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

May 11, 2022

Mr. Bob Coffey
Executive Vice President, Nuclear
and Chief Nuclear Officer
Florida Power & Light Company
Mail Stop: EX/JB
700 Universe Boulevard
Juno Beach, FL 33408

SUBJECT: DUANE ARNOLD ENERGY CENTER – REVIEW OF THE UPDATE TO THE SPENT FUEL MANAGEMENT PLAN (EPID L-2021-LLL-0000)

Dear Mr. Coffey:

The U.S. Nuclear Regulatory Commission (NRC) staff has completed reviewing the submittal dated January 13, 2021 (Agencywide Documents Access and Management System (ADAMS) Accession No. ML21014A455), by NextEra Energy Duane Arnold, LLC (NEDA, the licensee). In accordance with Title 10 of the *Code of Federal Regulations* (10 CFR), Section 50.54(bb), the licensee provided an update to the spent fuel management plan (SFMP) for the Duane Arnold Energy Center (DAEC). Pursuant to 10 CFR 50.54(bb), NEDA submitted an irradiated fuel management plan and preliminary decommissioning cost estimate (DCE) to the NRC on February 19, 2009 (ADAMS Accession No. ML090550968).

By letter dated January 18, 2019 (ADAMS Accession No. ML19023A196), NEDA certified to the NRC that it planned to permanently cease power operations at DAEC in the fourth quarter of 2020. By letter dated March 2, 2020 (ADAMS Accession No. ML20062E489), NEDA updated its timeline and certified to the NRC that it planned to permanently cease power operations at DAEC on October 30, 2020. Subsequently, by letter dated August 27, 2020 (ADAMS Accession No. ML20240A067), NEDA certified, pursuant to 10 CFR 50.82(a)(1)(i), that DAEC permanently ceased power operations on August 10, 2020, as the result of a derecho event.

By letter dated October 12, 2020 (ADAMS Accession No. ML20286A317), NEDA certified, pursuant to 10 CFR 50.82(a)(1)(ii), that fuel was permanently removed from the DAEC reactor vessel and placed in the spent fuel pool (SFP). Accordingly, pursuant to 10 CFR 50.82(a)(2), the renewed facility operating license (DPR-49) for DAEC no longer authorizes operation of the reactor or emplacement or retention of fuel in the reactor vessel. The facility is still authorized to possess and store irradiated (i.e., spent) nuclear fuel. Spent fuel is currently stored onsite at the DAEC facility in the SFP and in a dry cask independent spent fuel storage installation (ISFSI).

As a result of the decision to permanently cease operations at DAEC and related changes to the anticipated schedule of decommissioning activities, spent fuel management activities, and decommissioning funding assumptions, NEDA is modifying the DAEC SFMP. The January 13, 2021, letter provides the required Section 50.54(bb) notification.

By letter dated April 2, 2020 (ADAMS Accession No. ML20094F603), as supplemented by letter dated February 5, 2021 (ADAMS Accession No. ML21036A160), NEDA submitted the DAEC post-shutdown decommissioning activities report (PSDAR) and the site-specific DCE. The enclosed review focuses on spent fuel management. The NRC staff is conducting a separate review of the DAEC PSDAR and site-specific DCE.

Based on its review of NEDA's SFMP submittal, the NRC staff finds that the licensee's program to manage and provide funding for the management of all spent fuel is adequate and provides sufficient detail regarding the associated funding mechanisms. Further, the staff has determined that the elected actions within the program are consistent with the NRC requirements for licensed possession of spent nuclear fuel and that these actions will be implemented on a timely basis. Therefore, the staff concludes that the DAEC SFMP complies with 10 CFR 50.54(bb) and approves the plan on a preliminary basis. The enclosed safety evaluation documents the NRC staff's review of the updated SFMP for DAEC.

In accordance with 10 CFR 50.82(a)(8)(vii), the licensee must annually submit to the NRC, by March 31st, a report on the status of its funding for the management of irradiated fuel. Further, in accordance with 10 CFR 50.54(bb), the licensee shall notify the NRC of any significant changes to the SFMP. Accordingly, the regulations provide a means of informing the NRC staff of fluctuations in the reported fund balances and funding requirements for spent fuel, and significant changes to the DAEC SFMP.

In accordance with 10 CFR Part 2, "Agency Rules of Practice and Procedure," a copy of this letter will be available electronically for public inspection in the NRC Public Document Room or from the Publicly Available Records component of NRC's ADAMS. ADAMS is accessible from the NRC Web site at https://www.nrc.gov/reading-rm/adams.html.

If you or your staff have any questions regarding the above, please contact me at 301-415-3178 or via e-mail at marlayna.doell@nrc.gov.

Sincerely,

Signed by Doell, Marlayna
on 05/11/22

Marlayna V. Doell, Project Manager
Reactor Decommissioning Branch
Division of Decommissioning, Uranium Recovery,
and Waste Programs
Office of Nuclear Material Safety
and Safeguards

Docket Nos. 50-331 and 72-032

Enclosure: Safety Evaluation

cc w/enclosure: Duane Arnold Listserv

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

SAFETY EVALUATION BY THE OFFICE OF NUCLEAR MATERIAL SAFETY AND SAFEGUARDS UPDATE TO SPENT FUEL MANAGEMENT PLAN NEXTERA ENERGY DUANE ARNOLD, LLC DUANE ARNOLD ENERGY CENTER DOCKET NOS. 50-331 AND 72-32

1.0 INTRODUCTION

The U.S. Nuclear Regulatory Commission (NRC) staff has completed reviewing the submittal dated January 13, 2021 (Agencywide Documents Access and Management System (ADAMS) Accession No. ML21014A455), by NextEra Energy Duane Arnold, LLC (NEDA, the licensee). In accordance with Title 10 of the *Code of Federal Regulations* (10 CFR), Section 50.54(bb), the licensee provided an update to the spent fuel management plan (SFMP) for the Duane Arnold Energy Center (DAEC). Pursuant to 10 CFR 50.54(bb), NEDA submitted an irradiated fuel management plan and preliminary decommissioning cost estimate (DCE) to the NRC on February 19, 2009 (ADAMS Accession No. ML090550968), to fulfill the requirement to submit an SFMP to the NRC 5 years before expiration of the operating license. The January 13, 2021, SFMP supersedes and replaces, in its entirety, the DAEC SFMP submitted in 2009.

By letter dated January 18, 2019 (ADAMS Accession No. ML19023A196), NEDA certified to the NRC that it planned to permanently cease power operations at DAEC in the fourth quarter of 2020. By letter dated March 2, 2020 (ADAMS Accession No. ML20062E489), NEDA updated its timeline and certified to the NRC that it planned to permanently cease power operations at DAEC on October 30, 2020. Subsequently, by letter dated August 27, 2020 (ADAMS Accession No. ML20240A067), NEDA certified, pursuant to 10 CFR 50.82(a)(1)(i), that DAEC permanently ceased power operations on August 10, 2020, as the result of a derecho event.

By letter dated October 12, 2020 (ADAMS Accession No. ML20286A317), NEDA certified, pursuant to 10 CFR 50.82(a)(1)(ii), that fuel was permanently removed from the DAEC reactor vessel and placed in the spent fuel pool (SFP). Accordingly, pursuant to 10 CFR 50.82(a)(2), the renewed facility operating license (DPR-49) for DAEC no longer authorizes operation of the reactor or emplacement or retention of fuel in the reactor vessel. The facility is still authorized to possess and store irradiated (i.e., spent) nuclear fuel. Spent fuel is currently stored onsite at the DAEC facility in the SFP and in a dry cask independent spent fuel storage installation (ISFSI).

Pursuant to 10 CFR 50.54(bb), licensees of nuclear power reactors must, within two years following permanent cessation of operation, submit to the NRC for its review and preliminary approval the program by which the licensee intends to manage and provide funding for the management of all irradiated fuel at the reactor until title to and possession of the fuel is

transferred to the Department of Energy (DOE) for its ultimate disposal in a repository. In addition, pursuant to 10 CFR 50.82(a)(4)(i), prior to or within two years following permanent cessation of operation, the licensee must submit a post-shutdown decommissioning activities report (PSDAR) to the NRC. The PSDAR must contain, among other things, a site-specific DCE, including the projected cost of managing irradiated fuel.

By letter dated April 2, 2020 (ADAMS Accession No. ML20094F603), as supplemented by letter dated February 5, 2021 (ADAMS Accession No. ML21036A160), NEDA submitted the DAEC PSDAR and the site-specific DCE. The NRC staff is conducting a separate review of the DAEC PSDAR and site-specific DCE (see ADAMS Accession No. ML22090A192).

As a result of the decision to permanently cease operations at DAEC and related changes to the anticipated schedule of decommissioning activities, spent fuel management activities, and decommissioning funding assumptions, NEDA is modifying the DAEC SFMP. The January 13, 2021, letter provides the required Section 50.54(bb) notification. A separate letter dated March 31, 2021 (ADAMS Accession No. ML21090A232), submitted the 2021 Annual Decommissioning and Spent Fuel Management Funding Status Report for DAEC. This report was evaluated in SECY-21-0108 (ADAMS Accession No. ML21285A219) as part of the NRC's biennial review of the decommissioning funding status (DFS) reports submitted by operating power reactor licensees and power reactor licensees in decommissioning. DAEC's 2022 DFS report was submitted on March 31, 2022 (ADAMS Accession No. ML22090A035), and is currently under review by the NRC staff as part of the annual review of funding assurance for decommissioning power reactors. Portions of the DAEC DFS report submittals were used to inform the review of the modifications to the DAEC SFMP.

2.0 BACKGROUND

DAEC is a single boiling water reactor located about 9 miles from Cedar Rapids in Linn County, Iowa. Under renewed facility operating license No. DPR-49, DAEC is owned by NEDA (70 percent), Central Iowa Power Cooperative (20 percent), and Corn Belt Power Cooperative, and it is operated by NEDA. A brief history of major milestones related to DAEC construction and operation follows:

- Construction Permit Issued: June,17, 1970
- Full-Term Operating License Issued: February 21, 1974
- Commercial Operation: February 20, 1975
- Full-Term License Renewed: September 2, 2010
- Original License Expiration: February 21, 2014
- Renewed License Expiration: February 21, 2034

The DAEC facility employed a General Electric boiling-water reactor nuclear steam supply system licensed to generate 1,912 megawatts-thermal. The principal structures of DAEC are the reactor and turbine buildings, off-gas retention building, radwaste building, diesel generator building, intake structure, switchyard, main stack, and administration buildings. The DAEC reactor site also houses an independent spent fuel storage installation for dry fuel storage.

The decommissioning approach that has been selected by NEDA for DAEC is the SAFSTOR method. Under SAFSTOR, often considered "deferred dismantling," a nuclear facility is maintained and monitored in a condition that allows the radioactivity to decay; afterwards, the

plant is dismantled and the property decontaminated. In accordance with 10 CFR 50.82(a)(3), decommissioning will be completed within 60 years of permanent cessation of operations.

3.0 REGULATORY EVALUATION

The regulation under 10 CFR 50.54(bb) states, in relevant part:

> For nuclear power reactors licensed by the NRC, the licensee shall, within 2 years following permanent cessation of operation of the reactor or 5 years before expiration of the reactor operating license, whichever occurs first, submit written notification to the Commission for its review and preliminary approval of the program by which the licensee intends to manage and provide funding for the management of all irradiated fuel at the reactor following permanent cessation of operation of the reactor until title to the irradiated fuel and possession of the fuel is transferred to the Secretary of Energy for its ultimate disposal in a repository.

3.1 Criteria and Information Evaluated to Support the 10 CFR 50.54(bb) Review

Similar to reviews of other SFMPs,[1] the NRC staff reviewed the following information submitted in support of the DAEC SFMP to evaluate and provide preliminary approval of the spent fuel management (SFM) and funding program:

- Estimated cost to isolate the spent fuel pool and fuel handling systems. For the SAFSTOR option, the cost to manage and to provide funding for the management of irradiated fuel and fuel handling systems may be considered part of the preparation for transfer of the irradiated fuel to the DOE;
- Estimated cost to maintain and, if needed, expand an ISFSI;
- Estimated annual cost for the operation of the SAFSTOR condition and of the fuel until the DOE takes possession of the fuel;
- Estimated cost for the preparation, packaging, and shipping of the fuel to the DOE;
- Estimated cost to decommission the spent fuel storage facility;
- Brief discussion of the selected storage method or methods and the estimated time for these activities; and
- Information identifying the source of funds for managing spent fuel.

3.2 Spent Fuel Management Strategy

As discussed in 10 CFR 50.54(bb), the NRC requires that licensees establish a program "to manage and provide funding for the management of all irradiated fuel at the reactor following

---

[1] Recent reviews include safety evaluations by the Office of Nuclear Reactor Regulation related to the SFMPs for the Oyster Creek Nuclear Generating Station (ADAMS Accession No. ML18226A330), the Fort Calhoun Station, Unit 1 (ADAMS Accession No. ML18017B005), the San Onofre Nuclear Generating Station, Units 2 and 3 (ADAMS Accession No. ML15182A256), and the Crystal River Unit 3 Nuclear Generating Plant (ADAMS Accession No. ML14344A408).

permanent cessation of operation of the reactor until title to the irradiated fuel and possession of the fuel is transferred to the Secretary of Energy for its ultimate disposal in a repository." Pending transfer of the fuel to the DOE, NEDA will store fuel on an interim basis in the SFP and/or the ISFSI located at the DAEC site. A licensed ISFSI is currently operating under an NRC general license at DAEC. NEDA stated that an expanded ISFSI facility will be constructed that will accommodate the inventory of spent fuel remaining in the SFP at the time of permanent shutdown as well as all the spent fuel assemblies generated during the plant's operational history. After the required cooling time, the spent fuel will be loaded in fuel storage canisters and moved to the ISFSI. Once the SFP is emptied of fuel, NEDA currently plans to place the DAEC facility in a SAFSTOR condition. The ISFSI will continue to operate until the transfer of spent fuel to the DOE is complete.

Assuming the DOE's generator allocation/receipt schedules are based upon the oldest fuel receiving the highest priority and that DOE begins removing spent fuel from commercial facilities in 2030 with an annual capacity of 3,000 metric tons of uranium, spent fuel is projected by NEDA to remain at the DAEC site for approximately 39 years after the termination of operation (spent fuel is projected to be removed from the DAEC site by the end of 2059). Any delay in transfer of fuel to the DOE or decrease in the rate of acceptance will correspondingly prolong the transfer process and result in spent fuel remaining at the site longer than anticipated.

Operation and maintenance costs for the DAEC fuel storage facilities (ISFSI and SFP) are reflected in the NEDA site-specific DCE dated February 5, 2021, and include the costs for staffing the facilities, maintenance of necessary operational requirements as well as security, insurance, and licensing fees. The estimate includes the costs to purchase, load, and transfer the fuel storage canisters to the ISFSI and to decommission the ISFSI.

4.0 TECHNICAL EVALUATION

4.1 Evaluation of the Spent Fuel Management Plan Estimated Costs

As stated previously, by letter dated January 13, 2021, NEDA provided its SFMP for DAEC. The SFMP provided NEDA's spent fuel management strategy, referred to the DAEC site-specific DCE for the schedule for spent fuel management activities, and provided the cost estimate (in 2020 dollars) and funding assurance mechanisms for spent fuel management.

The NRC staff's review of the licensee's submittal included the SFM activities and associated cost elements found in the DAEC SFMP. The SFMP and associated costs estimated by DAEC total $267.4 million (2020 dollars). The NRC staff reviewed estimates for major SFM activities and funding requirements including for infrastructure; spent fuel operation, maintenance, and isolation costs; ISFSI expansion, operation, and maintenance costs; emergency planning costs; safe storage and dormancy costs; and spent fuel transfer costs. The staff notes that the ISFSI will be expanded by 2022 to accommodate the inventory of spent fuel in the SFP. The canisters for dry storage of spent fuel on the ISFSI are planned to be of the type currently used at the site.

With regard to spent fuel removal from the reactor site, the licensee indicated that its plan for spent fuel remains dependent on the DOE's ability to remove spent fuel from the site in a timely manner. Accordingly, the plan is based upon a 2030 start date for the DOE's acceptance of spent fuel from the industry based on the order by which the DOE plans to retrieve spent fuel from individual nuclear power facilities, including from DAEC. The licensee is therefore assuming that the DOE will complete spent fuel removal from DAEC by the end of 2059. The licensee maintains its position that the DOE has a contractual obligation to accept spent fuel

from DAEC in a timely manner. The NRC staff accepts these assumptions with regard to the final disposition of DAEC spent fuel as the Nuclear Waste Policy Act of 1982 authorizes the DOE to ultimately enter into contracts with owners and generators of commercial spent nuclear fuel to begin taking title to (i.e., legal ownership of) the spent nuclear fuel.

With regard to the cost estimate for the SFMP and related activities at DAEC, the NRC staff evaluated the $267.4 million (2020 dollars) estimated cost for reasonableness. In doing so, the NRC staff considered cost information from independent sources and compared data against information provided by other licensees. One such study, "Blue Ribbon Commission on America's Nuclear Future" (Blue Ribbon Commission report), dated January 2012, provided to the DOE cost and cost considerations for the operation and maintenance of spent fuel storage at shutdown sites. Costs cited in that report range from $4.5 million to $8 million per year (2012 dollars) for SFM at shutdown sites.[2] These costs adjusted for inflation (2020 dollars) are $5.2 million and $9.4 million, respectively. Accounting for inflation and considering the SFMP operational period with the DAEC site-specific costs, the NRC staff determined that the cost estimate provided by NEDA, on the average (approximately $9.2 million), is within the range of costs cited in the report. In addition, the staff determined that the DAEC cost estimate was comparable with a range of other licensee SFMP cost estimates previously reviewed by the NRC staff. The NRC staff acknowledges that potential site-specific variances may exist among individual SFMPs. Based on the foregoing, the NRC staff finds NEDA's $267.4 million cost estimate for SFM at DAEC to be reasonable.

As a result of its evaluation of the SFMP estimated costs, the NRC staff concludes that the DAEC SFMP is comprehensive, contains sufficient detail regarding activities and identified costs for managing spent fuel, and whose timeline for SFM activities is reasonable. In addition, the NRC staff finds the SFM program cost estimates to be reasonable. This conclusion is based upon the staff's analysis of estimated costs presented in the DAEC SFMP, upon a comparison with data from recent studies reflected in the Blue Ribbon Commission report, and from a range of other licensee SFM cost estimates previously reviewed by the NRC staff.

4.2 Evaluation of the Program to Manage and Provide Funding for all Spent Fuel

The NRC staff performed an independent cash flow analysis of the DAEC funding available for decommissioning and spent fuel management over the remaining SAFSTOR period, assuming an annual real rate return of 2 percent, as allowed by 10 CFR 50.75(e)(1)(ii), and determined the projected earnings for the associated decommissioning trust fund (DTF). The NRC staff confirmed that the current funds in the DAEC DTF and projected earning provide reasonable assurance of adequate funding to complete the NRC-required radiological decommissioning activities, and also to pay for spent fuel management. An exemption request that would allow NEDA to use excess funds from the DAEC decommissioning trust for spent fuel management and site restoration activities was considered by the NRC and approved via an exemption dated August 12, 2020 (ADAMS Accession No. ML20171A627).

As an additional potential source of funding for DAEC SFM costs, NEDA can also rely on reimbursements from the DOE to fund SFM activities, pursuant to the terms of the settlement agreement between NEDA and the United States Government, concerning the DOE's breach of

[2] See page 35 of the Blue Ribbon Commission report.

its contract to accept and dispose of spent fuel and high-level waste at DAEC.[3] The DOE has agreed to reimburse DAEC for costs incurred attributable to the DOE's failure to meet its contractual obligations for the transfer of spent fuel from DAEC.

Based on NEDA's plan to fund SFM costs with excess funds from the DAEC decommissioning trust , as well as anticipated payments from DOE reimbursements, the NRC staff concludes that DAEC's SFMP complies with 10 CFR 50.54(bb).

5.0 CONCLUSION

The NRC staff reviewed estimates for major spent fuel management activities and funding requirements. The NRC staff concludes that the activities and associated costs of the DAEC SFMP appear reasonable, and the staff does not have information that challenges the conclusions of the application according to the regulations. The NRC staff also finds that the licensee's program to manage and provide funding for the management of all irradiated fuel is adequate and provides sufficient detail regarding the associated funding mechanisms. Further, the staff has determined that the elected actions within the program are consistent with NRC requirements for licensed possession of irradiated nuclear fuel and that these actions will be implemented in a timely basis. Therefore, the NRC staff concludes that the DAEC SFMP complies with 10 CFR 50.54(bb) and approves the plan on a preliminary basis.

Principal Contributor: Emil Tabakov, NMSS

Date: May 11, 2022

[3] Settlement Agreement between DOE and Exelon Generation Company, LLC (including Commonwealth Edison Company and AmerGen Energy Company), signed and executed August 5, 2004, as amended by the Addendum to the Settlement Agreement signed May 4, 2009.

Duane Arnold Spent Fuel Management Plan Review Letter DATE May 11, 2022

DISTRIBUTION:
RidsNmssDuwpRdb, NMSS
RidsRgn3MailCenterResource, RGN III
RidsNmssRefsFab, NMSS
SHarwell, NMSS/REFS/FAB
ETabakov, NMSS/REFS/FAB
RTurtil, NMSS/REFS/FAB
MHenderson, NMSS/REFS/FAB

ADAMS Accession No.: Ltr ML22089A049

OFFICE	NMSS/DUWP/RDB	NMSS/REFS/FAB	OGC/GCHA/AGCOR/NLO	NMSS/DUWP/RDB
NAME	MDoell *MD*	FMiller *FM*	ANaber *AN*	BWatson *BW*
DATE	Apr 5, 2022	Apr 7, 2022	May 11, 2022	May 11, 2022
OFFICE	NMSS/DUWP/RDB			
NAME	MDoell *MD*			
DATE	May 11, 2022			

OFFICIAL RECORD COPY