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November 1, 2021
L-21-245

10 CFR 50.54(bb)
10 CFR 72.218

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

SUBJECT:

Perry Nuclear Power Plant, Unit No. 1
Docket No. 50-440, License No. NPF-58
Perry Nuclear Power Plant, Unit No. 1 ISFSI
Docket No. 72-69
Irradiated Fuel Management Plan

In accordance with 10 CFR 50.54(bb), Energy Harbor Nuclear Corp. (EHNC), on behalf of Energy Harbor Nuclear Generation LLC (EHNG) and itself, hereby submits the Irradiated Fuel Management Plan (IFMP) for the Perry Nuclear Power Plant, Unit No. 1 (PNPP) for Nuclear Regulatory Commission (NRC) review and preliminary approval. Although 10 CFR 50.54 (bb) requires an IFMP submittal five years prior to license expiration, as communicated in EHNC correspondence dated May 15, 2020 (ADAMS Accession No. ML20161A353), EHNC intends to submit a license renewal application no later than three years prior to expiration of the existing license to allow continued operation of the PNPP.

The IFMP is based, in part, on a PNPP decommissioning cost estimate (DCE), which included elements associated with spent fuel management. The PNPP DCE was prepared in 2020. By letter dated March 29, 2021, EHNC submitted to the NRC the decommissioning trust fund financial status report for its four operating nuclear facilities in accordance with 10 CFR 50.75(f)(1). Enclosure C in that letter provided the DCE for PNPP.

The DCE assumes that PNPP is placed and maintained in a condition that allows it to be safely stored and subsequently decontaminated. This approach for decommissioning is known as SAFSTOR. EHNC has not made a final determination on the decommissioning approach for PNPP. EHNC may select a different decommissioning option in the future, recognizing that the chosen option must meet NRC requirements for decommissioning funding.

Perry Nuclear Power Plant, Unit No. 1
L-21-245
Page 2

There are no regulatory commitments included in this submittal. If there are any questions or if additional information is required, please contact Mr. Phil H. Lashley, Manager - Fleet Licensing at (330) 696-7208.

Sincerely,

A handwritten signature in black ink, appearing to read "Rod L. Penfield". The signature is written in a cursive style with a large, looping "P" and "L".

Rod L. Penfield

Attachment:

Perry Nuclear Power Plant, Unit No. 1 Irradiated Fuel Management Plan

cc: NRC Region III Administrator
NRC Project Manager
NRC Resident Inspector

Attachment
L-21-245

Perry Nuclear Power Plant, Unit No. 1
Irradiated Fuel Management Plan
Page 1 of 9

Background

10 CFR Part 50.54(bb) requires licensees to establish a program to manage and provide funding for the management of spent fuel at the reactor site until title and possession of the fuel is transferred to the United States Department of Energy (DOE) for ultimate disposal. The Perry Nuclear Power Plant, Unit No. 1 (PNPP) Irradiated Fuel Management Plan (IFMP), described herein, is based, in part, on a decommissioning cost estimate (DCE) that was prepared in 2020 for PNPP, which includes elements associated with spent fuel management. The DCE identifies the details, schedules, and costs associated with spent fuel management activities described in the PNPP IFMP, along with license termination and site restoration activities and costs.

Pursuant to 10 CFR 50.75(f)(1) on March 29, 2021, Energy Harbor Nuclear Corp. (EHNC) submitted the decommissioning trust fund financial status report for its four operating nuclear facilities. Enclosure C of that report is a copy of the PNPP DCE. The DCE describes the bases for the assumptions regarding DOE acceptance of spent fuel from the industry and from PNPP.

As stated in the DCE (and subject to the assumptions, qualifications, and reservations stated therein), this IFMP is based on the assumption that PNPP shuts down by March 18, 2026¹. This IFMP presumes the DOE will commence acceptance of PNPP's spent fuel in 2038 and completes removal of spent fuel from the site by 2066 consistent with the most recent DOE spent fuel management and acceptance strategy² described below.

¹ The shutdown date of March 18, 2026 is based on an operating license expiration date that was in place when development of the estimate began. On October 8, 2020, the NRC approved an extension from the March 18, 2026 license expiration date to November 7, 2026 (ADAMS Accession No. ML20216A354). The impact of extending the shutdown date is considered negligible and would not have a significant impact on the estimate.

² DOE currently has no plans, program, or schedule in place for acceptance of utility spent fuel. However, for these purposes, certain simplifying assumptions must be made regarding the schedule and rate of DOE performance. Therefore, while DOE's Standard Contract governing the acceptance of spent fuel allows for alternative removal schedules, including priority for shutdown reactors and exchanges of allocations, for purposes of this estimate DOE acceptance is assumed to commence in 2038 from PNPP and in accordance with spent fuel shipment schedules that are based upon published historic acceptance priority rankings by DOE. Nothing herein should be interpreted as a concession or admission of any kind for purposes other than for this submission. Such other purposes would include, but are not limited to, disputes regarding DOE's legal or contractual acceptance obligations, or damages claims for recovery of incurred costs.

Spent Fuel Management Strategy

EHNC assumes that, as stated in the DOE's "Strategy for the Management and Disposal of Used Nuclear Fuel and High-Level Waste," dated January 2013, the DOE will start accepting spent fuel for storage from the nation's commercial nuclear plants beginning in 2025 for placement in a consolidated interim storage facility (CISF) that starts operation in 2025. The DCE assumes that PNPP will shutdown and cease operations in 2026 and that PNPP spent fuel will be accepted for placement in the CISF. Using the rankings for spent fuel receipt, as delineated in the Office of Civilian Radioactive Waste Management reports, "Annual Capacity Report," dated June 1987, and "Acceptance Priority Ranking & Annual Capacity Report," dated July 2004, PNPP fuel would be accepted at the DOE storage facility starting in 2038.

The spent fuel pool will contain discharged fuel from the previous refueling cycles, as well as the final reactor core at shutdown. Immediately after shutdown, spent fuel will be located in the spent fuel pool and in canisters located on an independent spent fuel storage installation (ISFSI). During the four-year period after the shutdown, the spent fuel from the spent fuel pool would be packaged into canisters and transferred to the ISFSI for interim storage. This period provides the necessary cooling time for the spent fuel to meet the decay heat requirements for placement in dry storage.

The current PNPP dry fuel storage system consists of a combination of the Holtec International HI-STORM 100S System (with a 68-fuel assembly capacity) canister and the HI-STORM FW-BWR storage system (with an 89-fuel assembly capacity) canister. The systems consist of a Multi-Purpose Canister (MPC) (storage and transport) and a concrete shield (overpack). The MPCs are assumed for this purpose to be transferred directly to the DOE.

EHNC has constructed an ISFSI at PNPP to support plant operations. The ISFSI operates under a general license pursuant to 10 CFR 72.210. The current size of the ISFSI pad is 347 feet by 75 feet. Total capacity of the pad is expected to be 77 MPCs holding spent fuel and 4 MPCs holding greater than Class C waste. The ISFSI will continue to operate until such time that the transfer of spent fuel to the DOE can be completed. The DCE assumes that the PNPP spent fuel and has been transferred to the DOE by 2066. In accordance with 10 CFR 72.30(b), an updated ISFSI DCE is being submitted separately from this IFMP.

Table 1 provides a listing of the location of the spent fuel from 2021 until the spent fuel has been accepted by the DOE.

Table 1 – Spent Fuel Management Schedule
(Fuel Assembly Location)¹

| Year | Pool Inventory | ISFSI Inventory | DOE Acceptance |
|------|----------------|-----------------|----------------|
| 2021 | 3,233 | 1,700 | 0 |
| 2022 | 2,877 | 2,056 | 0 |
| 2023 | 3,165 | 2,056 | 0 |
| 2024 | 2,720 | 2,501 | 0 |
| 2025 | 3,008 | 2,501 | 0 |
| 2026 | 3,756 | 2,501 | 0 |
| 2027 | 3,756 | 2,501 | 0 |
| 2028 | 3,756 | 2,501 | 0 |
| 2029 | 1,976 | 4,281 | 0 |
| 2030 | 0 | 6,257 | 0 |
| 2031 | 0 | 6,257 | 0 |
| 2032 | 0 | 6,257 | 0 |
| 2033 | 0 | 6,257 | 0 |
| 2034 | 0 | 6,257 | 0 |
| 2035 | 0 | 6,257 | 0 |
| 2036 | 0 | 6,257 | 0 |
| 2037 | 0 | 6,257 | 0 |
| 2038 | 0 | 6,131 | 126 |
| 2039 | 0 | 5,703 | 428 |
| 2040 | 0 | 5,497 | 206 |
| 2041 | 0 | 5,256 | 241 |
| 2042 | 0 | 5,256 | 0 |
| 2043 | 0 | 4,969 | 287 |
| 2044 | 0 | 4,718 | 251 |
| 2045 | 0 | 4,445 | 273 |
| 2046 | 0 | 4,146 | 299 |
| 2047 | 0 | 4,146 | 0 |
| 2048 | 0 | 3,865 | 281 |
| 2049 | 0 | 3,577 | 288 |
| 2050 | 0 | 3,577 | 0 |
| 2051 | 0 | 3,293 | 284 |
| 2052 | 0 | 3,014 | 279 |
| 2053 | 0 | 3,014 | 0 |
| 2054 | 0 | 2,732 | 282 |
| 2055 | 0 | 2,450 | 282 |
| 2056 | 0 | 2,226 | 224 |
| 2057 | 0 | 2,002 | 224 |
| 2058 | 0 | 1,778 | 224 |
| 2059 | 0 | 1,554 | 224 |
| 2060 | 0 | 1,330 | 224 |
| 2061 | 0 | 1,106 | 224 |

Table 1 (continued)

| Year | Pool Inventory | ISFSI Inventory | DOE Acceptance |
|-------|----------------|-----------------|----------------|
| 2062 | 0 | 882 | 224 |
| 2063 | 0 | 658 | 224 |
| 2064 | 0 | 434 | 224 |
| 2065 | 0 | 210 | 224 |
| 2066 | 0 | 0 | 210 |
| | | | |
| Total | - | - | 6,257 |

Note:

1. Fuel location is as of the date of the submittal.

Schedule

Table 2 provides a summary of the spent fuel management activities described in the DCE. The table provides the decommissioning period associated with the spent fuel program activity, its cost, and the approximate duration of the activity. The table does not consider ISFSI decommissioning, as this is an activity undertaken after spent fuel has been accepted by the DOE and removed from the site.

Table 2 – Spent Fuel Management Activities

| Decommissioning Period | Costs (thousands, 2020 dollars) ¹ | Start Date | Stop Date | Approximate Duration (years) |
|-------------------------------------|--|----------------|----------------|------------------------------|
| 1 - Preparations | 19,201 | November 2026 | September 2027 | 0.9 |
| 2a - Dormancy with Wet Fuel Storage | 81,395 | September 2027 | September 2030 | 3.0 |
| 2b - Dormancy with Dry Fuel Storage | 213,171 | September 2030 | December 2066 | 36.3 |
| Total | 313,766 ² | - | - | - |

Notes:

1. These values differ from those in Table 3 due to the way the values in both tables were calculated.
2. Mathematical rounding was used.

Decommissioning Period 1 - Preparations

During this period, the facility is placed in a condition that allows the spent fuel to be safely stored and the facility to be maintained in a condition to be subsequently

decontaminated to levels that permit release for unrestricted use. The facility is left essentially intact with structures maintained in a sound condition. The process of placing the plant in safe-storage includes, but is not limited to, isolating the spent fuel storage services and fuel handling systems so that the spent fuel can be safely transferred from the spent fuel storage pool to the ISFSI for interim storage.

Decommissioning Period 2a – Dormancy with Wet Fuel Storage

During this period, the facility is in the dormancy period of SAFSTOR decommissioning. During this phase, spent fuel will remain in the spent fuel pool until it meets the criteria for transfer to dry storage. EHNC plans to begin transferring the remaining PNPP spent fuel from the spent fuel pool to dry storage in 2029 and to complete the transfer of fuel to the consolidated ISFSI in 2030.

Decommissioning Period 2b – Dormancy with Dry Fuel Storage

During this period, spent fuel will remain stored on the ISFSI until the DOE accepts the fuel and removes it from the site. As discussed above and in the PNPP DCE, the IFMP assumes that the DOE will begin removing fuel from PNPP in 2038 and will complete the removal of spent fuel from the site in 2066, according to the schedule set forth in Table 1. During this period, programs and procedures required to support safe operation of the ISFSI will be maintained in accordance with applicable requirements. Maintenance, monitoring, and inspection of equipment, including fuel handling and shipping equipment, will be performed as required. PNPP will also maintain a security force, which will safeguard the spent fuel for as long as it remains on site. Security barriers, sensors, alarms, and other surveillance equipment will be maintained as required to provide security for the ISFSI and spent fuel.

Cost Estimate

The PNPP DCE provides the basis for the costs associated with spent fuel management.

The DCE includes the cost of operating and maintaining the spent fuel pool and the ISFSI. Pool operations are expected to continue approximately four years after the cessation of plant operations. ISFSI operating costs are based upon an approximately 40-year period of operation following plant shutdown. The cost for the labor and equipment to load and transfer each spent fuel canister to the ISFSI from the spent fuel pool is also included. Costs for transferring the fuel from the ISFSI into the DOE transport cask are also included in the DCE.

Operation and maintenance costs for the spent fuel pool and the ISFSI are included within the DCE and address the cost for staffing the facility, as well as security, insurance, and licensing fees. Costs are also provided within the DCE for the decommissioning of the spent fuel pool, and the ISFSI after the fuel transfer to the DOE from the ISFSI is complete.

Table 3 provides an expenditure summary for the PNPP IFMP in 2020 dollars.

Table 3 – IFMP Expenditure Summary

| Year | Expenditure (thousands, 2020 dollars) |
|------|--|
| 2026 | 7,539 |
| 2027 | 22,901 |
| 2028 | 31,451 |
| 2029 | 32,046 |
| 2030 | 25,283 |
| 2031 | 7,258 |
| 2032 | 7,465 |
| 2033 | 7,637 |
| 2034 | 7,835 |
| 2035 | 8,040 |
| 2036 | 8,275 |
| 2037 | 8,470 |
| 2038 | 8,999 |
| 2039 | 10,787 |
| 2040 | 10,135 |
| 2041 | 10,690 |
| 2042 | 9,657 |
| 2043 | 11,244 |
| 2044 | 11,559 |
| 2045 | 11,825 |
| 2046 | 11,780 |
| 2047 | 11,022 |
| 2048 | 11,354 |
| 2049 | 12,741 |
| 2050 | 12,706 |
| 2051 | 13,430 |
| 2052 | 13,819 |
| 2053 | 13,754 |
| 2054 | 14,521 |
| 2055 | 14,490 |
| 2056 | 15,326 |
| 2057 | 15,686 |
| 2058 | 15,663 |
| 2059 | 16,515 |
| 2060 | 16,544 |
| 2061 | 17,393 |
| 2062 | 17,848 |
| 2063 | 17,844 |

Table 3 (continued)

| Year | Expenditure (thousands, 2020 dollars) |
|-------|--|
| 2064 | 18,847 |
| 2065 | 18,805 |
| 2066 | 20,302 |
| | |
| Total | 579,486 |

Funding

The funding for PNPP spent fuel management follows the schedule described above. Funding for Periods 1 and 2a extends from 2026 to 2030. This correlates with preparation activities and transferring the spent fuel to the ISFSI pad. Period 2b funding covers the period from 2030 to 2066. This correlates to long-term storage of spent fuel on the ISFSI pad until the fuel is transferred to the DOE.

Periods 1 and 2a Funding

The total Energy Harbor Nuclear Generation, LLC (EHNG) obligation for Periods 1 and 2a funding, which includes ISFSI activities and the transfer of spent fuel from the spent fuel pools to the ISFSI, for PNPP is approximately \$120 million dollars. In the event that PNPP shuts down based on the current license expiring, EHNG intends to fund this obligation through a cash deposit of \$120 million paid into a provisional trust by no later than the final shutdown date³. In addition, EHNG expects to recover its costs by making claims for damages resulting from the DOE's breach of the Standard Contract for Disposal of Spent Nuclear Fuel and/or High-Level Radioactive Waste (Standard Contract) for PNPP. It also expects that by no later than January 1, 2031, it will be able to obtain a settlement agreement to recover costs annually. Therefore, EHNG has focused on planning to fund the expected costs through 2030 (that is, Periods 1 and 2a).

The provisional trust will enable use of the funds for spent fuel management activities occurring during Periods 1 and 2a. Upon the completion of the spent fuel activities in Periods 1 and 2a, the terms of the provisional trust will provide that it can be terminated, and its balance released back to EHNG.

EHNG will withdraw money from the \$120 million provisional trust to pay the PNPP Periods 1 and 2a spent fuel expenditures. Table 4 provides a summary of the EHNG

³ EHNG intends to fund the provisional trust no later than the plant shutdown date only if the PNPP shuts down because of license expiration. On October 8, 2020 (ADAMS Accession No. ML20216A354), the NRC approved an extension from the March 18, 2026 license expiration date to November 7, 2026. The NRC has issued an exemption to allow EHNC to submit the license renewal application for PNPP at least three years prior to the expiration of the existing license and still receive timely renewal protection (ADAMS Accession No. ML20171A318).

use of the \$120 million provisional trust. The expenditures came from the site-specific DCE that was submitted on March 29, 2021.

Table 4 – Periods 1 and 2a Spent Fuel Expenditures
(thousands, 2020 dollars)

| Year | EHNG Payments | Trust Value |
|---------------|---------------|-------------|
| Initial Value | | 120,000 |
| | | |
| 2026 | 7,539 | 112,461 |
| 2027 | 22,901 | 89,560 |
| 2028 | 31,451 | 58,109 |
| 2029 | 32,046 | 26,063 |
| 2030 | 25,283 | 780 |
| | | |
| Totals | 119,220 | - |

The PNPP Periods 1 and 2a costs will be fully paid for by funds withdrawn from the \$120 million provisional trust.

Period 2b Funding

As described in the PNPP DCE, it is anticipated that the spent fuel will be entirely located on the ISFSI pad by 2030. The spent fuel is assumed to remain on the ISFSI pad between 2030 and 2066, when the last of the spent fuel is transferred to the DOE. There are annual costs associated with maintaining the spent fuel on the ISFSI pad during this period. EHNG generally expects to recover those costs for spent fuel management during Period 2b, through reimbursements from the DOE due to its partial breach of the DOE Standard Contract.

EHNG has an existing settlement agreement with the DOE to recover spent fuel expenditures for its four facilities. However, this settlement expires December 31, 2022 and EHNG may need to litigate with the DOE in order to obtain reimbursement of Period 1 and 2a spent fuel expenditures after that date if the current settlement agreement is not extended. Other licensees with plants in shutdown have litigated with the DOE to obtain recovery of dry fuel storage costs and then obtained a settlement agreement. Thus, EHNG expects to obtain a settlement agreement for the Period 2b expenses and potentially some of the earlier expenses.

As EHNG recovers its damages from the DOE, adequate funds will be retained in a segregated account to fund future annual expenses. Depending upon when litigation is resolved or a settlement is reached, this may include funding for parts of Periods 1 and 2a. Once adequate funds are set aside to fund the remaining annual spent fuel

management expenses pending recovery from the DOE under a settlement, the purpose of the provisional trust will have been satisfied, and the provisional trust can be terminated. Instead, EHNG will rely upon funds set aside in the segregated account. The plan for PNPP Period 2b funding process is to retain approximately \$26.4 million in the segregated account for the site. The intent is to pay for the annual ISFSI activities, then apply for recovery of the expenses from the DOE, as needed. If EHNG is unable to obtain a settlement with DOE by the end of 2030, EHNG will obtain a performance bond for approximately \$26.4 million (approximately 1.3 times the highest one-year value of ISFSI maintenance expenses). If needed, the bond will be in place by the end of 2030. The bond will be renewed annually and remain in-place until such time that a settlement with the DOE is obtained.

ISFSI Decommissioning Funding

Once the ISFSI pad is no longer needed, ISFSI decommissioning can occur. The ISFSI decommissioning is expected to be completed by 2083. ISFSI decommissioning costs will be paid from an existing provisional ISFSI trust that was established for that purpose. EHNC (formerly, FENOC) letter to the NRC dated December 17, 2018 (Accession No. ML18351A161) states that sufficient funding is available for ISFSI decommissioning. The funding is also sufficient for the ISFSI DCE that will be reported in 2021.

Adjustments to Funding

Pursuant to 10 CFR 50.75(f)(1), and 10 CFR 50.82(a)(8)(v) and (vi), EHNC is currently required to annually report to the NRC the status of the EHNG facility NDTs. Pursuant to 10 CFR 50.54(bb), EHNC is required to report to the NRC any significant changes to the IFMP. Since this IFMP includes a description funding mechanisms and costs, significant changes to the funding mechanisms and costs will be reported. EHNC will make any adjustments, as needed, to ensure the adequacy of the facility NDT or the EHNG provisional trust used to support the IFMP.