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10 CFR 50.4

June 29, 2016
Serial: HNP-16-047

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

Shearon Harris Nuclear Power Plant, Unit 1
Docket No. 50-400
Renewed License Number NPF-63

Subject: Supplement to Notification of Full Compliance with Order EA-12-049, "Order Modifying Licenses with Regard to Requirements for Mitigation Strategies for Beyond-Design-Basis External Events" and with Order EA-12-051, "Order Modifying Licenses With Regard To Reliable Spent Fuel Pool Instrumentation" - Shearon Harris Nuclear Power Plant, Unit 1

References:

1. Nuclear Regulatory Commission (NRC) Order Number EA-12-049, *Order Modifying Licenses With Regard to Requirements for Mitigation Strategies for Beyond-Design-Basis External Events*, Revision 0, dated March 12, 2012, (Agency-wide Documents Access and Management System (ADAMS) Accession No. ML12054A735)

2. Duke Energy Letter, *Notification of Compliance Letter Notification of Full Compliance with Order EA-12-049, "Order Modifying Licenses with Regard to Requirements for Mitigation Strategies for Beyond-Design-Basis External Events" and with Order EA-12-051, "Order Modifying Licenses With Regard To Reliable Spent Fuel Pool Instrumentation" - Shearon Harris Nuclear Power Plant, Unit 1,* dated July 10, 2015, (ADAMS Accession No. ML15192A006)

3. Nuclear Energy Institute (NEI) 12-06, *Diverse and Flexible Coping Strategies (FLEX) Implementation Guide,* Revision 0, dated August 2012, (ADAMS Accession No. ML12242A378)

Ladies and Gentlemen:

On March 12, 2012, the 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 Modifying Licenses With Regard To Reliable Spent Fuel Pool Instrumentation." NRC Order EA-12-049 (Reference 1) required licensees to develop, implement, and maintain guidance and strategies to maintain or restore core cooling, containment and spent fuel pool cooling capabilities following a beyond-design-basis external event. To develop strategies for maintaining or restoring core cooling, licensees evaluated reactor coolant system (RCS) leakage from reactor coolant pump (RCP) seals during an extended loss of all AC power (ELAP). On July 10, 2015, Duke Energy Progress, Inc. (Duke Energy) provided a notification of compliance with these Orders for the Shearon Harris Nuclear Power Plant, Unit 1 (HNP) (Reference 2).

On March 31, 2015, NRC staff requested a RCS leakage margin assessment through an e-mail to resolve outstanding concerns regarding the RCP seals at HNP. The purpose of this margin assessment is to provide information regarding the margin for RCS makeup time, specifically addressing the examples of pertinent information regarding seal leakage as provided by NRC. Duke Energy completed additional analyses to support this assessment in December 2015. Attachment 1 to this letter provides a copy of this RCS leakage margin assessment. The contents of this attachment have been provided to the NRC through the Duke Energy Sharepoint site and there are no outstanding concerns regarding this information.

On November 12, 2015, the NRC staff informed Duke Energy through a conference call that the proposed spent fuel pool (SFP) cooling strategy for HNP was not sufficient since the pump being relied upon for SFP spray is not stored in a seismically robust structure, but rather a commercial grade warehouse building. On January 7, 2016, Duke Energy personnel presented a change to the SFP spray strategy to address this issue through a conference call with NRC staff. On January 27, 2016, the NRC informed Duke Energy through e-mail that the proposed change is acceptable but is considered an alternative to NEI 12-06, "Diverse and Flexible Coping Strategies (FLEX) Implementation Guide," (Reference 3). Attachment 2 to this letter provides a summary of the SFP spray alternative and justification for its acceptability at HNP. The contents of this attachment have been provided to the NRC through the Duke Energy Sharepoint site and there are no outstanding concerns regarding this information.

This letter contains no new regulatory commitments. Should you have any questions regarding this submittal, please contact John Caves, Regulatory Affairs Manager, at 919-362-2406.

I declare under penalty of perjury that the foregoing is true and correct. Executed on June 29, 2016.

Sincerely,

Benjamin C. Waldrep

Attachments:

1. Harris Nuclear Plant Reactor Coolant System Leakage Margin Assessment
2. Harris Nuclear Plant Spent Fuel Pool Spray Alternative Summary

cc: Mr. M. J. Riches, NRC Sr. Resident Inspector, HNP
Ms. M. Barillas, NRC Project Manager, HNP
NRC Regional Administrator, Region II
Mr. S. R. Monarque, NRC Japan Lessons-Learned Project Manager, HNP

containment and spent fuel pool cooling capabilities following a beyond-design-basis external event. To develop strategies for maintaining or restoring core cooling, licensees evaluated reactor coolant system (RCS) leakage from reactor coolant pump (RCP) seals during an extended loss of all AC power (ELAP). On July 10, 2015, Duke Energy Progress, Inc. (Duke Energy) provided a notification of compliance with these Orders for the Shearon Harris Nuclear Power Plant, Unit 1 (HNP) (Reference 2).

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SERIAL HNP-16-047

ATTACHMENT 1

HARRIS NUCLEAR PLANT REACTOR COOLANT SYSTEM LEAKAGE MARGIN ASSESSMENT

SHEARON HARRIS NUCLEAR POWER PLANT, UNIT 1

DOCKET NO. 50-400

RENEWED LICENSE NUMBER NPF-63

Harris Nuclear Plant Reactor Coolant System Leakage Margin Assessment

1. Background and Purpose

NRC Order EA-12-049, “Order Modifying Licenses with Regard to Requirements for Mitigation Strategies for Beyond-Design-Basis External Events,” required licensees to develop, implement, and maintain guidance and strategies to maintain or restore core cooling, containment and spent fuel pool cooling capabilities following a beyond-design-basis external event. To develop strategies for maintaining/restoring core cooling, licensees evaluated reactor coolant system (RCS) leakage from reactor coolant pump (RCP) seals during an extended loss of all AC power (ELAP).

Westinghouse issued NSAL-14-1, Revision 1 on September 9, 2014 and it documents that the nominal RCP seal leakage rate of 21 gallons per minute (gpm), as documented in WCAP-10541, Revision 2, may not be applicable for all plants with Westinghouse RCPs because of the various thermal-hydraulic conditions established by plant-specific seal leak-off piping designs.

The Pressurized Water Reactor (PWR) Owner’s Group issued PWROG-14015-P, Revision 2 in April 2015 to determine RCP seal leak-off flow rates following an ELAP.

The PWR Owner’s Group issued PWROG-14027-P, Revision 3 in April 2015 to evaluate the time to enter reflux cooling and the time at which the core uncovers based on revised seal leak-off flow rates during an ELAP.

Westinghouse issued NSAL-15-2, Revision 0 in March 2015 and it recommends that plants perform a structural analysis of the No. 1 seal leak-off line piping upstream of the flow measurement device at pressures of 2045 pounds per square inch absolute (psia) at a temperature corresponding to the maximum cold leg temperature during RCS natural circulation conditions.

Following issuance of the Watts Bar Nuclear Plant, Units 1 and 2 safety evaluation regarding implementation of mitigating strategies and reliable spent fuel instrumentation related to Orders EA-12-049 and EA-12-051, dated March 27, 2015 (Agency-wide Documents Access and Management System (ADAMS) Accession No. ML15078A193), the NRC requested licensees with Westinghouse RCP seals to review the technical content therein and provide information addressing similar issues. Specifically, the NRC identified (excerpted from the Watts Bar Safety Evaluation) “at the present time, the NRC staff is unable to conclude that Westinghouse’s analytical modeling of RCP seal leakage is acceptable on its own merits.” However, for the purpose of mitigating strategies, the NRC staff can balance the modeling uncertainties and deficiencies of the model with the unique aspect of diverse flexible coping strategies (FLEX). To expedite individual plant resolution, licensees could provide a brief discussion about the margin for RCS makeup time, based on the favorable aspects of individual site mitigating strategies. In addition, the NRC provided examples of pertinent information to include in the margin assessment.

The purpose of this margin assessment is to provide a discussion regarding the margin for RCS makeup time, specifically addressing the examples of pertinent information regarding seal leakage provided by the NRC.

2. RCP Seal Leak-Off Line Configuration

Shearon Harris Nuclear Plant, Unit 1 (HNP) is a three-loop Westinghouse PWR utilizing Model 93A RCPs. The RCP seals are Si_3N_4 and the orifice plate flow meter has an approximately ¼-inch bore. Based on the RCP seals and leak-off line configuration, HNP is a Category 1 plant as categorized by PWROG-14008-P. The Category 1 seal leak-off flow rates calculated in PWROG-14015-P, Revision 2 include an upper bound flow rate of 17.5 gpm at peak RCS temperature and 1500 psia and a 5.7 gpm flow rate at cooldown conditions of 310 psia and 415 degrees Fahrenheit (°F). The Duke Energy Progress, Inc. (Duke Energy) FLEX response for HNP is based upon the RCP seal leakage values identified in PWROG-14015-P, Revision 2.

Analyses to determine the temperature and pressure of the seal leak-off line were performed with a 2045 psia pressure (the NSAL-15-2 recommendation) as a forced input at the seal exit. Using outputs from these analyses, stress analysis of the orifice plate, leak-off piping, and associated supports were performed to show that the seal leak-off piping will remain protected from pressure transients by the orifice throughout the event, and as such the PWROG-14015-P, Revision 2, leak-off flow rates will still apply for HNP.

Similar to the position taken at Watts Bar, an additional analysis was performed by MPR Associates for HNP, under Engineering Change (EC) package 402243 Revision 0. This analysis determined that at the maximum possible #1 seal exit conditions (i.e., 2500 psia at the associated RCS Tcold value of 568°F), the RCP seal return piping satisfy the acceptance criteria during an ELAP condition for faulted conditions and therefore, will remain intact. These calculations also demonstrate that a sufficient number of pipe supports satisfy their faulted structural acceptance criteria to ensure that the RCP seal return piping will remain adequately supported in ELAP conditions.

3. Margin Assessment

The margin assessment was performed using the examples of pertinent information regarding seal leakage provided by the NRC. This assessment highlights the favorable aspects of the HNP FLEX strategy and identifies areas with margin.

3.1. Early RCS Cooldown

Per EOP-ECA-0.0, "Loss of All AC Power," within the note prior to step 38, RCS cooldown should be commenced within 2 hours of a loss of all RCP seal cooling to protect the No. 2 seal. The RCP seals contain O-rings made from 7228C elastomer material, which has been evaluated to withstand up to 582°F for eight hours per Westinghouse Letter LTR-RES-13-153, dated November 11, 2013. With no seal injection in service, reducing RCS pressure to less than 1710 pounds per square inch gauge (psig) within 2 hours minimizes the probability of RCP seal failure.

Additional Favorable Cooldown Information

RCS cold leg temperature should be less than 450°F within 4 hours of the loss of cooling, and RCS temperature and pressure should be less than 350°F and 400 psig within 24 hours. The HNP cooldown strategy in the first 24 hours of an ELAP also supports the integrity of the No. 2 seal per original equipment manufacturer guidance included in Westinghouse Technical Bulletin TB-15-1.

3.2. Early RCS Makeup

In order to identify margin associated with the RCS makeup strategy, two characteristics related to RCS behavior are addressed: (1) adequate boration capability and boron mixing during two-phase natural circulation in the RCS to prevent re-criticality and (2) the predicted time to reflux cooling in the steam generators.

Adequate Boration Capability and Boron Mixing

Per calculation HNP-I/INST-1014, "EOP Setpoint Technical Basis Document," the HNP FLEX strategy for RCS boration and makeup provides initiation of RCS FLEX pump makeup in excess of the RCP seal leakage rate prior to a transition to reduced loop flow conditions. A positive displacement pump rated for 40 gpm at 1600 psig is placed in service, injecting borated water at 7000 parts per million (ppm) or greater to the RCS no later than 10.5 hours into the ELAP. Additionally, the FLEX cooldown of the RCS to less than 400°F is completed by a time no later than 4 hours.

When boration is started at no later than 10.5 hours, the RCS is expected to be less than 400°F and 230 psig. The seal leak-off flow rates from PWROG-14015-P, Revision 2 at these conditions (5.7 gpm per pump, 17.1 gpm total) are significantly less than the 40 gpm capability of the FLEX RCS makeup pump.

The calculation HNP-F/NFSA-0240, "HNP Boration During Extended Loss of AC Power (ELAP) Event," was based on reactivity data for Core Cycle 18. The calculation determined 4256 gallons of at least 7000 ppm borated injection is required to ensure a subcritical margin of 1% or more is maintained. To bound future core cycles, 4800 gallons of boration is required by FSG-008. Calculation HNP-F/NFSA-0253, "HNP Cycle 20 Reload EC Supporting Calculations," Section 3.4, verified this amount provides 29 ppm of margin for Cycle 20.

Calculation HNP-F/NFSA-0240, Case C, determined that letdown of RCS inventory is required in order to create a receptive volume in the pressurizer for the required boration. The time to letdown the required boration volume is 5.82 hours. Per HNP-I/INST-1014, this value is rounded up to 6 hours and increased to 6.5 hours to account for estimated plant component manipulation time for two letdown cycles.

Calculation HNP-F/NFSA-0240 determined that with no boration, the time when the required k_{eff} < 0.99 is not met occurs at 20 hours. Initiating boration at no later than 10.5 hours will begin increasing the RCS boron concentration well in advance of the required 20 hours. Allowance for an additional hour of boron mixing requires boration to be complete by a time no later than 19 hours.

Per Calculation HNP-I/INST-1014, an estimated time of no longer than 4.5 hours is needed to deploy, connect, and initiate RCS boration by implementing FSG-008, "FLEX RCS Boration." When this activity was validated per the HNP FLEX Validation Plan, the validated time was only 1.85 hours.

With the conservative assumption of 4.5 hours deployment, 6.5 hours RCS letdown, and 2 hours boration injection, the total activity time is 13 hours, which means that FSG-008 must be initiated at a time no later than 6 hours of the start of the ELAP. Based on the validated deployment time and rounding in Calculation HNP-I/INST-1014, there is a minimum of 2.8 hours of margin to this time.

The margin inherent in the boration calculation assumptions and inputs therefore show that any return to criticality during an ELAP event would reasonably be expected to occur well beyond the maximum 10.5 hour RCS makeup initiation setpoint, which is documented in the Duke Energy FLEX response for HNP.

Additional conservative assumptions related to boration in HNP-F/NFSA-0240 are:

- The RCP seals are assumed not to leak (i.e., they seal perfectly), which minimizes RCS letdown and maximizes the amount of boron injection required.
- The required boration concentration is determined with all rods inserted, at a temperature of 350°F, and an end-of-life (EOL) core. This is conservative because 350°F is a lower bound and the EOL core is limiting.
- The assumed required final RCS boron concentration after FLEX makeup pump injection is conservatively high, which increases the amount of borated water volume injection to meet shutdown requirements.
- The minimum Technical Specification allowable Boric Acid Tank boron concentration is assumed.
- The minimum Technical Specification allowable Cold Leg Accumulator boron concentration is assumed.
- Minimum cover pressure is assumed in the Cold Leg Accumulators.
- The time to start the FLEX makeup pump is calculated based on the required boron curve at an RCS temperature of 350°F. During boration activities, operators would maintain the plant near 400°F. This conservatively requires the FLEX makeup pump to start earlier than necessary.

Time to Reflux Cooling

Per Westinghouse Letter LTR-LIS-15-82 and PWROG-14027-P, Revision 3, for 3-loop plants in Category 1, HNP will enter reflux cooling at 14.8 hours, with time to uncover the core at 44.9 hours. Initiating RCS boration at no later than 10.5 hours ensures that boration occurs with acceptable loop flow conditions.

Duke Energy compared the 3-loop parameters used in PWROG-14027-P, Revision 3, to the site-specific parameters for HNP. Overall, Duke Energy concluded that the parameters compared favorably and that the 3-loop case is suitable for use at HNP. Where differences exist, they were determined to be minor in nature, resulting in negligible differences.

3.3. Possessing the Capability to Initiate RCS Makeup within "X" Hours (Shorter than Planned Time)

Per HNP-I/INST-1014, an estimated time of no longer than 4.5 hours is needed to deploy, connect, and initiate RCS boration by implementing FSG-008. When this activity was validated per the HNP FLEX Validation Plan, the validated time was 1.85 hours, which was within the 4.5 hour window allotted.

EOP-ECA-0.0, Step 53, directs operators to initiate the ELAP boration strategy in accordance with FSG-008, if the time since event initiation is greater than 6 hours. This step, combined with the timeline contained in Attachment 9 of EOP-ECA-0.0, provide the operator with specific guidance to initiate FSG-008 in sufficient time to start boration.

The storage location for the FLEX RCS makeup pump and hoses is within the Tank Building on the same elevation as the connection points located in the Reactor Auxiliary Building (RAB). The pumps, hoses, and tools required are stored within 150 feet of the operating location. No movement of equipment external to the buildings is required for deployment. The pumps are mounted on carts designed for ready-mobility. The suction and discharge hose runs are only approximately 50 feet in length.

3.4. Having an Abundant Supply of Borated Coolant Onsite and/or Having a Relatively Large Capacity for Injecting Coolant

Step 5 of FSG-008 provides the preferred order of suction source for the FLEX RCS makeup pump for boration as follows: Boric Acid Tank (BAT), Alternate Seal Injection (ASI) Tank, and Reactor Water Storage Tank (RWST). The credited sources are the BAT and the RWST.

Although not a credited system for the FLEX strategy, the ASI pump, if available, would immediately provide 20 gpm of borated flow to the RCS. EOP-ECA-0.0 provides direction to check if the RCP seals should be locally isolated and checks the ASI pump status. FSG-008, Step 2, also requires operators to check if the ASI pump is running.

The flow rate of the FLEX makeup pump is 40 gpm. At this flow rate for an ELAP, there is more than 72 hours of continuous use, borated inventory available. Based on information provided in

Section 3.2 regarding assumed RCP seal leakage, 40 gpm continuous use is conservative, and hence there is margin with regard to borated inventory.

3.5. Having a High Capacity and/or High Pressure RCS FLEX Makeup Pump

A positive displacement pump rated for 40 gpm at 1600 psig will be placed in service, injecting borated water at 7000 ppm or greater to the RCS no later than a time equal to 10.5 hours into the ELAP. Additionally, the FLEX cooldown of the RCS to less than 400°F will be complete by 4 hours.

When boration is started at no later than 10.5 hours, the RCS is expected to be less than 400°F and 230 psig. The seal leak-off flow rates from PWROG-14015-P, Revision 2, at these conditions are significantly less than the 40 gpm capability of the FLEX RCS makeup pump.

3.6. Having the Ability to Monitor RCS Inventory during the Event and Attempting to Implement Makeup More Rapidly If Signs of Increased Leakage Were Detected

Some of the relevant instrumentation available during an ELAP because of the FLEX strategies includes the Reactor Vessel Level Indication System (RVLIS), Neutron Flux Monitoring System, Core Exit Thermocouples, RCS Hot Leg and Cold Leg Temperature, RCS Wide Range Pressure, Pressurizer Level, RWST Level, and BAT Level.

FSG-007, “Loss Of Vital Instrumentation Or Control Power,” provides an alternate strategy for obtaining relevant instrument readings upon a loss of vital instrumentation or control power.

EOP-ECA-0.0, Step 52.a, checks RCS conditions (RVLIS & Pressure) and Step 52.b directs implementation of FSG-001, “Long Term Inventory Control.” Step 52.c checks pressurizer level and directs implementation of FSG-001 if time and personnel are available. FSG-001, will direct RCS boration using FSG-008, if boration is required. FSG-008, note prior to step 3, states that boration flow should be initiated prior to losing natural circulation (single-phase or two phase) such that reflux cooling does not occur.

3.7. Restricting Leakage (i.e. Installation of a Flow Restricting Orifice Not Already Accounted for in the Plan)

As HNP is a Category 1 plant, Duke Energy did not perform any modifications to restrict leakage beyond the flow-restricting orifice already installed in the RCP seal leak-off line.

3.8. NSAL-15-2 Leakoff Line Break

In the e-mail from NRC staff to Duke Energy dated 3/31/15, the NRC also stated the following:

“Regarding leak-off line pressurization Westinghouse NSAL 15-2 describes concerns regarding potential impact on overall RCS leak rate due to a seal leak-off line break during a loss of seal cooling event. While the NRC staff has not yet fully reviewed or endorsed the methodology described in NSAL-15-2, it would be beneficial for licensees to describe how they plan to address this issue for their particular plant configuration.”

As stated in Section 2 above, analyses to determine the temperature and pressure of the seal leak-off line were performed with a 2045 psia pressure (the NSAL-15-2 recommendation) as a forced input at the seal exit. In addition, a case was also run at a more extreme condition, (i.e., 2500 psia at the associated RCS Tcold value of 568°F). Evaluation of the results show the RCP seal return piping satisfy the acceptance criteria during an ELAP condition for faulted conditions and therefore will remain intact. These calculations also demonstrate that a sufficient number of pipe supports satisfy their faulted structural acceptance criteria to ensure that the RCP seal return piping will remain adequately supported in ELAP conditions. Using outputs from these analyses, stress analysis of the orifice plate, leak-off piping, and associated supports were performed to show that the seal leak-off piping will remain protected from pressure transients by the orifice throughout the event, and as such the PWROG-14015-P, Revision 2, Category 1 leak-off flow rates still applies for HNP.

3.9. Additional Considerations

There is additional qualitative margin associated with the PWROG analyses performed in support of this issue. Specifically noted by the NRC in the Watts Bar Nuclear Plant, Units 1 and 2 safety evaluation regarding implementation of mitigating strategies and reliable spent fuel instrumentation related to Orders EA-12-049 and EA-12-051, dated March 27, 2015 ADAMS Accession No. ML15078A193):

- The PWROG's generic ITCHSEAL calculations contain known conservatisms, for example, as observed in the comparison of the results of the generic analysis to the Montereau test data and in the application of the generic leak-off line configuration assumptions for each maximum leakage analysis category to individual plants' leak-off lines.

- Although entry into reflux cooling is undesirable and has not been fully analyzed in the context of an ELAP event, the use of this threshold as an acceptance criterion provides significant margin to prevent uncovering the core and causing severe core damage.

SERIAL HNP-16-047

ATTACHMENT 2

HARRIS NUCLEAR PLANT SPENT FUEL POOL SPRAY ALTERNATIVE SUMMARY

SHEARON HARRIS NUCLEAR POWER PLANT, UNIT 1

DOCKET NO. 50-400

RENEWED LICENSE NUMBER NPF-63

Harris Nuclear Plant Unit Spent Fuel Pool Spray Alternative Summary

Alternative Description:

Should spent fuel pool (SFP) makeup flow be inadequate in keeping the fuel in the SFPs covered with water, Shearon Harris Nuclear Plant, Unit 1 (HNP) can deploy the spray strategy designed to meet 10 CFR 50.54(hh)(2) requirements. This strategy utilizes a 1500 gallon per minute (gpm) Emergency Diesel Makeup Pump (EDMP), which is stored in a Seismic Category 1 structure and is protected from all applicable extreme external hazards at HNP. However, since HNP does not have another pump available to deploy the spray strategy, the N+1 requirement is not met and the proposed means of deploying the spray strategy is considered an alternative to Nuclear Energy Institute (NEI) 12-06, *Diverse and Flexible Coping Strategies (FLEX) Implementation Guide,* Revision 0, dated August 2012, (ADAMS Accession No. ML12242A378).

HNP has reviewed its proposed alternative to the spray strategy against applicable regulatory guidance to demonstrate acceptability.

Guidance:

NEI 12-06, Revision 0, Section 3.2.1.1, General Criteria, states that “For both PWRs and BWRs, the requirement is to keep fuel in the spent fuel pool covered.”

NEI 12-06, Revision 0, Section 3.2.2, Minimum Baseline Capabilities, states that, “In order to support the objective of an indefinite coping capability, each plant will be expected to establish capabilities consistent with Table 3-1 (BWRs) or Table 3-2 (PWRs).” Table 3-2 is applicable to HNP (PWR plant).

NEI 12-06, Revision 0, Table 3-2, “PWR FLEX Baseline Capability Summary,” lists safety functions, methods, and baseline capability requirements. This table includes the spent fuel cooling safety function and the associated baseline capabilities, which includes spray via portable nozzles.

NEI 12-06, Revision 0, Section 3.2.2 also specifies that the N+1 capability applies to the portable FLEX equipment described in Table 3-2 (i.e., to equipment that directly supports maintenance of the key safety functions). Other FLEX support equipment only requires an N capability.

NEI 12-06, Revision 0, Table D-3, “Summary of Performance Attributes for PWR SFP Cooling Functions,” identifies the spent fuel cooling safety function and the associated baseline capabilities, which includes the spray capability via portable monitor nozzles from the refueling floor using a portable pump. The performance attributes listed in this table for this safety function are
(1) Minimum of 200 gpm per unit to the pool or 250 gpm per unit if overspray occurs consistent with 10 CFR 50.54(hh)(2).
(2) This capability is not required for sites that have SFPs that cannot be drained.

Response:

The HNP SFP is fully protected against applicable seismic hazards. From the HNP Final Safety Analysis Report, Section 3.1.52, Criterion 61 Fuel Storage and Handling and Radioactivity Control, “The spent fuel pools are protected from postulated missiles and designed to withstand the seismic events without loss of the pool water or damage to stored fuel.”
From a NRC Memo dated May 21, 2014 (Agency-wide Documents Access and Management System (ADAMS) Accession No. ML14136A126), the Design Basis Safe Shutdown Earthquake (SSE) for HNP bounds the Seismic Reevaluated Hazard (GMRS) in the 1 to 10 Hz range. Therefore, the design of the HNP SFP ensures a seismic event will not drain the SFP and a SFP evaluation is not required per the Electric Power Research Institute Screening Prioritization and Implementation Details (SPID). The HNP suction and return lines to the SFP are located to assure adequate water level is maintained above the spent fuel following a SFP line break. The HNP SFP is not subject to an event that could reduce level below approximately 17 feet above the spent fuel.

Spray to the SFP is only needed if there is a leak in the SFP that lowers the water level below the level of the fuel assemblies. NEI 12-06, Revision 0, section 3.2.1.6, states that an initial SFP condition is that all boundaries of the SFP are intact; thus, the NEI 12-06 guidance to have spray available is a defense-in-depth measure, and the conditions that would require this capability (i.e., draining of the SFP and uncovering of the spent fuel) are extremely unlikely due to the robust construction of the SFP as a Seismic Category I structure.

The HNP FLEX strategies rely on a diesel-driven, 500 horsepower FLEX Emergency Service Water (ESW) pump to provide long-term SFP makeup when other sources of water are unavailable. The FLEX ESW Pump is a horizontal centrifugal pump rated for 3,000 gpm at 150 psi. HNP calculated that the FLEX ESW Pump is capable of transferring water from either ESW pump bay or the Auxiliary Reservoir at a flow of 1,700 gpm. This flow rate exceeds the requirements for SFP makeup and other potentially concurrent demand.

HNP has two portable FLEX ESW Pumps to satisfy the N+1 requirement. During Phase 2 and 3, water can be transferred from the Auxiliary Reservoir using a portable ESW pump. The Auxiliary Reservoir will provide a sustained water supply with essentially an indefinite capacity. The Auxiliary Reservoir and all associated piping are protected from all applicable extreme external hazards at HNP. During Phase 3, water from the Auxiliary Reservoir can be processed by National SAFER Response Center (NSRC) water treatment equipment to supply higher purity makeup water. If necessary, the FLEX ESW pump can be replaced by a pump from the NSRC.

Should SFP makeup flow be inadequate in keeping the fuel in the SFPs covered with water, HNP can deploy the spray strategy that utilizes an Emergency Diesel Makeup Pump (EDMP).

HNP’s analysis contained in Engineering Change (EC) package 291688 shows that following a full core offload to the SFP, about 61.9 hours are available to implement makeup before boil-off results in the SFP water level dropping to a level that would uncover fuel assemblies. HNP can provide SFP makeup in advance of this timeline.

Conclusion:

With consideration of the 61.9 hour time period estimated for the SFP boil-off to decrease pool level to the top of the spent fuel, HNP has deemed an “N” set of equipment to support the SFP spray strategy is acceptable.

A description of the fuel pool cooling strategy, the EC package 403144 description that supported the relocation of the pump, and a sketch of the Emergency Diesel Generator 2A Bay FLEX Equipment Layout that shows the EDMP in protected storage have been posted on the HNP Sharepoint for reference.