



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

January 26, 2015

Mr. John Dent, Jr.
Site Vice President
Entergy Nuclear Operations, Inc
Pilgrim Nuclear Power Station
600 Rocky Hill Road
Plymouth, MA 02360-5508

SUBJECT: PILGRIM NUCLEAR POWER STATION - 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. MF0777 AND MF0778)

Dear Mr. Dent:

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. ML13063A063), Entergy Nuclear Operations (Entergy, the licensee) submitted its OIP for Pilgrim Nuclear Power Station (Pilgrim) in response to Order EA-12-049. By letters dated August 28, 2013, and February 28, 2014 (ADAMS Accession Nos. ML13247A411 and ML14069A320, respectively), Entergy 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) Office Instruction LIC-111, "Regulatory Audits" (ADAMS Accession No. ML082900195). This audit process led to the issuance of the Pilgrim interim staff evaluation (ISE) on December 16, 2013 (ADAMS Accession No. ML13225A587), and continues with in-office and onsite portions of this audit.

By letter dated February 28, 2013 (ADAMS Accession No. ML13063A097), Entergy submitted its OIP for Pilgrim in response to Order EA-12-051. By letter dated June 20, 2013 (ADAMS Accession No. ML13165A276), the NRC staff sent a request for additional information (RAI) to the licensee. By letters dated July 19, 2013, August 28, 2013, and February 28, 2014 (ADAMS Accession Nos. ML13207A142, ML13247A411, and ML14069A307, respectively), the licensee submitted its RAI responses and first two six-month updates to the OIP. The NRC staff issued the Pilgrim ISE and RAI on December 5, 2013 (ADAMS Accession No. ML13333A910). 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 Entergy's OIPs, as supplemented, the NRC staff conducted an onsite audit at Pilgrim from October 6-9, 2014, pursuant to the audit plan dated September 3, 2014 (ADAMS Accession No. ML14231A016). 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, staging and deployment of offsite equipment, and physical sizing and placement of 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 audit items currently under NRC staff review.

J. Dent

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If you have any questions, please contact me at 301-415-1544 or by e-mail at Stephen.Monarque@nrc.gov.

Sincerely,

A handwritten signature in black ink that reads "Stephen Monarque". The signature is written in a cursive style with a large, prominent initial 'S'.

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

Docket No.: 50-293

Enclosure:
Audit report

cc w/encl: Distribution via Listserv



UNITED STATES
NUCLEAR REGULATORY COMMISSION
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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
ENTERGY NUCLEAR OPERATIONS, INC
PILGRIM NUCLEAR POWER STATION
DOCKET NO. 50-293

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. ML13063A063), Entergy Nuclear Operations (Entergy, the licensee) submitted its OIP for Pilgrim Nuclear Power Station, (Pilgrim, PNPS) in response to Order EA-12-049. By letters dated August 28, 2013, and February 28, 2014 (ADAMS Accession Nos. ML13247A411 and ML14069A320, respectively), Entergy 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) Office instruction LIC-111, "Regulatory

Enclosure

Audits" (ADAMS Accession No. ML082900195). This audit process led to the issuance of the Pilgrim interim staff evaluation (ISE) on December 16, 2013 (ADAMS Accession No. ML13225A587), and continues with in-office and onsite portions of this audit.

By letter dated February 28, 2013 (ADAMS Accession No. ML13063A097), Entergy submitted its OIP for Pilgrim in response to Order EA-12-051. By letter dated June 20, 2013 (ADAMS Accession No. ML13165A276), the NRC staff sent a request for additional information (RAI) to the licensee. By letters dated July 19, 2013, August 28, 2013, and February 28, 2014 (ADAMS Accession Nos. ML13207A142, ML13247A411, and ML14069A307, respectively), the licensee submitted its RAI responses and first two six-month updates to the OIP. The NRC staff issued the Pilgrim ISE and RAI on December 5, 2013 (ADAMS Accession No. ML13333A910). 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 (OI) and confirmatory items (CI) from the mitigation strategies ISE, RAI responses from the spent fuel pool instrumentation (SFPI) ISE, the licensee's integrated plans, and other audit questions (AQs). 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 Pilgrim from October 6-9, 2014, pursuant to the audit plan dated September 3, 2014 (ADAMS Accession No. ML14231A016). 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, staging and deployment of offsite equipment, and physical sizing and placement of 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 Project 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 Pilgrim facility from October 6, 2014, through October 9, 2014. The NRC audit team staff was as follows:

Title	Team Member	Organization
Lead Project Manager	Stephen Monarque	NRR/JLD
Branch Chief	Stewart Bailey	NRR/JLD
Technical Support – Electrical	Matthew McConnell	NRR/JLD
Technical Support – Reactor Systems	Joshua Miller	NRR/JLD
Technical Support – Containment	Brett Titus	NRR/JLD
Technical Support – Balance of Plant	Michael Levine	NRR/JLD
Technical Support – SFPI	Carla Roque-Cruz	NRR/JLD
Project Manager	Charles Norton	NRR/JLD
Project Manager	Jason Paige	NRR/JLD

The NRC staff executed the onsite portion of the audit pursuant to the three part approach discussed in the September 3, 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 6, 2014)

At the 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

As an introduction to the site's program, the licensee provided a presentation to the NRC audit team titled "Pilgrim Nuclear Power Station Mitigating Strategies, Spent Fuel Pool instrumentation, and Communication for Beyond Design basis External Events." The licensee discussed its strategy to implement the two orders, the overall FLEX program, the installation of the spent fuel pool level instrumentation, changes to the Emergency Preparedness Communications Program, and the development of the FLEX support guidelines (FSGs). Also, Entergy discussed the design and location of the FLEX

equipment storage facility, the FLEX equipment that would be stored in these facilities, and the access routes to the plant.

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 the Entergy 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

NRC staff met with licensee staff to discuss the timing of the injection of water into the reactor coolant system, the use of raw water in the reactor vessel, the leakage out of the system, and the flow rates needed to make up to the system

ISE CI 3.2.1.1.A through ISE CI 3.2.1.1.E

The NRC staff reviewed the analysis and found that the collapsed level will remain above the top of active fuel and the cooldown rate will be within technical specification (TS) limits. The Pilgrim plan states that their operators would commence a cooldown of the reactor pressure vessel (RPV) at 6 hours in accordance with existing procedures, until a vessel pressure of approximately 120 per square inch gauge (psig) is reached at the Pilgrim TS limit cooldown rate of 100 degrees Fahrenheit (°F) per hour (hr) averaged over a period of one hour. The Modular Accident Analysis Program (MAAP) 4 analysis shows the cooldown rate. Entergy's calculation was performed in accordance with Sections 4.1, 4.2, 4.3, 4.4, and 4.5 of the June 2013 position paper Electric Power Research Institute technical report 3002001785, "Use of Modular Accident Analysis Program in Support of Post Fukushima Applications." Entergy provided the response to the nodalization used, general two phase flow modeling, modeling of the heat transfer and losses, choked flow, vent line pressure losses, and decay heat in attachment 1 of the analysis. The MAAP analysis was performed to support the PNPS integrated plan as documented on the e-portal. Case 1 is the run that Entergy used to represent the strategy. The NRC staff had no further questions and ISE CI 3.2.1.1. A through ISE CI 3.2.1.1.E are closed.

ISE CI 3.2.1.2.A

The NRC staff's review found that the MAAP4 analysis assumed an initial primary system leakage of 25 gallons per minute (gpm) at the normal operating pressure and 1035 psig for the RPV. This 25 gpm value is the allowable TS Section 3.6 primary system coolant total leakage limit for any 24 hour period. The primary system leakage is assumed to start at time zero and vary with reactor pressure. The RPV leakage location is set at the reactor recirculation pump suction nozzle elevation and it was iteratively determined that a leakage area of 3.81E-4 square feet would provide the assumed initial leakage of 25 gpm at normal reactor pressure. The leakage is determined using an area

in order to allow variation in the leakage value depending on primary side pressure conditions. This location and conditions would result in a single phase liquid discharge that flashes to a liquid vapor mixture that is representative of recirculation pump seal leakage. Upon exiting the recirculation pump, the seal leakage will flash a portion of the flow to steam based on saturated conditions in the drywell, creating a steam source and a liquid water source to the drywell that is included in the MAAP4 model. This seal leakage that occurs during FLEX Phase 1 Reactor Core Isolation Cooling (RCIC) high pressure coolant injection (HPCI) system operation does not challenge the RPV makeup capabilities of these systems. It is included to account for potential steam leakage in the drywell and the resulting temperature effects.

In FLEX calculation M1380, RP P-201A/B total seal leakage is assigned a value of 16 gpm at 75 psig for the purpose of evaluating FLEX makeup water supply requirements after RPV depressurization has been performed. The licensee stated that a leakage of 16 gpm at 75 psig would correspond to approximately 60 gpm at the normal operating pressure of 1035 psig, which is higher than the actual leakage of 25 gpm assumed at this condition in the licensee's MAAP4 analysis. The licensee stated that the modest leakage reduction assumed in going from 25 gpm at normal operating pressure to 16 gpm at 75 psig is to account for the potential for disproportionate seal leakage occurring after RPV depressurization, due to internal seal component leakage (commonly referred to as seal face hang up). Entergy, in its Calculation M1380 analysis, assumed the transfer of all decay heat to the suppression pool water such that there is no modeling of the drywell, it is simply assumed to be saturated steam conditions based on the wetwell saturation temperature, which is maximized by this heat transfer. The NRC staff had no further questions and ISE CI 3.2.1.2.A is closed.

Safety Evaluation (SE) No. 2

Entergy is using licensee specific calculation M1380 and MAAP4 to show that its calculation is bounding. Entergy provided a sheet showing the plant specific calculation conservatisms compared to the MAAP4 analysis. The licensee specific calculation showed good engineering practices and conservative assumptions. The NRC staff had no further questions and SE No. 2 is closed.

SE No. 4

The licensee provided information on the quality of the water that would be injected into the RPV, including the suspended solids and calculated the time for the suspended solids to plate out and accumulate blockage. The licensee has multiple water sources that they will try to inject if available. The plan is to inject until top-down core cooling occurs to ensure that there will be core cooling even in the event of blockage at the inlet of the fuel rods. The NRC staff had no further questions and SE No. 4 is closed.

3.2 Electrical Technical Discussions and Walk-Downs

ISE CI 3.2.4.8.A

Entergy provided electrical single line diagrams showing the proposed connections of the Phase 2 and 3 electrical equipment. The NRC staff reviewed the electrical single line diagrams and had no further questions. Therefore, ISE CI 3.2.4.8.A is closed.

ISE CI 3.2.4.8.B and AQ 26

Entergy identified the studies needed to be performed to support FLEX diesel loading and load flow studies. The licensee's Phase 2 FLEX equipment includes a single 150 kilowatt (KW) diesel generator (DG) and two 86 KW DGs. The NRC staff reviewed the electrical load study (PS262, "FLEX Diesel Generator Loading") for the FLEX DGs. The NRC staff had no further questions and ISE CI 3.2.4.8.B and AQ 26 are closed.

ISE CI 3.2.4.10.A and AQ 43

Entergy was requested to provide the direct current (DC) load profile with the required loads for the mitigating strategies to maintain core cooling, containment, and spent fuel pool cooling. During the audit process, Entergy responded that the DC load profiles were developed as part of a new electrical battery FLEX extended operation load flow and battery sizing study PS258, "125V & 250V DC Load Flow Studies – Fukushima Response Project." The NRC staff reviewed Entergy's DC analysis and had no further questions. ISE CI 3.2.4.10.A and AQ 43 are closed

AQ 25

Entergy was requested to evaluate its safety/relief valves (SRVs) qualification against the predicted containment response with FLEX implementation to ensure there will be sufficient DC bus voltage during the extended loss of alternating current power (ELAP) event. SRVs with shuttle valves may also require additional pneumatic supply pressure to actuate. This in turn may require a higher pneumatic pressure and the ability to implement would be a plant specific action. Entergy was requested to provide site-specific timing requirements needed for resources and installation of portable pneumatic supplies and potential higher voltage DC power to reliably actuate SRVs. The NRC staff reviewed Entergy's DC analysis and had no further questions. AQ 25 is closed.

AQ 27

Entergy was requested to provide justification as to why battery powered instrumentation is not available for Suppression Pool Level, Suppression Pool Temperature, and Suppression Pool Pressure. The NRC staff verified that Entergy has the capability to obtain indications for Suppression Pool Level, Temperature, and Pressure as part of its strategy. The NRC staff had no further questions. AQ 27 is closed.

AQ 34

Entergy was requested to justify why the staging and use of the ventilation fans is not identified in the Attachment 1A Sequence of Events of the Overall Integrated Plan. Entergy clarified the use of temporary fans and included a staffing assessment and FSGs. The NRC staff had no further questions and AQ 34 is closed.

AQ 35

Entergy was requested to provide an analysis on the hydrogen gas ventilation in the safety-related battery rooms. Specifically, Entergy was asked to provide discussion on the accumulation of hydrogen during an ELAP event when the batteries will be discharged and then recharged. The NRC staff reviewed Entergy's hydrogen accumulation study for the safety-related battery rooms and had no further questions. AQ 35 is closed.

AQ 37

Entergy was requested to provide a summary of sizing of FLEX DGs, and clarify, if the first FLEX DG staged in the Turbine Building Truck Lock becomes unavailable due to the event and the other two FLEX DGs are dedicated to repowering both 125V DC batteries chargers simultaneously for next 8 hours, how will the 250V DC battery be charged after first 8 hours of Phase 1. The NRC staff reviewed Entergy's Phase 2 FLEX DG sizing study (PS262, "FLEX Diesel Generator Loading") and its plan to connect the two FLEX DGs to the 125V and 250V batteries. The NRC staff had no further questions and AQ 37 is closed.

AQ 44

When transitioning from Phase 1 to Phase 2, the licensee plans to deploy a FLEX DG(s) that will repower the 125 and 250 V DC Battery Chargers to maintain the station DC Power Systems operating indefinitely. Entergy was requested to clarify how the FLEX generators will be connected to the 125 V DC and 250 V DC battery chargers at 8 hours. The NRC staff reviewed Entergy's FSGs and the FLEX DG sizing study (PS262, "FLEX Diesel Generator Loading") and had no further questions. AQ 44 is closed.

3.3 Balance of Plant Technical Discussions and Walk-Downs

ISE CI 3.1.1.2A

While on site, NRC staff met Entergy to discuss ISE CI 3.1.1.2A. The NRC staff walked down the licensee's planned FLEX connection points, hose deployment paths and areas of the plant that operators will be performing manual action. The NRC staff had no further questions regarding FLEX connections, deployment paths and manual actions. ISE CI 3.1.1.2A is closed.

ISE CI 3.1.1.3A

While on site, the NRC staff requested to review Entergy's coping strategy for the failure of seismically qualified electrical equipment, typically outlined in FSG-7. The licensee is currently developing this strategy which will be similar in format to the generic format in FSG-7. This Item should be conformed during the NRC inspection phase. ISE CI 3.1.1.3A is closed.

ISE CI 3.1.3.1.A

While on site, the NRC staff walked down the sea vans and reviewed calculation C15.0.3642-EC 42259, "Evaluation of FLEX Storage Containers for Wind Loads." The NRC staff focused their review on the adequacy of the sea vans to provide reasonable protection to the onsite FLEX equipment. The NRC staff has no further questions regarding the sea vans and ISE CI 3.1.3.1.A is closed.

ISE CI 3.1.3.2.A

While on site, the NRC reviewed Entergy's strategy for pre-staging or deploying FLEX equipment prior to or during a hurricane. Entergy's procedures direct operators to not deploy FLEX equipment before or during a hurricane event. The NRC staff requested Entergy to provide information on the duration and intensity of expected hurricanes at the site and whether FLEX equipment would need to be deployed during a hurricane event. Entergy stated that hurricanes are infrequent and of low intensity at PNPS and that northeasters are the primary high wind/heavy precipitation event of concern. Entergy stated that they will provide a written discussion of the frequency, duration, and intensity of northeasters at PNPS, whether FLEX equipment will need to be deployed during a northeaster, and if FLEX equipment can be deployed during a northeaster. In addition, Entergy needs to provide a discussion on whether the FLEX deployment/refueling trucks are reasonably protected from non-tornado high wind events that affect the entire site. ISE CI 3.1.3.2.A will remain open.

ISE OI 3.2.1.4.A

While on site, the NRC staff reviewed Entergy's FLEX equipment hydraulic analysis, Calculation M1384, "Pilgrim FLEX Hydraulic Analysis," Revision 0. The NRC staff noted that the calculation contained several discrepancies involving the net positive suction head (NPSH) available, the NPSH required for the FLEX pumps, and the ability of the FLEX pump to draw water from Entergy's planned drafting location during extreme low tide. In addition, Entergy's calculation modeled two identical pumps when in actuality the FLEX pumps are different sizes with different power and hydraulic characteristics. Entergy stated that they will revise the hydraulic calculation and provide the updated version to the NRC for review. As such, ISE OI 3.2.1.4.A will remain open.

ISE CI 3.2.1.5.A

While on site, the NRC staff reviewed Entergy's strategy to monitor water flow rates while using FLEX pumps. Entergy stated that flow will be monitored with via flow indicators on portable flow control stations connected inline downstream of the FLEX pumps. The NRC staff has no further questions regarding flow control and monitoring while using FLEX pumps and ISE CI 3.2.1.5.A is closed.

ISE CI 3.2.4.4.A

While on site, the NRC staff walked down areas where operators are required to perform manual actions to support implementation of FLEX strategies. The NRC staff focused on the feasibility of the operator to complete the manual actions during an ELAP event with only portable or hand-held lighting available. Entergy stated that all operators will have head/hardhat mounted lights to eliminate the need to carry lighting. The NRC staff has no further questions regarding manual actions in low light conditions. ISE CI 3.2.4.4.A is closed.

AQ 4

While on site, the NRC staff walked down Entergy's proposed storage locations for their refueling/FLEX towing trucks. The NRC staff noted that the proposed locations of the trucks did not provide reasonable protection of the trucks for tornado winds and tornado generated missiles. Entergy revised their severe weather procedures by adding steps directing operators to relocate one of the trucks to the applicable van location. The NRC staff has no further questions regarding protection of the FLEX refueling/towing trucks and AQ 4 is closed.

AQ 7

While on site, the NRC staff walked down areas of the site affected by a probable maximum precipitation (PMP) event. Entergy stated that the flooding resulting from a PMP event is minimal (1-2 feet in some locations) with duration being less than an hour. Entergy stated that the PMP should not prevent ingress or egress to buildings where access is needed during an ELAP event. In addition, Entergy stated that any ingress of water to buildings is bounded by their design-basis internal flooding analysis. The NRC staff has no further questions regarding the PMP event and access to critical building during an ELAP and AQ 7 is closed.

AQ 8

While on site, the NRC staff reviewed Entergy's tornado wind loading/missile protection and verified the values bound the hurricane hazards. AQ 8 is closed.

AQ 9

While on site, NRC staff walked down the proposed storage locations and sea vans, and reviewed Calculation C15.0.3642-EC 42259, "Evaluation of FLEX Storage Containers for Wind Loads." The NRC staff's review focused on whether the sea vans needed to be tied down to prevent protected equipment from being damaged or becoming airborne. Entergy's calculation used design-basis wind loads and corresponding wind speeds to determine the minimum weight required in each sea van to preclude tipping or sliding during a hurricane event. Entergy plans to add additional ballast weight to the sea vans such that each sea van (without including weight of FLEX equipment) will meet the minimum weight requirement derived in Entergy's calculation. The NRC staff has no further questions regarding anchoring of the sea vans. AQ 9 is closed.

AQ 10

The NRC staff closed AQ 10 as it was similar to ISE CI 3.1.3.2.A.

AQ 12

While on site, NRC staff walked down debris removal equipment. Entergy has redundant debris removal equipment on site that will be located in diverse storage locations during predicted storm events. The NRC staff has no further questions regarding quantity of debris removal equipment and AQ 12 is closed.

AQ 36

While on site, the NRC walked down the turbine building truck lock area. The NRC staff's review focused on the need for ventilation of the truck lock to allow personnel access while the DG is running. Entergy stated that the DG will be stored in the truck lock but will be deployed and operated outside during an ELAP event. The NRC staff has no further questions regarding ventilation of the truck lock and AQ 36 is closed.

AQ 38

While on site, the NRC staff questioned whether heat tracing was needed for any installed equipment. Entergy stated that no credited installed equipment requires heat tracing to perform its intended function in support of FLEX strategies during an ELAP event. The NRC staff has no further questions regarding heat tracing and AQ 38 is closed.

AQ 42

During the audit, the NRC staff reviewed Calculation No. M1394, "PNPS FLEX Strategy Diesel Fuel Study", which discussed Entergy's proposed locations for the emergency DG Fuel Storage Tanks and examined the access routes for the FLEX trucks to these fuel tanks. The NRC staff walked down applicable portions of the plan with Entergy personnel. The NRC staff has no further questions and AQ 42 is closed.

AQ 60

NRC staff reviewed Calculation No. M1394, "PNPS FLEX Strategy Diesel Fuel Study," and walked down applicable portions of the strategy. The NRC staff found that Entergy needs to provide the strategy for transition to phase 3 equipment and supplies. Included in this strategy, Entergy should address:

- ensuring proper electrical phase rotation of the phase three equipment
- refueling the phase three equipment
- means to deliver 120 VAC power.

Therefore, AQ60 will remain open.

AQ 65

The NRC staff closed AQ 65 as it was similar to ISE CI 3.2.4.8.A.

AQ 69

While on site, the NRC staff reviewed the seismic analysis of the ground water wells. Entergy has yet to test the well pumps for seismic survivability. Entergy stated that they will provide the results of the seismic tests to the NRC for review. AQ 69 will remain open.

3.4 Containment and Ventilation Technical Discussions and Walk-Downs

AQ 2

During the onsite portion of the audit, Entergy personnel stated that FLEX generators will be supplying power to the batteries, which support operation of the containment isolation valves. Installed nitrogen tanks will also be supplying the motive force necessary to open the vent valves. Calculation M1386 was provided to the NRC staff for review. This calculation showed that enough nitrogen is available for 10 total cycles of the vent valves before replenishment is necessary. The operation of the valves can be performed from the main control room without any field actions necessary to support this activity. The generators and nitrogen bottles will be protected in accordance with NEI 12-06. The NRC staff has no further questions regarding the strategy to accomplish this task and Audit Question 2 is closed.

AQ 24

Pilgrim Station's FLEX Support Guideline 5.9.7.1 specifies that the Reactor Building truck lock doors in the ground level portion of the Reactor Building, and the Reactor Building roof access air lock and roof hatch in the upper portion of the Reactor Building are opened to provide a natural ventilation pathway to exhaust the hot, humid air in an effort to maintain habitability in the vicinity of the spent fuel pool. During the onsite portion of the audit, Entergy personnel took the NRC staff on a guided walkdown of the aforementioned locations and pointed out the doors which need to be opened. The NRC

staff has no further questions regarding the strategy to accomplish this task and AQ 24 is closed.

AQ 27

During the onsite portion of the audit, Entergy provided more information regarding the instruments which would be available to support the FLEX strategy. Specifically, Entergy stated that the Reactor Pressure Vessel pressure and level, as well as the RCIC and HPCI suction pressure and flow parameters will be continuously powered from the DC battery systems. The Primary Containment parameters of drywell and wetwell pressure, torus bottom pressure, torus water level, and torus airspace and suppression pool temperature will be repowered within 8 hours following an ELAP event. Entergy stated that drywell pressure indication is available on DC powered instruments in the Cable Spreading Room. The RCIC suction pressure is available in the Main Control Room (which may be used as an accurate indication of torus bottom pressure), and that torus water temperature could be obtained using a portable infrared thermometer at readily accessible locations in the Residual Heat Removal/Core Spray Pump Quad Rooms. These readings will be used to accurately monitor torus temperature for the Emergency Operating Procedure Heat Capacity Temperature Limit criteria, which may require actions to begin a controlled RPV depressurization as early as 6 hours into the event when the torus temperature exceeds 170 °F. Additionally, the torus water temperature is conservatively estimated to reach 280 °F (the temperature at which wetwell venting will be commenced) no earlier than 16 hours following an ELAP initiating event. This information was subsequently documented on Entergy's ePortal. The NRC staff has no further questions regarding the strategy to accomplish this task and AQ 27 is closed.

AQ 67

During the onsite portion of the audit, Entergy reiterated that Pilgrim will only be relying on the operation of the RCIC system for the first 10 hours following an ELAP. During that portion of time, the suppression pool is between 170 °F and 235 °F for approximately 3 hours. The cited feasibility study states that at Fukushima Dai-ichi Unit 2, the RCIC system operated with the suppression pool above 212 °F for over 2 days and did not fail until the temperature was between 290 and 300 °F. Based on the information presented in the feasibility study, the expected overlap in time between the continued operation of the Phase 1 equipment and the availability of the Phase 2 equipment (i.e. when the FLEX pumps are planned to be aligned and ready to take over core injection), the NRC staff has no further questions regarding the strategy to accomplish this task and AQ 67 is closed.

3.5 SFPI Technical Discussions and Walk-Downs

NRC staff met with Entergy and reviewed diagrams and walked down the areas showing the locations and routing cables from the SFP area to the display locations. The NRC staff also reviewed documentation related to the mounting of the SFPI to the SFP deck and discussed the issue of electromagnetic interference with Entergy.

SE No. 1

During this audit, the NRC staff discussed the issue of electromagnetic compatibility with Entergy. Specifically, the NRC staff was concerned that electromagnetic interference (EMI) could affect performance of the SFPI during a beyond-design-basis event. The NRC staff reviewed Pilgrim Nuclear Power Station Procedure 2.2.85, "Fuel Pool Cooling and Filtering System," Attachment 11. The NRC staff noted that Entergy addresses the EMI concern with a caution note in the procedure to prohibit the use of cell phones or radio transmissions within the SFP exclusion zone of the SFP level indicators. The NRC staff has no further questions and SE No. 1 is closed.

SFPI RAI No. 1

In response to SFPI RAI No. 1, Entergy provided a drawing of the SFP area that showed the location and placement of the primary and backup SFPI, and the routing of the cables. Entergy also provided Engineering Change package 45088, Rev 0 which describes the arrangement for the SFPI in section 3.1.2.2, "Arrangement". During this audit, the NRC staff walked down Reactor Building SFP area to observe the cable routing areas for the primary and backup SFPI. The NRC staff observed the cables were mostly separated by more than 1 foot apart using conduits and existing cable trays. The cable routing areas were also protected from internal and external missiles. The NRC staff has no further questions and SFPI RAI No. 1 is closed.

SFPI RAI No. 2

In response to SFPI RAI No. 2, the NRC staff reviewed Enercon calculation C15.0.3625, "Spent Fuel Pool Level Probe LE-4816A and LE-4816B Mounting Bracket Evaluation" Rev 0 and drawing C2901, "Pilgrim Spent Fuel Pool Probe Mounting Bracket Details Civil", Rev 0. The NRC staff also saw the proposed location for the SFPI and mounting brackets on the SFP area. The NRC staff noted that the calculations done for the SFPI mounting bracket include consideration of static weight loads and hydrodynamic loads, including sloshing. The NRC staff has no further questions and SFPI RAI No. 2 is closed.

3.6 Other Technical Discussion Areas and Walk-Downs

ISE 3.2.4.4.B

The NRC staff met with Entergy to discuss ISE 3.2.4.4.B Communications Assessment. The NRC staff reviewed Pilgrim Nuclear Power Station Procedure 5.9.11 "BDBEE Communications (FSG-101)" Draft Revision 0 and performed tour of communications areas. The NRC staff observed Entergy's plans to use satellite phones, uninterrupted power supplies, proposed connections to portable DGs, use of repeaters, hand held radios, and rechargeable batteries. Entergy also discussed where this equipment will be located inside the licensee controlled area. The NRC staff had no further questions. Therefore, ISE 3.2.4.4.B is closed.

4.0 Exit Meeting (October 9, 2014)

The NRC staff's 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 open items were discussed at the exit meeting (see Attachment 3 for additional information):

a. ISE OI 3.2.1.4, Portable Equipment Needed to Maintain Core Cooling

Entergy described the use of portable pumps to provide reactor pressure vessel injection. The NRC staff had requested supporting analysis for the diesel driven FLEX pump that demonstrated that the pump was capable of injecting water into the RPV with a sufficient rate to maintain and recover core inventory for both the primary and alternate flow paths. Entergy plans to provide NRC staff with hydraulic calculations and analysis that shows this pump has sufficient net positive suction head.

b. AQ 60, Supplying Fuel Oil to FLEX Equipment

Entergy was requested to describe plans for supplying fuel oil to FLEX equipment and explain how fuel quality will be assured if stored for extended periods of time. Entergy plans to provide NRC staff of procedure that will be used to refuel Phase 3 equipment.

c. AQ 69, Groundwater Well Pumps

Entergy plans to use ground water well pumps during phases 2 and 3. The NRC staff requested that Entergy provided information on the seismic qualification of the pumps. Entergy has not completed shaker test for this pump. The NRC staff plans to review the test results.

c. SE 5, Ventilation Analysis for Electrical Equipment

The NRC staff reviewed the licensee's ventilation analyses for areas containing electrical equipment to ensure that the equipment can perform as expected during a loss of ventilation as a result of ELAP. The NRC staff was able to review calculation M1382, "Pilgrim Nuclear Power Station MCR Heatup for Extended Loss of AC Power (FLEX)," ENTGPG012-PR-01, "Review of FLEX Strategy for Mitigation of Beyond Design Basis External Events," EC0000018842, "RPS – Vital MG Set Room Temperature Evaluation Following a Loss of Normal Ventilation," and M1304, "Vital MG Set Room Temperature during a Loss of Ventilation Event." However, the NRC staff still needs to evaluate Entergy's final ventilation analysis on the electrical switchgear room.

d. SE 7, Extended loss of alternating current during low power modes

Entergy is developing procedures that address the extended loss of alternating current during low power modes.

e. SE 8, Flex Support Guidelines for Transitioning from Phase 2 to Phase 3

Entergy is developing procedures to use equipment provided by the Regional Response Center.

f. SE 9, Diesel 'N' Storage

Entergy believes that one 86 KW DG is sufficient to power all loads and function as 'N' if the 250 volt battery lasts for 10 hours without having to be recharged. The NRC staff has taken this as a generic issue and plans to evaluate the battery's capability to support this duration.

CONCLUSION

The NRC staff completed all three parts of the September 3, 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 Entergy 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 Mitigation Strategies and Spent Fuel Pool Level Instrumentation orders. The five sources for the audit items referenced in Attachment 3 are as follows:

- a. ISE OIs and CIs
- b. AOs
- c. Licensee-identified OIP OIs
- d. Spent Fuel Pool Level Instrumentation RAIs
- e. Additional 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: PNPS Mitigative Strategy/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 September 3, 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:

Stephen Monarque	NRR/JLD
Matthew McConnell	NRR/JLD
Joshua Miller	NRR/JLD
Stewart Bailey	NRR/JLD
Jason Paige	NRR/JLD

Brett Titus	NRR/JLD
Stephen Wyman	NRR/JLD
Chuck Norton	NRR/JLD
Michael Levine	NRR/JLD
Carla P Roque Cruz	NRR/JLD
William Cook	Region 1

Entergy and Support Staff:

Robert M Byrne	Senior Engineer
Bryan Ford	Senior Manager Licensing
David Noyes	Director Regulatory Performance Improvement
P. D. Smith	Project Staff
Ron German	Operator
Paul Cormier	Project ERO Logistics Ltd – Pilgrim Nuclear Power Station
Philip Harizi	Engineer FLEX Engineering Lead
Ed Duda	Project Procedures FSGs and Training
John Bonner	Electrical design Engineer
Dominick Fucito	Mechanical Design Engineer
James Edelhauser	Assistant Project Manager
Tom White	Manager
Grant Flynn	AOM Shift Operations
Gary Sweder	Enercon Engineering Support
Bruce Rancourt	Lead ITC Design
David Stallings	Emergency Planning Communications Lead
Bill Hendy	Lead Procedure Writer
Steve Phillips	Entergy Corp Logistics Lead
Norman Eisenmann	Principal Engineer
Gary W Smith	Consultant
Charles Adey	Procedures Training
Michael Jacobs	Nuclear Oversight Manager
Bill Chenault	Lead Safety Analysis Engineer
Jeff Brown	Engineering Supervisor
Fred Mogolesko	Fukushima Project Manager
David Mannai	Regulatory Assurance
John McDonald	Entergy Operations
Murray Williams	Licensing Specialist
Mike Krupe	Director Major Projects Corporation

Pilgrim Nuclear Plant Documents Reviewed

- Pilgrim Nuclear Power Station Procedure 2.2.85, "Fuel Pool Cooling and Filtering System"
- Document 1-0410-7, "MOHR EFP-IL SFPI System Battery Life Report"
- Calculation procedure C.15.0.3625, Revision 0A, "Spent Fuel Pool Level Probe LE 4816A and LE-4816B Mounting Bracket Evaluation"
- Drawing C2901, "Pilgrim Spent Fuel Pool Probe Mounting Bracket Details Civil"
- Engineering Change Package 45088, "Pilgrim Nuclear Plant Station SFPI"
- Pilgrim Nuclear Power Station procedure 5.9.11 "BDBEE Communications (FSG-101)" Draft Revision 0
- Calculation C15.0.3642-EC 42259 "Evaluation of FLEX Storage Containers for Wind Loads"
- Calculation M1384, "Pilgrim FLEX Hydraulic Analysis," Revision 0
- Calculation M1386, "Pilgrim ,"HCVS Vent Valves AO-5025 and AO-5042B Backup N2 System"
- Pilgrim Station FLEX Support Guideline 5.9.7.1, "Secondary Containment Ventilation"
- Pilgrim Station FLEX Support Guideline 7, "Loss of Vital Instrumentation and Control Power"
- Procedure Number 5.9.5.2, "Retrieval and Staging of FLEX Equipment"
- Calculation No. M1394, "PNPS FLEX Strategy Diesel Fuel Study"
- Calculation No. M1380, "Mechanical Calculation PNPS FLEX Strategy Thermal-Hydraulic Analysis"
- PS258, "125V & 250V DC Load Flow Studies – Fukushima Response Project"
- Procedure 5.9.4, "DC Bus Load Shed & Repower Battery Chargers and Safeguards Panels (FSG-4)"
- PS262, "FLEX Diesel Generator Loading"
- M1382, "Pilgrim Nuclear Power Station MCR Heatup for Extended Loss of AC Power (FLEX)"
- ENTGPG012-PR-01, "Review of FLEX Strategy for Mitigation of Beyond Design Basis External Events"
- EC0000018842, "RPS – Vital MG Set Room Temperature Evaluation Following a Loss of Normal Ventilation"
- M1304, "Vital MG Set Room Temperature during a Loss of Ventilation Event"
- Drawing No. E13, Rev E80, "Single Line Relay & Meter Diagram 125V & 250V DC Systems"
- Drawing No. E14, Rev 38, "Single Line Diagram 120V Instrument AC Systems & +/- 24VDC Power System"
- Drawing No. E14, Rev E10, "Single Line Diagram 120/208/240V Vital AC Control & Power"
- Drawing No. M12 Rev 21, "Equipment Location Turbine Building Plan Ground Floor El. 23' – 0"

- Drawing No. M13 Rev 23, "Equipment Location Turbine Building Plan El. 37' – 0"
- Drawing No. M17 Rev E11, "Equipment Location Reactor Building Plan El. 37' – 0"
- Pilgrim Nuclear Power Station NEI 12-01 Phase 2 Staffing Assessment and accompanying staffing assessment chart (DRAFT)

**Pilgrim Nuclear Power Station
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 3.2.1.4.A	Pages 16, 23, and 63 of the Integrated Plan [NRC Order EA-12-049, dated February 28, 2013, (ADAMS Accession No. ML13063A063)], regarding Portable Equipment to Maintain Core Cooling, Entergy describes the use of portable pumps to provide reactor pressure vessel injection. No technical basis or supporting analysis was provided for the diesel driven FLEX pump capabilities considering the pressure within the RPV and the loss of pressure along with details regarding the FLEX pump supply line routes, length of hose runs, connecting fittings, and elevation changes to show that the pump is capable of injecting water into the RPV with a sufficient rate to maintain and recover core inventory for both the primary and alternate flow paths.	Entergy has action to provide the revised hydraulic calculations and analysis that demonstrate that the portable pump has sufficient net positive suction head.
AQ 60	Describe plans for supplying fuel oil to FLEX equipment (i.e., fuel oil storage tank volume, supply pathway, etc.). Also, explain how fuel quality will be assured if stored for extended periods of time.	Entergy to provide NRC staff of procedure to refuel Phase 3 equipment.
AQ 69	Entergy plans to use ground water well pumps during phases 2 and 3. The staff requested information on the seismic qualification of the pumps.	NRC staff waiting for shaker test on pump. Entergy has not completed this test.

Audit Item Reference	Item Description	Licensee Input Needed
RAI SE No. 5	The NRC staff needs to review the ventilation analysis for areas containing electrical equipment to ensure the equipment can perform as expected during a loss of ventilation as a result of ELAP (Primary Areas will include HPCI/RCIC Pump Rooms, Switchgear Rooms, Main Control Room, and Battery Rooms).	Entergy to finalize their ventilation analysis on the electrical switchgear room.
RAI SE No. 6	As described in Item 5 on page 8 of the integrated plan, confirm that the stresses associated with passing liquid phase water through the SRV tail pipe, including those on the tail pipe, the tail pipe supports, the quencher and the quencher supports are evaluated with acceptable results.	Entergy to confirm whether it has evaluated the issue previously and consider whether additional review from structural experts is necessary to assist in review.
RAI SE No. 7	Extended loss of alternating current during low power modes.	Entergy developing procedures.
RAI SE No. 8	Flex support guidelines for transitioning from Phase 2 to Phase 3.	Entergy to develop procedures to use equipment from the Regional Response Center.
RAI SE No. 9	Diesel 'N' Storage - Entergy believes one 86 KW diesel generator is sufficient as 'N' if the 250 volt battery lasts 10 hours.	Generic issue, NRC staff is evaluating this battery.

J. Dent

- 3 -

If you have any questions, please contact me at 301-415-1544 or by e-mail at Stephen.Monarque@nrc.gov.

Sincerely,

/RA/

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

Docket No.: 50-293

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