designs to validate the timeline of events for FLEX. Associated audit item CI 3.2.1.3.A will remain open.
- d. NRC staff discussed engineering change request (ECR) 14-00013 and ECR 14-00019 regarding the mechanical and electrical connectors used for FLEX equipment to confirm that standard connectors will be used for FLEX equipment. In addition, LGS corrective action item ACT 1340416-46-34 was modified to require the FLEX program document to contain information that LGS electrical and mechanical FLEX connectors have been specified to be compatible with NSRC supplied components.
- e. NRC staff discussed the licensee's plans to abide by the generic resolution for refueling and cold shutdown conditions. NRC staff confirmed that the key elements of the generic approach described in NRC endorsement letter dated September 30, 2013 (ADAMS Accession No. ML13267A382), have been incorporated into Exelon procedure OU-AA-103, Rev. 15, "Shutdown Safety Management Program," Section 4.7
- f. NRC staff performed walkdowns and reviewed plant calculations regarding the ability of the portable FLEX pumps to deliver the required flow through the system of FLEX hoses, couplings, valves and elevation changes for the configurations described in the LGS OIP. NRC staff confirmed that the associated analyses are adequate for the LGS FLEX strategies.

- g. NRC staff determined that the LGS FLEX Communications Plan was not sufficiently developed to complete the staff's review. Therefore, the associated LGS FLEX audit item CI 3.2.4.4.A will remain open.
- h. NRC staff discussed the plans and procedures to ensure PA access and access to security doors in the power block during ELAP conditions. The licensee issued LGS corrective action items ACT 1340416-46-32 and ACT-130416-46-42 to track completion of an evaluation of key access and storage requirements to meet FLEX strategy access requirements such that all required keys will be protected from applicable BDBEEs and available during ELAP conditions.
- i. NRC staff discussed FLEX portable lighting requirements with the licensee and determined that the FSGs and FLEX implementation plans were adequate to provide necessary portable lighting under ELAP conditions.
- j. NRC staff reviewed the LGS FLEX documentation associated with RCS makeup, in conjunction with walkdowns of the FLEX equipment connection points, and determined the RCS makeup FLEX strategy is adequate under ELAP conditions.
- k. NRC staff discussed the FLEX deployment path debris removal strategy and noted that no debris removal tools, such as chain saws, are protected. In addition, no protected vehicle/equipment were identified that could be credited for removing the jersey barriers blocking the alternate PA entry point gate. The licensee issued LGS corrective action item A/R 1340416-46-37 to address the adequacy of protected debris removal equipment and identify any additional debris removal tools or equipment that will be required to implement the FLEX deployment path debris removal strategy.
- l. NRC staff discussed the LGS FLEX training activities. Licensed Operator and Equipment Operator FLEX training is in progress and draft long range and short range training plans were reviewed and confirmed to include FLEX implementation training. Final approval of training plans is being tracked in the licensee's corrective action program under corrective action tracking items AR 01614859, Assignment 5, Subtask 4, 18 and 19.
- m. NRC staff discussed the licensee's FLEX equipment maintenance and testing program. LGS corrective action item ACT 1340316-46-26 was issued to track completion of development and implementation of the FLEX component maintenance and testing program. Corrective action item ACT 1340416-46-34 was also issued to create and approve the LGS overall FLEX/ spent fuel pool level instrumentation (SFPLI) program procedure to provide overall governance and oversight for the FLEX and SFPLI strategies, equipment and procedures.
- n. NRC staff reviewed and confirmed the adequacy of the design and deployment strategy for the suction strainers that will provide water from the LGS spray pond for the FLEX pumps.
- o. NRC staff reviewed and confirmed that human factors considerations have been adequately incorporated into the FLEX deployment strategies.

- p. NRC staff discussed the expected adverse environmental conditions during ELAP conditions to confirm with the licensee that RCIC operation will continue for the associated required time period.
- q. NRC staff confirmed that LGS procedures have been revised to direct the establishment of communications and activity coordination to initiate and facilitate the delivery of SAFER off-site resources. LGS also completed the SAFER demonstration of concept exercise in June 2014. Correction action task item ACT-1340416-46-38 was issued to track completion of the LGS SAFER Playbook (Response Plan) in accordance with the SAFER Response Plan Template, RRC-002.

4.0 Exit Meeting (October 30, 2014)

The NRC staff audit team conducted an exit meeting with licensee staff following the closure of onsite audit activities. The NRC staff highlighted items reviewed and noted that the results of the onsite audit trip will be documented in this report. The following audit items were discussed at the exit meeting (see Attachment 3 for additional information):

- a. The NRC staff discussed the LGS FLEX equipment storage building configuration and identified that it is not consistent with the guidance of NEI 12-06, Rev. 0. The LGS configuration will store a total of N sets of equipment in 2 robust buildings that fully protect FLEX equip against all BDBEEs. An additional ASCE 7-10 designed non-tornado protected building will hold the +1 FLEX equipment. Therefore, the LGS FLEX storage strategy does not reasonably protect N+1 FLEX equipment per the guidance of NEI 12-06, Rev. 0, and the NRC staff communicated the need for the submission of an alternative to the guidance. Associated audit item OIP - 4 will remain open pending resolution of this issue. (See Section 3.6 above for additional information.)
- b. The NRC staff discussed debris removal plans associated with the LGS FLEX equipment deployment strategy. The LGS FLEX storage requirements do not include debris removal tools or equipment beyond the Ford F750 and F550 heavy duty trucks. The NRC staff did not consider this as adequate debris removal equipment considering all debris that could reasonably be expected to block the deployment paths. LGS corrective action item A/R 1340416-46-37 has been issued to address the adequacy of protected debris removal equipment and identify any additional debris removal tools or equipment that will be required to implement the FLEX deployment path debris removal strategy.
- c. The NRC staff discussed the SFPI walkdowns conducted during the onsite audit. NRC staff identified that the primary and back up cable routing paths do not have adequate separation at 2 electrical junction box locations on the refueling floor. During ongoing audit activities, LGS provided additional information stating that the junction boxes have been relocated to provide a separation of approximately 13 feet. The NRC staff determined that relocation of the junction boxes resolves the staff's concern.

CONCLUSION

The NRC staff completed all three parts of the October 9, 2014, onsite audit plan. Each audit item listed in Part 2 of the plan was reviewed by NRC staff members while on site. In addition to the list of NRC and licensee onsite audit staff participants in Attachment 1, Attachment 2 provides a list of documents reviewed during the onsite audit portion.

In support of the continuing audit process as the licensee proceeds towards orders compliance for this site, Attachment 3 provides the status of all open audit review items that the NRC staff is evaluating in anticipation of issuance of a combined safety evaluation for both the MS and SFPI orders. The five sources for the audit items referenced below are as follows:

- a. ISE Open Items (OIs) and Confirmatory Items (CIs)
- b. Audit Questions (AQs)
- c. Licensee-identified OIP OIs
- d. SFPI RAIs
- e. Additional Safety Evaluation (SE) needed information

The attachments provide audit information as follows:

- a. Attachment 1: List of NRC staff and licensee staff audit participants
- b. Attachment 2: List of documents reviewed during the onsite audit
- c. Attachment 3: MS/SFPI SE Audit Items currently under NRC staff review (licensee input needed as noted)

While this report notes the completion of the onsite portion of the audit per the audit plan dated October 9, 2014, the ongoing audit process continues as per the letters dated August 28, 2013, and March 26, 2014, to all licensees and construction permit holders for both orders.

Additionally, while Attachment 3 provides a list of currently open items, the status and progress of the NRC staff's review may change based on licensee plan changes, resolution of generic issues, and other NRC staff concerns not previously documented. Changes in the NRC staff review will be communicated in the ongoing audit process.

Attachments:

1. NRC and Licensee Staff Onsite Audit Participants
2. Onsite Audit Documents Reviewed
3. MS/SFPI Audit Items currently under NRC staff review

Onsite Audit Participants

NRC Staff:

John Hughey	NRR/JLD/JOMB
Bruce Heida	NRR/JLD/JCBB
Kerby Scales	NRR/JLD/JERB
Garry Armstrong	NRR/JLD/JCBB

Matthew Hardgrove	NRR/DSS/SRXB
Stephen Wyman	NRR/JLD/JERB
Richard Montgomery	Region I/Resident Inspector

LGS Staff:

Jason Murphy	Senior Manager Operations Support
Craig Nichols	Fukushima Site Lead
George Budock	Regulatory Affairs Engineer
Craig Markle	Fukushima Project Operations Lead
Greg Wallace	Capital Modifications Engineering Manager
Ray George	Electrical Design Engineering Manager
Brandon Shultz	Ops Support Manager
Ken Slough	Structural Design Engineering Manager
Craig Fritz	Senior Reactor Operator
Jay Lyter	Emergency Operating Procedures (EOP)/Severe Accident Management Guidelines/FSG Lead
Abiola Olayiwola	Electrical Design Engineer
Ming Lui	Electrical Design Engineer
Brian Wehrman	Mechanical Design Engineer
Joe Dullinger	Structural Design Engineer
Jean Broillet	Emergency Planning (EP) Manager
Julie McDonald	Senior EP Specialist
Dave Schupp	Corporate Operations Lead
Bob Lance	EOP Program Owner
Dave Molteni	Operations Training Manager

Documents Reviewed

- Design Analysis No. LM-0706, "Fukushima FLEX Hydraulic Analysis," Rev. 0.
- Design Analysis No. LE-0052, "Class 1E Battery Load Duty Cycle Determination," Rev. 15.
- Design Analysis No. LM-0689, "RCIC Pump Room Temperatures for Extended Loss AC Power - Post Fukushima Scenario," Rev. 0.
- Design Analysis No. LM-0708, "Spent Fuel Pool Heatup – FLEX," Rev. 0.
- Chicago Bridge and Iron Calculation 151871-C-G-08005.
- Drawing E-28, "Single Line Meter & Relay Diagram, D114, D124, D134, D144; Safeguard Load Center, 440V – 1 Unit," Rev. 18.
- Drawing E-29, "Single Line Meter & Relay Diagram, D214, D224, D234, D244; Safeguard Load Center, 440V – 2 Unit," Rev. 17.
- Drawing E-33, Sh.1 of 3, "Single Line Meter & Relay Diagram 125/250VDC System - 1 Unit," Rev. 45.
- Drawing E-33, Sh.2 of 3, "Single Line Meter & Relay Diagram 125/250VDC System - 1 Unit," Rev. 47.
- Drawing E-34, Sh.1 of 3, "Single Line Meter & Relay Diagram 125/250VDC System - 2 Unit," Rev. 38.
- Drawing E-55, Sh.1 of 2, "Single Line Meter & Relay Diagram, MCC Load Tabulation, D114-R-G Reactor Area, Safeguard MCC 440V - 1 Unit," Rev. 59.
- Engineering Technical Evaluation 01550669, Rev. 17.
- LGS Updated Final Safety Analysis Report, Section 2.4.8.2.1.
- Electric Power Research Institute Technical Report 3002002749, "Technical Basis for Establishing Success Timelines in Extended Loss of AC Power Scenarios in Boiling Water Reactors Using MAAP4," Final Report February 2014.
- LGS Engineering Change Requests 14-00013 and 14-00019.
- Design Specification No. 151871-DC-C-00001-0.
- Procedure LG-MISC-015, "Use of MAPP in Support of FLEX Implementation," Rev. 0.
- Procedure LG-MISC-012, "MAAP Analysis to Support FLEX Initial Strategy," Rev. 2.
- Procedure OU-AA-103, "Shutdown Safety Management Program," Rev. 15, Section 4.7.
- Procedure T-361, "Division 1 & 2 Safeguard Battery Room Emergency Ventilation," Rev. 0.
- Procedure T-333, "FLEX Generator Connection for Repowering Div 1 Battery Chargers," (Draft).
- Procedure T-334, "FLEX Generator Connection for Repowering Div 2 Battery Chargers," (Draft).
- Procedure E-1, "Loss of All AC Power (Station Blackout)," Rev. 46, Step 3.13.
- Procedure T-363, "Venting Main Generator of Hydrogen During Loss of Offsite Power Event," Rev. 0.
- Procedure T-300, "FLEX Pump Setup at Spray Pond," (Draft).
- Procedure T-301, "Unit 2 RPV Injection From Spray Pond," (Draft).
- Procedure ER-AA-200, "Preventative Maintenance Program," (Draft).

Limerick

Mitigation Strategies/Spent Fuel Pool Instrumentation Safety Evaluation Audit Items:

Audit Items Currently Under NRC Staff Review, Requiring Licensee Input As Noted

Audit Item Reference	Item Description	Licensee Input Needed
ISE OI 3.1.2.2.A	Further review is required regarding how the licensee will address NEI 12-06 Section 6.2.3.2 deployment considerations 2, 4, 5, and 8 with respect to transient floods. This review shall include an applicable procedure review.	The +1 FLEX equipment storage building is located above the site design basis flood elevation and will not be impacted by a LIP event. However, the path from the +1-building to the PA deployment areas can be impacted by a LIP event. The current LGS FLEX strategy does not credit utilizing +1 equipment before phase 3, and any LIP flooding will have dissipated by that time. Since, the current LGS FLEX equipment storage configuration is not considered to be resolved by NRC staff (see Section 3.6 above), final resolution of the FLEX storage configuration may require deployability from the +1-building.
ISE CI 3.2.1.3.A	The licensee stated that the "times to complete actions in the events timeline are based on current supporting analyses." Confirm that the final timeline is validated once detailed designs are completed and procedures are developed.	LGS is continuing to finalize procedures and designs to validate the timeline of events for FLEX.

Audit Item Reference	Item Description	Licensee Input Needed
ISE CI 3.2.4.2.A	It was not clear from the information presented in the integrated plan what analysis or technical basis was used to conclude that the battery room temperature rise is inconsequential. Also, no discussion was presented to address possible low temperature effects. Confirm the adequacy of the battery room ventilation to protect the batteries from the effects of elevated or lowered temperatures.	The licensee is continuing to finalize the associated calculations.
ISE CI 3.2.4.4.A	Confirm that the proposed communications upgrades in the licensee's communications assessment are completed as planned.	NRC staff determined that the LGS FLEX Communications Plan was not sufficiently developed to complete the staff's review.
ISE CI 3.2.4.6.B	With regard to the fuel building habitability, the licensee acknowledged that the evaluation of the spent fuel pool area for steam and condensation has not yet been performed. Confirm that this evaluation is completed, and its resulting conclusions satisfactorily addressed.	The licensee is providing additional information.
AQ - 22	049-RAI-Limerick-22: Support Systems Ventilation - Battery Room. Provide a discussion of battery room ventilation to prevent hydrogen accumulation while recharging the batteries in phase 2 or 3. In your response, include a description of the exhaust path if it is different from the design basis. Also provide information on the adequacy of the ventilation provided in the battery room to protect the batteries from the effects of extreme high and low temperatures.	The licensee is continuing to finalize the associated calculations.

Audit Item Reference	Item Description	Licensee Input Needed
OIP - 4	<p>Identify how strategies will be deployed in all modes (OIP p. 11):</p> <p>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.</p> <p>Identification of storage areas and creation of the administrative program are open items.</p>	<p>The LGS FLEX storage strategy does not reasonably protect N+1 FLEX equipment per the guidance of NEI 12-06, Rev. 0, and the NRC staff communicated the need for the submission of an alternative to the guidance. (See Section 3.6 above for additional information.)</p>

B. Hanson

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

Sincerely,

/RA/

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

Docket Nos.: 50-352 and 50-353

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