



UNITED STATES
NUCLEAR REGULATORY COMMISSION
REGION III
2443 WARRENVILLE ROAD, SUITE 210
LISLE, ILLINOIS 60532-4352

January 25, 2022

Mr. Paul Hansen
Decommissioning Director
NextEra Energy Duane Arnold, LLC
3277 DAEC Road
Palo, IA 52324-9785

SUBJECT: NRC INSPECTION REPORT NOS. 05000331/2021001(DNMS);
07200032/2021001(DNMS); AND 07200032/2021002(DNMS) – DUANE ARNOLD
ENERGY CENTER

Dear Mr. Hansen:

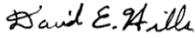
On December 17, 2021, the U.S. Nuclear Regulatory Commission (NRC) completed inspection activities for January through December 2021, at the permanently shut down Duane Arnold Energy Center (DAEC) in Palo, Iowa. The purpose of the inspection was to determine whether Independent Spent Fuel Storage Installation (ISFSI) and decommissioning activities were conducted safely and in accordance with NRC requirements. The enclosed report presents the results of this inspection, which were discussed with Mr. Paul Hansen and other members of your staff on December 17, 2021.

During the inspection period, the NRC inspectors reviewed the following aspects of on-site activities: safety reviews, design changes and modifications; problem identification and resolution; spent fuel pool safety; design and construction of an additional ISFSI pad; operation of an ISFSI; fire protection; decommissioning performance; emergency preparedness; occupational radiation exposure; radioactive waste treatment, effluent, and environmental monitoring; material control and accounting; and waste management and transportation. The inspection consisted of an examination of activities at the site as they relate to safety and compliance with the Commission's rules and regulations. Areas examined during the inspection are identified in the enclosed report. Within these areas, the inspection consisted of a selective examination of procedures and representative records, observation of work activities, and interviews with personnel.

Based on the results of this inspection, the NRC did not identify any violations.

This letter, its enclosure, and your response (if any) will be made available for public inspection and copying at <https://www.nrc.gov/reading-rm/adams.html> and at the NRC Public Document Room in accordance with Title 10 of the Code of Federal Regulations (CFR) 2.390, "Public Inspections, Exemptions, Requests for Withholding."

Sincerely,

 Signed by Hills, David
on 01/25/22

David E. Hills, Chief
Materials Control, ISFSI, and
Decommissioning Branch
Division of Nuclear Materials Safety

Docket Nos: 50-331; 72-032

License No: DPR-49

Enclosure:

Inspection Report Nos. 05000331/2021001(DNMS); 07200032/2021001(DNMS); and
07200032/2021002 (DNMS)

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Letter to Paul Hansen from David Hills, dated January 25, 2022.

SUBJECT: NRC INSPECTION REPORT NOS. 05000331/2021001(DNMS);
07200032/2021001(DNMS); AND 07200032/2021002(DNMS) – DUANE ARNOLD
ENERGY CENTER

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U.S. NUCLEAR REGULATORY COMMISSION
REGION III

Docket No: 50-331; 72-032

License No: DPR-49

Report Nos: 05000331/2021001(DNMS)
07200032/2021001(DNMS)
07200032/2021002(DNMS)

Enterprise Identifiers: I-2021-001-0072
I-2021-001-0143
I-2021-002-0144

Licensee: NextEra Energy Duane Arnold, LLC

Facility: Duane Arnold Energy Center (DAEC)

Location: Palo, IA

Dates: January 25, 2021, to December 17, 2021

Inspectors: Rhex Edwards, Senior Health Physicist
Vijay Meghani, Reactor Inspector
Jennifer Dalzell, Technical Assistant
Bill Lin, Health Physicist
Kim Conway, Project Manager

Approved by: David E. Hills, Chief
Materials Control, ISFSI, and
Decommissioning Branch
Division of Nuclear Materials Safety

Enclosure

EXECUTIVE SUMMARY

Duane Arnold Energy Center NRC Inspection Report Nos. 05000331/2021001(DNMS); 07200032/2021001(DNMS); and 07200032/2021002(DNMS)

The Duane Arnold Energy Center (DAEC) is a permanently shut-down and defueled power reactor transitioning to a Safe Storage (SAFSTOR) condition. This periodic safety inspection reviewed licensed activities associated with safety reviews, design changes and modifications; problem identification and resolution; spent fuel pool (SFP) safety; design and construction of an additional Independent Spent Fuel Storage Installation (ISFSI) pad; operation of an ISFSI; fire protection; decommissioning performance; emergency preparedness; occupational radiation exposure; radioactive waste treatment, effluent, and environmental monitoring; material control and accounting; and waste management and transportation.

Safety Reviews, Design Changes, and Modifications

- The licensee performed adequate safety evaluations or screenings, completed design change evaluations, and properly assessed decommissioning impacts of various work activities as required by Title 10 of the Code of Federal Regulations (CFR) 50.59 and its safety review process. (Section 1.0)

Problem Identification and Resolution

- Issues were identified by the licensee at appropriate thresholds and entered into the Corrective Action Program (CAP). Issues were screened and prioritized commensurate with safety significance. Licensee evaluations determined the significance of issues and included appropriate remedial corrective actions. (Section 2.0)

Spent Fuel Pool Maintenance, Surveillance, and Safety

- The inspectors determined that the licensee safely stored spent fuel in the SFP. The SFP equipment, instrumentation, alarms, leak detection, and power supplies were available and consistent with requirements. (Section 3.0)

On-Site Fabrication of Components and Construction of an Independent Spent Fuel Storage Installation

- Construction activities related to dry cask storage operations at DAEC complied with the design specifications contained in the Safety Analysis Report. Materials used in construction conformed to procurement specifications and activities related to quality were performed by qualified individuals. Deficiencies and non-conformances were documented in the CAP and DAEC provided adequate supervision of its contractors performing construction activities. (Section 4.0)

Operation of an Independent Spent Fuel Storage Installation

- ISFSI loading operations were performed in accordance with the NUHOMS Certificate of Compliance (CoC) 1004, Amendment 17, requirements. (Section 5.0)

Fire Protection Program

- An effective decommissioning Fire Protection Program was maintained and implemented that reasonably prevented fires; provided the capability to rapidly detect, control, and

extinguish fires that could result in radiological hazards; and ensured the risk of fire-induced hazards to the public, environment, and plant personnel were minimized. (Section 6.0)

Decommissioning Performance and Status Review

- The inspectors determined that decommissioning activities were in accordance with the regulations and license requirements. Decommissioning staffing, qualifications, and training were appropriate to the requirements and current decommissioning status. The material condition of structures, systems and components supported the safe storage of spent fuel and conduct of safe decommissioning. (Section 7.0)

Decommissioning Emergency Preparedness Scenario Review and Exercise Evaluation

- The inspectors determined that the licensee's exercise scenario provided sufficient opportunities to demonstrate the capability to protect public health and safety. Additionally, the licensee demonstrated adequate performance to identify weaknesses during the conduct of a critique following an emergency exercise. Identified weaknesses were entered into the CAP as appropriate. (Section 8.0)

Decommissioning Emergency Preparedness Program Evaluation

- The inspectors confirmed that changes made to the emergency preparedness program continued to meet U.S. Nuclear Regulatory Commission (NRC) requirements and licensee commitments. (Section 9.0)

Occupational Radiation Exposure

- Adequate protection of worker health and safety from exposure to radiation and radioactive material was provided. Decommissioning activities were executed in general alignment with planning documents and as provided in Radiation Work Permits (RWPs) and As Low As Is Reasonably Achievable (ALARA) reviews. Radiation surveys were performed adequately to identify the hazards present. Command and control of radiologically significant activities was executed in a manner that was safe and achieved the desired result. (Section 10.0)

Radioactive Waste Treatment, and Effluent and Environmental Monitoring

- The effluent flow paths and environmental monitoring systems reviewed aligned with descriptions in the Offsite Dose Assessment Manual (ODAM) and were functional. The effluent monitors reviewed were functional, calibrated, and alarm set points conservatively set to meet regulatory requirements. Changes to the effluent and environmental monitoring program were consistent with regulatory requirements. (Section 11.0)

Material Control and Accounting at Decommissioning Nuclear Power Reactors

- The inspectors determined that the licensee conducted materials control and accounting activities in accordance with the regulations. (Section 12.0)

Solid Radioactive Waste Management and Transportation of Radioactive Materials

- The licensee effectively processed, handled, stored, and transported radioactive material. (Section 13.0)

Report Details

Summary of Plant Activities

During the inspection period, the licensee took actions to place the unit in SAFSTOR conditions. No major decommissioning activities occurred during the inspection period.

1.0 Safety Reviews, Design Changes, and Modifications at Permanently Shutdown Reactors (IP 37801)

1.1 Inspection Scope

The inspectors performed walkdowns, reviewed documents, and interviewed plant personnel to assess the licensee's performance in the following areas:

- Whether the licensee's safety review process and procedures identified potential changes to Technical Specifications resulting from proposed changes, tests, experiments, or modifications;
- Whether the licensee's safety review process committee was appropriately staffed and trained in accordance with requirements;
- Whether the licensee's training program effectively trained and assessed qualified personnel for performing safety evaluations;
- Changes to design basis documentation were updated consistent with design changes;
- Design changes or modifications were effectively evaluated to maintain safety;
- Maintenance and/or work activities appropriately considered whether the activity resulted in a change or modification and was assessed in accordance with 10 CFR 50.59; and
- The effectiveness of the safety review committee meetings.

The inspectors verified that when issues were identified, licensee personnel appropriately documented the issue in the CAP.

1.2 Observations and Findings

The inspectors assessed the licensee's safety review and change control process during the week of February 8, 2021. Following this initial review, the inspectors remotely attended an On-site Review Group meeting on February 17, 2021. The On-site Review Group is the licensee's safety review committee. Minimum requirements for a quorum were met to conduct the business of the meeting attended. The training and qualification requirements for personnel performing safety evaluations and regulatory reviews were similar to the methods used while the plant was operating, and consistent with NRC requirements. The inspectors reviewed proposed and implemented changes throughout the inspection period. Specifically, the inspector reviewed the proposed design changes associated with:

- Modifications to existing utilities to support demolishing abandoned buildings (EC 294373)
- Replacing analog chart recorders with digital recorders associated with the discharge of liquid effluents (EC 294414)
- Installation of filters to support liquid effluent discharges (EC 294415)

- Changes proposed for distributing power throughout the site following moving all spent fuel to dry cask storage (EC 294736)

No findings were identified.

1.3 Conclusions

The licensee performed adequate safety evaluations or screenings, completed design change evaluations, and properly assessed decommissioning impacts of various work activities as required by 10 CFR 50.59 and its safety review process.

2.0 **Problem Identification and Resolution at Permanently Shutdown Reactors (IP 40801)**

2.1 Inspection Scope

The inspectors performed walkdowns, reviewed documents, and interviewed plant personnel to assess the licensee's performance in the following areas:

- Effectiveness at preventing, detecting, and correcting issues;
- Identifying and evaluating potential 10 CFR Part 21, "Reporting of Defects and Non-Compliance Issues;"
- Audits and assessments evaluating the CAP and Quality Assurance Program; and
- The licensee's safety culture

2.2 Observations and Findings

Throughout the inspection period, the inspectors assessed the licensee's performance as it relates to preventing, detecting, and correcting issues. This review included inspectors screening all issues entered into the licensee's CAP and attending the licensee's CAP review meeting on September 29, 2021. The inspectors followed up with several issues and troubleshooting efforts associated with Kaman effluent radiological monitors located in approved release pathways. In each instance, the inspectors confirmed that adequate monitoring, or compensatory actions, were maintained consistent with the ODAM. Repairs were effective at returning this equipment to service. There were no issues identified requiring reporting under 10 CFR Part 21 during this inspection period. Audits were performed consistent with a prepared schedule and in accordance with the Quality Assurance Topical Report and NRC requirements.

The safety culture program evolved at DAEC consistent with the decommissioned state. The program was managed at a corporate level and the inspectors found the site continued to focus on safety culture. The inspectors periodically met with many site employees and managers, and specifically interviewed the Decommissioning Director on November 3, 2021, to discuss safety culture

No findings were identified.

2.3 Conclusions

Issues were identified by the licensee at appropriate thresholds and entered into the CAP. Issues were screened and prioritized commensurate with safety significance. Licensee evaluations determined the significance of issues and included appropriate remedial corrective actions.

3.0 Spent Fuel Pool Maintenance, Surveillance, and Safety at Permanently Shutdown Reactors (IP 60801)

3.1 Inspection Scope

The inspectors performed walkdowns, reviewed documents, and interviewed plant personnel to assess the licensee's performance in the following areas:

- Requirements to prevent a reduction in SFP inventory, and maintenance and surveillance activities of SFP instrumentation, alarms, leak detection, and collection systems were adequate to assure the safe storage of spent fuel;
- SFP chemistry and cleanliness controls maintained water purity standards;
- Fuel assemblies were stored consistent with nuclear criticality safety analyses and requirements;
- SFP cooling, cleanup, and power supplies were lined up consistent with the decommissioning strategy;
- Fuel movements;
- Structures, systems, and components were appropriately scoped in and maintenance or condition problems are adequately addressed consistent with 10 CFR 50.65; and
- Risk was appropriately managed for proposed maintenance activities.

The inspectors verified that when issues were identified, licensee personnel appropriately documented the issue in the CAP.

3.2 Observations and Findings

On September 29, 2021, the inspectors performed a walkdown of the control room, SFP area and pump room. Throughout the tour, the inspectors confirmed that installed redundant instrumentation was consistent with each other, within calibration, and reflective of actual conditions. There were no temporary systems, or other pathways identified, which could cause an unintentional reduction in SFP inventory. Chemistry records from September 21, 2021, were reviewed and water cleanliness controls were maintained. Calibration and calibration check records were reviewed for:

- SFP level Hi/Lo alarm
- SFP level transmitter
- SFP level probe
- SFP leakage flow indicator

On September 30, 2021, the inspectors observed a licensee briefing for lifting two assemblies so that a visual inspection could be performed. The inspectors observed the licensee perform the lifts and found the evolution was performed as briefed, and consistent with approved procedures. The licensee maintained a program consistent with 10 CFR 50.65, to monitor the effectiveness of systems that are associated with the storage, control, and maintenance of spent fuel. During this inspection period, the inspectors reviewed scoping documents and maintenance records associated with the following systems:

- SFP cooling and cleanup
- Well water
- Reactor Building Closed Cooling Water
- Fire protection

The inspectors concluded that risk was appropriately considered when planning maintenance activities.

No findings were identified.

3.3 Conclusions

The inspectors determined that the licensee safely stored spent fuel in the SFP. The SFP equipment, instrumentation, alarms, leak detection, and power supplies were available and consistent with requirements.

4.0 **On-Site Fabrication of Components and Construction of an Independent Spent Fuel Storage Installation (IP 60853)**

4.1 Inspection Scope

The inspectors reviewed documents and interviewed plant personnel to assess the licensee's performance in the following areas:

- Whether materials and services received met the design procurement specifications;
- Whether the procurement specifications conformed to the design commitments and requirements;
- Whether the provisions of 10 CFR Part 21 were implemented;
- Whether fabrication specifications were consistent with design commitments and requirements;
- Whether the licensee established an effective method for tracking, evaluating, and dispositioning changes or modifications;
- Whether the applicable documentation for design changes was complete and accurate;
- Whether individuals performing quality-related activities were trained as required;
- Whether on-site personnel are familiar with the design, fabrication, testing requirements, and quality controls associated with construction;
- Whether components were fabricated per an NRC approved Quality Assurance Program;
- Whether deficiencies were appropriately handled with corrective actions implemented in a timely manner;
- Whether nonconformance reports documenting deficiencies were initiated and resolved;
- Whether licensee completed evaluations establishing that the design adequately supports the static and dynamic loads including the potential for amplification of earthquakes through soil-structure interaction, liquefaction, or other instabilities;
- Whether the subsoil was compacted and treated properly
- Whether the correct size, grade, and spacing of reinforcing steel was installed per specifications;
- Whether concrete was properly batched, placed, consolidated, and cured according to specifications;
- Concrete slump, air entrainment, and compressive strength tests meet specifications;
- Whether the overall dimensions, orientation, and levelness met specifications; and
- Whether there was appropriate quality controls oversight of construction activities.

The inspectors verified that when issues were identified, licensee personnel appropriately documented the issue in the CAP.

4.2 Observations and Findings

Design

In support of placing all spent fuel into dry cask storage, the licensee planned to install a second ISFSI pad to serve as foundation for up to 34 NUHOMS Horizontal Storage Modules (HSM-H). Title 10 CFR 72.212(b)(5)(ii) requires that licensees perform written evaluations, before use, which establish that cask storage pads and areas have been designed to adequately support the static and dynamic loads of the stored casks, considering potential amplification of earthquakes through soil-structure interaction, and soil liquefaction potential or other soil instability due to vibratory ground motion. The inspectors evaluated the licensee's soil and ISFSI pad engineering design evaluations to verify the licensee's compliance with the cask CoC, 10 CFR Part 72 requirements, and industry standards.

The new reinforced concrete pad was 3-foot thick, 176' long, 43' 4" wide, and was located near and to the north of the existing pad. While the pad was classified as Not Important To Safety, its design was classified as Important To Safety. The inspectors reviewed the licensee's soil investigation reports and calculations documenting the engineering properties and design soil profile of the ISFSI site. The inspectors verified that the pad design duly addressed geological and hydrological considerations using the information from the earlier and newly performed soil investigations. The inspectors reviewed the licensee's liquefaction analysis to verify seismic input and safety factors were consistent with Regulatory Guidance 1.198, "Procedures and Criteria for Assessing Seismic Soil Liquefaction at Nuclear Power Plant Sites."

The inspectors reviewed documents for the generation of new seismic acceleration time histories from the seismic ground motion spectra for the reactor site to be used as inputs for the ISFSI analyses. The inspectors reviewed the soil structure interaction analysis methodology and calculations to verify adequacy of the soil / pad / cask analytical model, including consideration of uncertainties of the soil investigation data. The inspectors reviewed the ISFSI pad structural design to verify the methodology, load factors and acceptance criteria, consideration of long-term total and differential settlements, and consideration for sequential and partial loading. The inspectors reviewed evaluations for determination of static and ultimate soil bearing capacities, and safety factors under worst case static and dynamic loads.

Pad Subgrade Preparation

On March 17, 2021, the inspectors toured the construction site with the DAEC ISFSI Project Manager and observed that the construction area had been excavated and cleared of any debris. The subgrade subsurface was proof rolled prior to placement of fill material. A cementitious Controlled Low Strength Material (CLSM) was placed atop of the native soil subgrade. The inspectors reviewed the CLSM design and compared 28-day break test results against design requirements.

Placement of Reinforcing Steel

The formwork and reinforcing steel (rebar) placed on top of the CLSM met design specifications. The inspectors reviewed certified material test reports for the rebar used

and found procurement specifications were being met and the steel met specified quality requirements. Following initial placement and review, additional rework was needed to ensure the bar spacing was within approved design tolerances. After adjustments were made, the inspectors concluded that the licensee adequately placed the correct number and size of bars according to design specifications.

Concrete Mix Design

The concrete mix design met applicable codes and standards listed in the licensee's design drawings and specification. Specifically, the inspectors found that the mix design satisfied specified strength requirements and American Concrete Institute (ACI) code specifications for durability.

Placement of Concrete

The concrete for the ISFSI pad was placed in one continuous pour and adequate supervision was provided by the licensee over the contractors. The concrete was appropriately tested, consolidated, finished, and cured as specified by the design documents.

Concrete Field Tests

Batch tickets for each truck were checked by the licensee to verify conformance with the mix design and to ensure delivery time and drum rotations met construction specifications. The batch tickets reviewed by the inspectors met design specifications. The licensee's contractor performed additional on-site testing for concrete temperature, slump, and air content. Concrete testing was performed by qualified inspectors and in accordance with industry standards. Concrete samples were taken and placed in test cylinders, stored appropriately for curing, and later tested in a laboratory to determine the compressive strength of the concrete. The inspectors reviewed the 28-day break test results and compared the results against ACI requirements.

Documented deficiencies and non-conformances were handled in accordance with the licensee's CAP. Materials provided met design and procurement specifications and construction activities and materials testing were performed by qualified individuals.

No findings were identified.

4.3 Conclusions

Construction activities related to dry cask storage operations at DAEC complied with the design specifications contained in the Safety Analysis Report. Materials used in construction conformed to procurement specifications and activities related to quality were performed by qualified individuals. Deficiencies and non-conformances were documented in the CAP and DAEC provided adequate supervision of its contractors performing construction activities.

5.0 Operation of an Independent Spent Fuel Storage Installation (IP 60855)

5.1 Inspection Scope

The inspectors performed walkdowns, reviewed documents, and interviewed plant personnel to assess the licensee's performance in the following areas:

- Changes, tests, or experiments were made in accordance with 10 CFR 50.59 and 10 CFR 72.48 and evaluations required by 10 CFR 72.212 were revised; as applicable;
- loading operations were performed safely and in accordance with approved procedures;
- Fuel selected for dry cask storage met the requirements of the dry cask storage system;
- ISFSI monitoring activities were performed in accordance with approved procedures; and
- The effectiveness of the licensee's quality assurance program;

The inspectors verified that when issues were identified, licensee personnel appropriately documented the issue in the CAP.

5.2 Observations and Findings

In December 2021, the licensee began the process of moving the remaining fuel out of the SFP and into NUHOMS CoC 1004, Amendment 17, dry cask storage systems. This effort, and inspection, will continue into 2022 until the project is complete. The inspectors were on-site during the week of December 13, 2021, to observe the licensee load the second dry cask storage canister of the campaign. During the inspection, the inspectors found changes made since the last inspection were consistent with the requirements of 10 CFR 72.48, 10 CFR 50.59, and the evaluations required per 10 CFR 72.212 were updated appropriately. The inspectors reviewed the records for the fuel assemblies selected for loading in the canister observed and found that the assemblies met the approved contents listed in the CoC. The inspectors directly observed fuel handling, heavy loads movements, welding, non-destructive testing, radiological surveys, processing, as well as transport and placement of the loaded canister into storage. The inspectors reviewed condition reports, the associated corrective actions, and verified that the licensee took adequate corrective actions, in a timely manner, to correct any issues identified.

No findings were identified.

5.3 Conclusions

ISFSI loading operations were performed in accordance with the NUHOMS CoC 1004, Amendment 17, requirements.

6.0 Fire Protection Program at Permanently Shutdown Reactors (IP 64704)

6.1 Inspection Scope

The inspectors performed walkdowns, reviewed documents, and interviewed plant personnel to assess the licensee's performance in the following areas:

- Fire protection program met Technical Specifications, Post Shutdown Decommissioning Analysis Report (PSDAR), and fire hazard analyses requirements;
- Changes to the Fire Protection Program did not reduce the effectiveness of the program;
- Assessments were being performed in accordance with 10 CFR 50.48(f)(2);

- Fire protection detection and suppression systems were effectively maintained, surveillances were performed, and systems were capable of performing their intended function;
- Fire barriers were effectively maintained;
- Firefighting equipment was properly inventoried, inspected, tested, and maintained;
- Administrative controls were in place to minimize the occurrence of a fire; and
- Staffing and training requirements were consistent with the Fire Protection Program and Emergency Plan.

The inspectors verified that when issues were identified, licensee personnel appropriately documented the issue in the CAP.

6.2 Observations and Findings

Fire protection walkdowns of the following areas were completed by the inspectors on the indicated dates:

- SFP area and refuel floor (November 2, 2021)
- SFP pump room (November 2, 2021)
- East Diesel Generator room (November 2, 2021)
- Low-Level Radwaste Processing and Storage Facility (November 3, 2021)

These walkdowns verified that any fire hazards present were as described in the licensee's fire protection program. The inspectors confirmed during walkdowns that the fire extinguishers, hose reels, and automatic fire suppression systems were available, maintained, and located as indicated in the approved pre-fire plans.

The inspectors reviewed the revisions to the fire protection program following the approval and implementation of license amendment 312 (ML20184A003). An on-site fire brigade was no longer required or maintained at DAEC. An existing letter of agreement, confirming available equipment and services from the Palo Fire Department, was provided, and reviewed by the inspectors. Due to the permanent shutdown condition, fire barriers were no longer required or being maintained for the purposes of maintaining separation between redundant trains of safe shutdown equipment. However, barriers were still in place and were utilized and available where appropriate. Administrative controls, staffing, and training were all found to be appropriate to the shutdown condition and consistent with regulatory requirements.

No findings were identified.

6.3 Conclusions

An effective decommissioning Fire Protection Program was maintained and implemented that reasonably prevented fires; provided the capability to rapidly detect, control, and extinguish fires that could result in radiological hazards; and ensured the risk of fire-induced hazards to the public, environment, and plant personnel were minimized.

7.0 Decommissioning Performance and Status Review (IP 71801)

7.1 Inspection Scope

The inspectors performed walkdowns, reviewed documents, and interviewed plant personnel to assess the licensee's performance in the following areas:

- Whether maintenance was conducted at an appropriate frequency;
- Updates to Final Safety Analysis Report (UFSAR) and Decommissioning Safety Analysis Report (DSAR) were made consistent with 10 CFR 50.71
- Records important to decommissioning were kept consistent with 10 CFR 50.75(g)
- Commitments and requirements in the Technical Specifications, PSDAR, ODAM, or Emergency Plan were effective and being met;
- Appropriate administrative and/or engineering controls were identified and implemented in work plans;
- Organization and staffing were appropriately adjusted for changes in the status of decommissioning; and
- Changes to the decommissioning schedule or costs were made consistent with the requirements in 10 CFR 50.82(a)(7).

The inspectors verified that when issues were identified, licensee personnel appropriately documented the issue in the CAP.

7.2 Observations and Findings

Maintenance was performed at specified frequencies for equipment related to the safe storage of spent fuel, fire protection, and radiological monitoring as documented in the respective sections of this report. The DAEC UFSAR, Revision 25, was replaced by Revision 0 of the DSAR on March 29, 2021 (ML21102A195). There were no further updates to the DSAR provided to the NRC. Records important to decommissioning were being maintained to satisfy 10 CFR 50.75(g). The licensee's guidance for these records was found in EV-AA-100-1001; "Fleet Groundwater Protection," which was reviewed in detail to understand the licensee's record keeping expectations and storage requirements.

Throughout 2021, the inspectors attended numerous daily status briefings and remotely received periodic updates from site management on a biweekly frequency. Plant tours of the Reactor Building and Turbine Building were performed frequently during the weeks of February 8, March 15, April 19, September 13, September 27, November 1, and December 13, 2021. License requirements were completed as specified and the inspectors directly observed performance of these requirements when on-site. Specifically, a required Emergency Preparedness drill, involving a simulated spill of contaminated liquid, was observed by the inspectors on December 15, 2021.

As the facility continued to transition to a SAFSTOR condition, the licensee adjusted staffing levels consistent with the needs of the facility and regulatory requirements. The inspectors found the staffing and qualifications appropriate to the current condition.

There were no changes to the schedule or costs associated with decommissioning during this inspection period. The Financial Assessment Branch in the NRC Office of Nuclear Materials Safety and Safeguards completed its initial review of the licensee's decommissioning funding financial allocation control process on April 22, 2021. The inspectors met with the decommissioning Project Manager and Decommissioning

Director on September 27, 2021, to discuss how funding was provided for various licensee activities. During this meeting, the inspectors inquired about work scope, changes, potential delays, expenditures, challenges to decommissioning, staffing levels, and any planned major decommissioning activities.

No findings were identified.

7.3 Conclusions

The inspectors determined that decommissioning activities were in accordance with the regulations and license requirements. Decommissioning staffing, qualifications, and training were appropriate to the requirements and current decommissioning status. The material condition of structures, systems and components supported the safe storage of spent fuel and conduct of safe decommissioning.

8.0 **Decommissioning Emergency Preparedness Scenario Review and Exercise Evaluation (IP 82401)**

8.1 Inspection Scope

The inspectors performed walkdowns, reviewed documents, and interviewed plant personnel to assess the licensee's performance in the following areas:

- Whether the exercise scenario provided sufficient opportunities to demonstrate the licensee's capability to perform key skills in principle functional areas to protect public health and safety; and
- The adequacy of the licensee's conduct of an exercise and ability to assess performance via a formal critique to identify and correct weaknesses.

The inspectors verified that when issues were identified, licensee personnel appropriately documented the issue in the CAP.

8.2 Observations and Findings

The inspectors reviewed and determined that the exercise scenario provided sufficient opportunities to demonstrate key skills in principle functional areas to protect public health and safety. Additionally, through direct observation of the emergency response organization during an emergency exercise performed on September 15, 2021, the inspectors confirmed the scenario provided sufficient opportunities to demonstrate the licensee's capability. Following the exercise, the inspectors observed portions of the licensee's critique and concluded that the licensee adequately assessed performance and entered identified weaknesses into the CAP as appropriate.

No findings were identified.

8.3 Conclusions

The inspectors determined that the licensee's exercise scenario provided sufficient opportunities to demonstrate the capability to protect public health and safety. Additionally, the licensee demonstrated adequate performance to identify weaknesses during the conduct of a critique following an emergency exercise. Identified weaknesses were entered into the CAP as appropriate.

9.0 Decommissioning Emergency Preparedness Program Evaluation (IP82501)

9.1 Inspection Scope

The inspectors performed walkdowns, reviewed documents, and interviewed plant personnel to assess the licensee's performance in the following areas:

- Whether the licensee maintained Emergency Preparedness requirements;
- Staffing of the Emergency Response Organization; and
- Emergency Action Level and Emergency Plan changes.

The inspectors verified that when issues were identified, licensee personnel appropriately documented the issue in the CAP.

9.2 Observations and Findings

DAEC implemented the Post-Defueled Emergency Plan on June 11, 2021. This plan was previously approved by the NRC on April 28, 2021, and became effective 10 months following the permanent cessation of power operations at DAEC, which was June 10, 2021. The inspectors confirmed the implementation of the approved plan during an on-site inspection the week of September 12, 2021. The emergency response organization and changes implemented by the licensee were consistent with the approved Emergency Plan.

No findings were identified.

9.3 Conclusions

The inspectors confirmed that changes made to the emergency preparedness program continued to meet NRC requirements and licensee commitments.

10.0 Occupational Radiation Exposure at Permanently Shutdown Reactors (IP 83750)

10.1 Inspection Scope

The inspectors performed walkdowns, reviewed documents, and interviewed plant personnel to assess the licensee's performance in the following areas:

- Changes made to organization, personnel, facilities, instrumentation, equipment, and programs that impact occupational radiation protection;
- Training and qualifications of members of the radiation protection organization;
- Radiological hazards and worker protection in work activities;
- Planning identified appropriate dose reduction techniques, defined reasonable dose goals, and radiation protection hold points;
- Radiological controls, postings, and material conditions inside the radiological control area;
- Planned special exposures;
- External exposure dosimetry;
- Engineering controls, respiratory protection program, and dose assessments;
- Contamination monitoring including release of radioactive materials from controlled areas;
- Accuracy and functionality of radiation monitoring instruments;
- Area radiation monitors and continuous air monitors were appropriately positioned;

- Temporary ventilation systems were correctly configured; and
- The characterization of the radiation type and energies were appropriate to the surveys and work practices.

The inspectors verified that when issues were identified, licensee personnel appropriately documented the issue in the CAP.

10.2 Observations and Findings

There were staffing changes in the radiation protection organization following the permanent cessation of operations. The inspectors verified qualifications of the remaining personnel, including verifying that the Radiation Protection Manager met minimum qualification requirements per Regulatory Guide 1.8-1975 and ANSI/ANS 3.1-1978, consistent with the licensee's Technical Specifications.

Throughout the inspection period, the inspectors reviewed ALARA planning documents associated with the removal of instrumentation under the reactor vessel, and removal of non-fuel material from the SFP for disposal. The inspectors observed the under-vessel work on October 28, 2020. During this assessment period, the inspectors reviewed the planning assessments for the under-vessel work in detail and assessed the effectiveness of the plan. After work was complete, the inspectors compared the estimated worker dose to the actual dose received through a review of electronic dosimetry data. The dose estimates were conservative and found to be reasonably accurate compared to the actual dose received. Similarly, on September 13 and September 29, 2021, the inspectors directly observed work activities associated with removal of non-fuel hardware stored in the SFP. The inspectors reviewed the ALARA plan for this work and compared dose estimates to the actual dose received. As material was brought out of the SFP, Radiation Protection staff were constantly monitoring radiological conditions consistent with good radiation protection practices. The inspectors spot checked the radiological instruments in the field and found them to be calibrated, source checked, and in good material condition.

Several tours were performed throughout the year. However, on November 3, 2021, a tour was specifically performed for the purposes of assessing radiological conditions, postings, and controls. The inspectors found postings and controls were appropriate to notify personnel of potential radiological hazards. Barriers used to preclude unintentional access were checked and found to be intact and capable of serving their intended purpose. The inspector independently assessed dose rates and compared them to the licensee's surveys. Additionally, any installed and portable instruments encountered during the walkdown were checked for a recent calibration and source check. The following in-service instruments were specifically checked:

- Data Radiation Monitoring (DRM) S/N 11307-082
- DRM S/N 11007-185
- DRM S/N 12708-058
- Ludlum Model 177 S/N 28312
- Ludlum Model 177 S/N 3332210

There were no planned special exposures during this inspection period.

The licensee notified the NRC on April 14, 2021, that their annual report of individual monitoring was submitted to the Radiation Exposure Information and Reporting System webpage on March 3, 2021 (ML21104A110). Dosimeter storage was away from

sources of radiation, and in an on-site area of low dose. Storage, issuance, and receipt of dosimeters was consistent with standard industry practices. Processing was done at a National Voluntary Laboratory Accreditation Program (NVLAP) accredited laboratory. Accreditation through the NVLAP was reviewed and found to be current and effective, at the time of the review, through June 30, 2021.

During the inspection period, the licensee was monitoring changes in the source term following shutdown and was assessing changing the biases for electronic dosimetry consistent with the decay of short-lived radionuclides that are no longer present following plant shutdown. Electronic dosimetry was biased to read conservatively compared to thermoluminescent dosimeters. The licensee's assessment also concluded that there were no notable changes to the isotopic mixture and the Dry Activated Waste 10 CFR Part 61 analysis was consistent with prior years.

A prospective evaluation was performed regarding the need for internal monitoring at DAEC. This evaluation was previously updated in 2017 and most recently updated in 2021. Consistent with past conclusions, the prospective evaluation concluded that DAEC's passive monitoring system was able to detect potential doses as low as 1% of the Allowable Level of Intake for a representative mixture of radionuclides present at DAEC. The inspectors reviewed two airborne dose assessments prepared for work under-vessel as discussed above.

While the inspectors were on-site during the week of November 1, 2021, a mobilization effort for an upcoming dry cask storage campaign was in progress. As a result, several additional personnel were on-site and were observed by the inspectors entering and exiting the controlled area throughout the week. No individuals were observed to alarm personnel contamination monitors (PCMs) and loose articles were appropriately placed through small article monitor prior to removing them from the controlled area.

On November 2, 2021, the inspectors observed the calibration of an Eberline PCM 1B-16 (Serial Number 869) located on the 4th floor of the Reactor Building. The personnel monitor was within its required calibration frequency and the as-found values of the observed calibration were within specification. Alarm setpoints were as expected and consistent with industry practice. The calibration source certificate was reviewed, and the activity was appropriately decay corrected during calibration of the PCM.

On November 3, 2021, the inspectors observed the response check of three DRMs prior to the DRMs being placed in service. All three of the DRMs failed the response check and were not placed in service. The licensee documented the issue in their CAP for further investigation. Also, on November 3, the inspectors observed the response check of a Canberra GEM-5 (Serial Number 367) personnel monitor located at the exit of the facility. Each detector located within the GEM-5 was individually checked with a source positioned at a fixed distance. The GEM-5 responded as expected to the source. Alarm setpoints were also as expected and consistent with the prospective evaluation for a passive internal monitoring program.

The inspectors did not observe any work involving the use of respirators during this inspection period. During the SFP cleanup project, the inspectors noted calibrated air monitors were in-service and placed within the vicinity of the workers. There were no temporary ventilation systems in service during the inspection.

There were no major decommissioning activities performed during this inspection period. Aside from reductions in staffing, there were no significant changes to the occupational radiation safety program at DAEC in 2021.

No findings were identified.

10.3 Conclusions

Adequate protection of worker health and safety from exposure to radiation and radioactive material was provided. Decommissioning activities were executed in general alignment with planning documents and as provided in RWPs and ALARA reviews. Radiation surveys were performed adequately to identify the hazards present. Command and control of radiologically significant activities was executed in a manner that was safe and achieved the desired result.

11.0 **Radioactive Waste Treatment, and Effluent and Environmental Monitoring (IP 84750)**

11.1 Inspection Scope

The inspectors performed walkdowns, reviewed documents, and interviewed plant personnel to assess the licensee's performance in the following areas:

- Changes made to the ODAM or liquid, gaseous, and solid radwaste system design and operation were within the licensing basis and regulations;
- Effluent monitoring ventilation and discharge system configurations, flow paths, and operations were consistent with the licensing basis and procedures;
- Effluent monitors were calibrated;
- Radioactive liquid and gaseous waste discharge permits projected doses to members of the public that were based on representative samples in the discharge pathway and were within 10 CFR Part 50, Appendix I, and Technical Specification limits;
- The annual effluent release report was submitted as required, and any anomalous results, unexpected trends, or abnormal releases were identified and entered into the CAP;
- Environmental monitoring equipment was properly located, calibrated, and maintained, and environmental samples were adequately collected;
- Whether the Groundwater Protection Initiative program was implemented as intended;
- Whether potential leakage or spills were appropriately added to records as required by 10 CFR 50.75(g);
- The licensee's annual radiological environmental monitoring report was submitted as required, and any anomalous results, unexpected trends, or abnormal environmental impacts were identified and entered into the CAP;
- Whether the licensee's vendor laboratory analyzed environmental samples under an approved quality control program and the inter-laboratory comparison program was adequate; and
- Changes made to the environmental program.

The inspectors verified that when issues were identified, licensee personnel appropriately documented the issue in the CAP.

11.2 Observations and Findings

Changes to the ODAM were made following permanent shutdown and are expected to continue as the site transitions to SAFSTOR. The inspectors reviewed changes to the ODAM made from revision 41 to 42, as well as changes to the ODAM from revision 42 to Defueled ODAM revision 0. The inspectors specifically looked at changes related to the abandonment of the Offgas stack and any evaluations associated with this change. The liquid radwaste discharge pathways were walked down on February 10, 2021. On March 17, 2021, the inspectors performed a walkdown of the gaseous effluent pathways for the Reactor Building, Turbine Building, and Low-Level Radwaste Processing and Storage Facility.

Planned liquid discharges continued throughout the inspection period. Isotopic analysis, calibration records, quarterly functional checks, and alarm setpoints for discharges performed on January 22, 2021, and October 16, 2021, were specifically reviewed by the inspectors. The licensee's isotopic software correctly identified the nuclides present based on their known energy. The licensee's calculations for assessing doses to a member of the public were consistent with approved ODAM methodologies. The inspectors assessed the isotopic analysis of the contents discharged, and independently performed calculations in accordance with the ODAM to verify the licensee's results. Additionally, the inspectors independently calculated and verified the licensee established conservative alarm setpoints in the effluent discharge pathway to ensure no quantities of radioactive material exceeded regulatory limits.

On March 16, 2021, the inspectors met with ground water protection program (GWPP) system expert and toured the extraction and sampling system for the ground water mitigation system. The inspectors observed a technician collect three, 1-gallon environmental samples from three different shallow water wells. The inspectors reviewed the last five-year groundwater assessment completed on March 23, 2017, as well as the last annual GWPP well inspection completed on December 16, 2020.

There were no new entries into the 50.75(g) files during this inspection period.

On October 22, 2021, the 2020 Annual Radiological Environmental Operating Report was submitted, as required, to the NRC on May 4, 2021 (ML21124A103). The inspectors reviewed the report and confirmed that the lower limits of detection (LLD) for radionuclides of concern were less than the specified maximum in the ODAM LLD. The number of environmental samples required to be taken, and the lower limit of detection limits for these samples, met requirements specified in the ODAM. There were no anomalous or unexpected environmental monitoring samples collected in water, air, fish, milk, vegetation, or sediments in 2020. The licensee continues to use a lab participating in an interlaboratory comparison program.

No findings were identified.

11.3 Conclusions

The effluent flow paths and environmental monitoring systems reviewed aligned with descriptions in the ODAM and were functional. The effluent monitors reviewed were functional, calibrated, and alarm set points conservatively set to meet regulatory requirements. Changes to the effluent and environmental monitoring program were consistent with regulatory requirements.

12.0 Material Control and Accounting at Decommissioning Reactors (IP 85103)

12.1 Inspection Scope

The inspectors performed walkdowns, reviewed documents, and interviewed plant personnel to assess the licensee's performance in the following areas:

- The licensee implemented and maintained an adequate and effective program to control and account for the special nuclear material (SNM) in its possession.
- The licensee can detect loss, theft, or diversion of SNM in a timely manner.

12.2 Observations and Findings

The inspectors determined through reviews of documents, interviews of plant personnel, and tours that the licensee conducted activities in accordance with regulatory requirements and plant procedures.

No findings were identified.

12.3 Conclusions

The inspectors determined that the licensee conducted materials control and accounting activities in accordance with the regulations.

13.0 Solid Radioactive Waste Management and Transportation of Radioactive Materials (IP 86750)

13.1 Inspection Scope

The inspectors performed walkdowns, reviewed documents, and interviewed plant personnel to assess the licensee's performance in the following areas:

- Radioactive waste storage areas are appropriately controlled, labelled, posted, and secured against unauthorized removal;
- Containers of radioactive material are inventoried, and their material condition is monitored;
- Implementation of the 10 CFR Part 37 security plan;
- Sealed sources are accounted for and are appropriately leak tested;
- Waste processing systems were configured and operated consistent with the DSAR, ODCM, and Process Control Program;
- Temporary waste processing systems were adequately implemented;
- Shippers of radioactive material were adequately trained and met TS, 10 CFR 71.5 and Department of Transportation 49 CFR Part 172, Subpart H, requirements;
- Changes in organization, personnel, facilities, equipment, programs, and procedures affecting waste management and transportation of radioactive materials;
- Shipments of radioactive material were appropriately surveyed as well as marked, labeled, and placarded consistent with the shipping documentation; and
- Shipments were appropriately characterized, classified, and prepared in accordance with procedures.

The inspectors verified that when issues were identified, licensee personnel appropriately documented the issue in the CAP.

13.2 Observations and Findings

On November 4, 2021, the inspectors toured the Radwaste Processing and Storage Facility and found the radiological postings to be accurate and the material in storage was labeled appropriately. Eight sealed drums awaiting disposal, and containing liquid radioactive materials, were inventoried by the inspectors. The inventory was accurate, and the drums were in good material condition.

The inspectors reviewed the sealed source inventory and verified the sources were secured and located in the plant as indicated by records. The most recent leak test was completed in July 2021, no leakage was detected.

On December 14, 2021, the inspectors observed the licensee load resin into an ASC-200 liner and process the liner for eventual disposal. The operator present was knowledgeable of loading and dewatering operations. The inspector walked down the flow path and confirmed the accessible valves were lined up consistent with the procedures. There were no temporary waste processing systems in use at the facility in 2021.

Qualification records for two individuals involved with the shipment of radioactive materials were reviewed and found to meet 49 CFR Part 172, Subpart H requirements. There were two TN-RAM shipments made during September 2021. The inspectors reviewed the characterization paperwork for these shipments. All materials were characterized using ORIGEN software and were verified by both the shipper and by the licensee. Based on the characterization, the shipment complied with the requirements of the CoC for the shipping package. On September 17 and on September 29, 2021, the inspectors observed radiological surveys and placarding of the two TN-RAM shipments. The inspectors confirmed that the shipping paperwork contained the required information such as emergency contacts and contingencies, appropriate route planning, and proper notification to the states.

No findings were identified.

13.3 Conclusions

The licensee effectively processed, handled, stored, and transported radioactive material.

14.0 **Exit Meeting**

The inspectors presented the results of the inspection to Mr. P. Hansen and other members of the DAEC staff at an exit meeting on December 17, 2021. The licensee acknowledged the results presented and did not identify any of the information discussed as proprietary.

ATTACHMENT: SUPPLEMENTAL INFORMATION

SUPPLEMENTAL INFORMATION

PARTIAL LIST OF PERSONS CONTACTED

P. Hansen, Decommissioning Director
M. Davis, Licensing Manager
R. Spading, Operations Director
M. Casey, Radiation and Chemistry Manager
J. Both, Decommissioning Project Manager

INSPECTION PROCEDURES (IPs) USED

IP 37801 Safety Reviews, Design Changes, and Modifications at Permanently Shutdown Reactors
IP 40801 Problem Identification and Resolution at Permanently Shutdown Reactors
IP 60801 Spent Fuel Pool Safety at Permanently Shutdown Reactors
IP 60853 On-Site Fabrication of Components and Construction of an Independent Spent Fuel Storage Installation
IP 60855 Operation of an Independent Spent Fuel Storage Installation
IP 64704 Fire Protection Program at Permanently Shutdown Reactors
IP 71801 Decommissioning Performance and Status Reviews at Permanently Shutdown Plants
IP 82401 Decommissioning Emergency Preparedness Scenario Review and Exercise Evaluation
IP 82501 Decommissioning Emergency Preparedness Program Evaluation
IP 83750 Occupational Radiation Exposure
IP 84750 Radioactive Waste Treatment, and Effluent and Environmental Monitoring
IP 85103 Material Control and Accounting at Decommissioning Reactors
IP 86750 Solid Radioactive Waste Management and Transportation of Radioactive Materials

ITEMS OPENED, CLOSED, AND DISCUSSED

<u>Opened</u>	<u>Type</u>	<u>Summary</u>
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None

<u>Closed</u>	<u>Type</u>	<u>Summary</u>
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None

PARTIAL LIST OF DOCUMENTS REVIEWED

The following is a partial list of documents reviewed during the inspection. Inclusion on this list does not imply that the NRC inspectors reviewed the documents in their entirety, but rather that selected sections of portions of the documents were evaluated as part of the overall inspection

Attachment

effort. Inclusion of a document on this list does not imply NRC acceptance of the document or any part of it, unless this is stated in the body of the inspection report.

- 1st Quarter 2022 Audit Plan; 10/26/2021
- 21EX – Biennial Evaluated Exercise; 09/15/2021
- 2021 Dry Fuel Storage Campaign #4 Duane Arnold Energy Center ALARA Plan; 11/17/2021
- ACP 1411.35; DAEC Groundwater Protection Program; Revision 19
- AD-AA-08; Nuclear Safety Culture; Revision 5
- APED-F16-021; ISFSI Extension Basemat Design Basis Requirements Document for Duane Arnold Energy Center; Revision 1
- ALARA Package No. 20-IMISC; DFO27 Drywell All Activities; Revision 0
- ALARA Package No. 20-R1; SAFESTOR - SFP Cleanup Project; Revision 0
- AR 02380677; 'A' Fuel Pool Pump Did Not Start; 01/12/2021
- AR 02384563; TSC Diesel Failed to Autostart During Monthly Test Run; 02/18/2021
- AR 02385063; Damage to GWPP Monitoring Well MW-19A; 02/24/2021
- AR 02385772; ISFSI Construction Identified Nuclides; 03/03/2021
- AR 02386117; Kaman 8 Found With Pumps Not Running; 03/06/2021
- AR 02386563; GWPP Autosampler Failed to Collect a Sample; 03/10/2021
- AR 02388106; Turbine Building Normal Range Kaman Continues to Go; 03/27/2021
- AR 02389593; Electrical Transient Resulted in Loss of Fuel Pool Cooling; 04/12/2021
- AR 02388925; Kaman 2 Microcomputer Locked up and Unreachable; 04/06/2021
- AR 02390051; Kaman 2 Repeated Unreachable; 04/15/2021
- AR 02399442; Tritium Identified in Sewage Plant; 07/26/2021
- AR02410238; DRMs Failing Response Checks; 11/3/2021
- BECH-MRS-C060A; DAEC ISFSI Expansion Construction Specification, Part 1; Revision 0
- BECH-MRS-C060A; DAEC ISFSI Expansion Construction Specification, Part 2; Revision 0
- BO-AA-100-1008; Nuclear Decommissioning Trust Reimbursement Process; Revision 1
- C051-024<1>; ISFSI Phase 2 HSM Basemat and Apron Plan & Details SHT 1; Revision 0
- C051-24<2>; ISFSI Phase 2 HSM Basemat and Apron Plan & Details SHT 2; Revision 0
- CAL-C20-001; Duane Arnold Ground Motion Time History Generation; Revision 0
- CAL-C20-002; DAEC Site Response Analysis for ISFSI Extension; Revision 0
- CAL-C20-003; DAEC SSI Analysis of ISFSI Expansion; Revision 0
- CAL-C20-005; Concrete Design of Phase 2 Approach Slab DAEC ISFSI; Revision 0
- CAL-C20-006; Design of Phase 2 Basemat for HSMs DAEC ISFSI; Revision 0
- CAL-F21-001; Duane Arnold Offload Spent Fuel Decay Heat Analysis; Revision 0
- CAL-F21-002; Duane Arnold 2022 Campaign Loading Plan; Revision 0
- DAEC Permanently Defueled Emergency Plan; Revision 0
- DFS-201B; Dry Shielded Canister / Transfer Cask Preparation for Fuel Loading Operations; Revision 0
- DFS-203B; Dry Shielded Canister Sealing Operations; Revision 0
- DFS-301B; Loaded Dry Shielded Canister/Transfer Cask From Refueling Floor to ISFSI Operations; Revision 0
- DFS-302B; Dry Shielded Canister From Transfer Cask to Horizontal Storage Module Transfer Operations; Revision 0
- DI-11269-03; Duane Arnold Geotechnical Summary and Report; 11/09/2020
- Drawing No. C051-024-1; Duane Arnold Energy Center ISFSI Phase 2 HSM Basemat & Apron Plan and Details SH01; Revision 0
- Drawing No. C051-024-2; Duane Arnold Energy Center ISFSI Phase 2 HSM Basemat & Apron Plan and Details SH02; Revision 0

- EC 294373; Modification for Maintaining Necessary Utilities from Buildings Being Demolished; Revision 0
- EC 294414; RR3972/FR3943 Replacement, Yokogawa Upgrade; Revision 0
- EC 294415; Install Filters on Recirculation Line for 1T071A/B and Radwaste Discharge to Dilution Pipe; Revision 3
- EC 294736; Campus Power; Revision 3
- EC 295014; Design and Installation of ISFSI Expansion Pad Final Campaign; Revision 0
- EC 295216; Effluent Discharge Dilution Flow Loop Replacement (4909 Loop); Revision 1
- Employee Qualification Record; Radiation Protection Manager; 12/7/2020
- EN-DC-200-1001; Decommissioning System Layup Plans; Revision 1
- EN-DC-203-1201; 10 CFR Applicability and 10 CFR 50.59 Screening Reviews; Revision 0
- EP-AA-100-1000; Conduct of Emergency Preparedness; Revision 9
- EP-AA-100-1001; Guidelines for Maintaining Emergency Preparedness Nuclear Fleet Administrative; Revision 17
- EPIP Form EAL-02; Revision 12
- ER-AA-112; Environmental Qualification Program; Revision 6
- ESP 4.3.1.5; Ground Water Sampling; Revision 34
- ESP 4.3.1.5; Sampling Site Monitoring Wells; Revision 13
- ESP 4.8; Monitoring Well Maintenance Program; Revision 2
- FPL-3; Quality Assurance Topical Report; Revision 1
- HPP 3110.31; Calibration of Eberline PCM-1B Personnel Monitor; Revision 13
- LI-AA-1000; On-Site Review Group; Revision 15
- MR Scoping Document SUS 79.00 Radiation Monitoring; Revision 1
- NUG ENG GEN 7005; Prepare or Review a 10 CFR Applicability and 10 CFR 50.59 Screening; Revision 2
- NVLAP Lab Code 100555-0; NVLAP Accreditation Program; 07/01/2021
- Offsite Dose Assessment Manual Gaseous and Liquid Effluents; Revision 42
- OI 435A1, Fuel Pool Cooling System Electrical Lineup
- OI 435A2, Fuel Pool Cooling System Valve Lineup
- On-Site Review Group Meeting Minutes; 12/02/2020
- OP-AA-104-1010; Spent Fuel Pool Risk Management; Revision 7
- PI-AA-104-1000; Condition Reporting; Revision 30
- PDA 21-004; Nuclear Assurance Audit Report - Independent Spent Fuel Storage Installation; 05/28/2021
- PDA 21-005; Nuclear Assurance Audit Report – Emergency Preparedness; 08/26/2021
- PDA Maintenance Rule Scoping Document - SUS 8.00 Well Water; Revision 1
- PDA Maintenance Rule Scoping Document - SUS 13.01 Fire Protection; Revision 1
- PDA Maintenance Rule Scoping Document - SUS 14.00 Reactor Building Closed Cooling Water; Revision 1
- PDA Maintenance Rule Scoping Document - SUS 35.00 Fuel Pool Cooling and Cleanup; Revision 4
- PFP-LL-757; Pre-Fire Plan LLRPSF; Revision 6
- QUAL-SC101; Environmental and Seismic Service Conditions; Revision 19
- Qualification Journals for all CFHs
- Quick Hit Self Assessment # 40463169; Ground Water Protection Program: Five Year Review; 03/23/2017
- Radiological Engineering Calculation No. 21-002-D; Periodic Evaluation of the Internal Monitoring Program at the Duane Arnold Energy Center; 05/04/2021
- Report of Facility Changes, Tests and Experiments, and Commitment Changes; 04/27/2021
- RP-AA-104-1000; ALARA Implementing Procedure; Revision 18

- RWH 3414.1; Setup and Operation of the Self-Engaging Dewatering System Fillhead; Revision 10
- RWH 3414.2; Ecodex Precoat/Powdex/Solka-Floc/Diatomaceous Earth/Zeolite Dewatering Procedure for EnergySolutions 14-215 or Smaller Liners Utilizing the Self-Engaging Dewatering System (SEDS); Revision 9
- RWH 3414.3; Bead Resin/Activated Carbon Dewatering Procedure for EnergySolutions 14-215 or Smaller Liners Utilizing Self-Engaging Dewatering System (SEDS); Revision 4
- RWH 3414.4; Isolok Remote Sampler Procedure for Duane Arnold Energy Center; Revision 3
- Sample No. 21-148; WO40757901 1T-71A Pre Discharge Isotopic; 01/22/2021
- Sample No. 21-148; WO40757901 1T-71A Post Discharge Isotopic; 01/23/2021
- Sample No. 21-148; WO40757901 PCP 8.7A Attachment 1, Liquid Effluent Radioactivity Monitor Setpoint; 01/22/2021
- Sample No. 21-148; Tri-CARB Analyzer Calculation Sheet; 01/22/2021
- Sample No. 21-1544; September Chemistry Sample for Fuel Pool; 09/21/21
- Sample No. 21-1680; WO40795826 PCP 8.7A Attachment 1, Liquid Effluent Radioactivity Monitor Setpoint; 10/15/2021
- Sample No. 21-1680; WO40795826 1T-71A Post Discharge Isotopic; 10/16/2021
- Sample No. 21-1680; WO40795826 1T-71A Pre Discharge Isotopic; 10/15/2021
- Sample No. 21-1680; Tri-CARB Analyzer Calculation Sheet; 10/15/2021
- Sealed Source Leak Test Listing Verification Report; 01/21/2021
- Sealed Source Leak Test Listing Verification Report; 07/24/2021
- SPC-3023497; DAEC ISFSI Expansion Construction Specification BECH-MRS-C060A Part 2 of 2; Revision 0
- SRS No. 111308A; Certificate of Calibration; 01/22/2019
- Technical Evaluation No. 21-003-H; 2019-2020 Site Alpha Characterization Update at the Duane Arnold Energy Center (DAEC); 05/05/2021
- Terracon Test plan; Construction Testing Work Plan, Field Testing of Portland Cement Concrete, DAEC ISFSI Expansion; 04/26/2021
- TR-AA-201-1000-F02; DAEC Certified and Non-Certified Fuel Handler Training Program Description; Revision 2
- TR-AA-230-J308; Certified Fuel Handler Initial Training Program
- WO4049664701; FIS3403: Disassemble/Clean/Functional Test
- WO4068990501; LI3413: Fuel Pool Level Indicator Check
- WO4070038301; G41A-K34: Calibration Check On Fuel Pool Level Hi/Lo
- WO4071074301; LIT3414: Calibrate Spent Fuel Pool Level Transmitter Primary
- WO4071074302; LE3414: Calibration Spent Fuel Pool Level Probe Primary
- WO4071074401; LIT3415: Calibrate Spent Fuel Pool Level Transmitter Secondary
- WO4071074402; LE3415: Calibration Spent Fuel Pool Level Probe Secondary
- WO 40756367; STPNS790704 Radwaste Effluent Radiation Monitor Calibration; 08/17/2021
- WO 40757907; STPNS79071A 1T71A Liquid Release Through Radwaste (RM-3972); 01/22/2021
- WO 40795826; STPNS79071A 1T71A Liquid Release Through Radwaste (RM-3972); 10/14/2021
- WO4079664701; Debris In FIS-3403, Fuel Pool Gate Leakage Flow Indicator

LIST OF ACRONYMS USED

ACI	American Concrete Institute
ADAMS	Agencywide Document Access and Management System
ALARA	As Low As Is Reasonably Achievable
CAP	Corrective Action Program
CFR	Code of Federal Regulations
CLSM	Controlled Low Strength Material
CoC	Certificate of Compliance
DAEC	Duane Arnold Energy Center
DNMS	Division of Nuclear Materials Safety
DRM	Data Radiation Monitoring
DSAR	Decommissioning Safety Analysis Report
GWPP	Ground Water Protection Program
IP	Inspection Procedure
IR	Inspection Report
ISFSI	Independent Spent Fuel Storage Installation
LLD	Lower Limits of Detection
NRC	U.S. Nuclear Regulatory Commission
NVLAP	National Voluntary Laboratory Accreditation Program
ODAM	Offsite Dose Assessment Manual
PCM	Personnel Contamination Monitor
PSDAR	Post Shutdown Activities Report
RWP	Radiation Work Permit
SAFSTOR	Safe Storage
SFP	Spent Fuel Pool
SNM	Special Nuclear Material
UFSAR	Updated Final Safety Analysis Report