



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

July 23, 2019

Mr. Andrew McGehee  
BWRVIP Program Manager  
Electric Power Research Institute  
1300 West W.T. Harris Blvd.  
Charlotte, NC 28262

**SUBJECT: DUANE ARNOLD ENERGY CENTER - APPROVAL OF CHANGE IN THE  
BWRVIP INTEGRATED SURVEILLANCE PROGRAM CAPSULE TEST  
SCHEDULE TO ACCOMMODATE EARLY CLOSURE  
(EPID L-2019-LLL-0022)**

Dear Mr. McGehee:

By letter dated May 15, 2019, to the U.S. Nuclear Regulatory Commission (NRC) (Agencywide Documents Access and Management System (ADAMS) Accession No. ML19137A027), the Electric Power Research Institute (EPRI) under the Boiling Water Reactor Vessels and Internals Project (BWRVIP), submitted a request for a change in the BWRVIP Integrated Surveillance Program (ISP) capsule test schedule to accommodate early closure of the Duane Arnold Energy Center (DAEC).

Specifically, due to DAEC's ceasing power operation in the fourth quarter of 2020, it will not be possible to withdraw and test the ISP(E) capsule in accordance with the currently approved schedule. EPRI requested an approval to withdraw and test the ISP(E) capsule from DAEC upon plant closure in late 2020 or early 2021.

The NRC staff has determined that the change to the ISP test schedule for the DAEC ISP(E) capsule will not change the overall effectiveness of the ISP. Accordingly, based on the expectation that DAEC will be ceasing power operation in the fourth quarter of 2020, the staff concludes that the change to the ISP test schedule for the ISP(E) capsule for withdrawal in 2020 is acceptable.

The NRC staff has reviewed the submittal and based on the enclosed evaluation approves the request for the early withdrawal of the ISP(E) capsule at DAEC.

If you have any questions, please contact me at 301-415-8371 or by e-mail to [Mahesh.Chawla@nrc.gov](mailto:Mahesh.Chawla@nrc.gov).

Sincerely,

**/RA/**

Lisa Regner, Chief (A)  
Plant Licensing Branch III  
Division of Operating Reactor Licensing  
Office of Nuclear Reactor Regulation

Docket No. 50-331  
BWRVIP Docket No. 99902016

Enclosure: Safety Evaluation

cc: ListServ

SUBJECT: APPROVAL OF CHANGE IN THE BWRVIP INTEGRATED SURVEILLANCE PROGRAM CAPSULE TEST SCHEDULE TO ACCOMMODATE EARLY CLOSURE OF THE DUANE ARNOLD ENERGY CENTER (EPID L-2019-LLL-0022) DATED:

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**ADAMS Accession No.: ML19198A010**

**\*via email**

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STAFF EVALUATION BY THE OFFICE OF NUCLEAR REACTOR REGULATION

BWRVIP ISP REVISED SURVEILLANCE CAPSULE WITHDRAWAL SCHEDULE

ELECTRIC POWER RESEARCH INSTITUTE

NEXTERA ENERGY DUANE ARNOLD, LLC

DUANE ARNOLD ENERGY CENTER

DOCKET NOS.: EPRI 99902016; NRC 50-331

1.0 INTRODUCTION

By letter dated May 15, 2019, to the U.S. Nuclear Regulatory Commission (NRC or Commission) (Agencywide Documents Access and Management System (ADAMS) Accession No. ML19137A027), the Electric Power Research Institute (EPRI) under the Boiling Water Reactor Vessels and Internals Project (BWRVIP), submitted a request for a change in the BWRVIP Integrated Surveillance Program (ISP) capsule test schedule to accommodate early closure of the Duane Arnold Energy Center (DAEC).

Specifically, due to DAEC ceasing power operation in the fourth quarter of 2020, it will not be possible to withdraw and test the ISP(E) capsule in accordance with the currently approved schedule of the BWRVIP ISP and therefore EPRI is requesting approval to withdraw and test the ISP(E) capsule upon plant closure in late 2020 or early 2021.

2.0 REGULATORY EVALUATION

The regulatory requirements in Section III.C of Title 10 of the *Code of Federal Regulations* (10 CFR) Part 50, Appendix H, establish the Commission's requirements for granting approval of alternative reactor pressure vessel (RPV) ISPs for designated reactors in the U.S. nuclear power industry. Paragraph III.C.1 of the rule defines that in an ISP, "materials chosen for surveillance for a reactor are irradiated in one or more other reactors that have similar design and operating features." Paragraph III.C.1 of the rule establishes that an RPV ISP may be implemented if approved by the Director of the Office of Nuclear Reactor Regulation (NRR). To receive NRR approval, the following criteria must be met:

- a. The reactor in which the materials will be irradiated and the reactor for which the materials are being irradiated must have sufficiently similar design and operating features to permit accurate comparisons of the predicted amount of radiation damage.
- b. Each reactor must have an adequate dosimetry program.

- c. There must be an adequate arrangement for data sharing between plants.
- d. There must be a contingency plan to assure that the surveillance program for each reactor will not be jeopardized by operations at reduced power levels or by an extended outage of another reactor from which data are expected.
- e. There must be substantial advantages to be gained, such as reduced power outages or reduced personnel exposures to radiation, as a direct result of not requiring surveillance capsules in all reactors in the set.

The rule also establishes two limitations relative to the design and implementation of approved ISPs. The first limitation is cited in Paragraph III.C.2 of the rule and establishes that “no reduction in the requirements for the number of materials to be irradiated, specimen types, or number of specimens per reactor is permitted.” The second limitation is cited in Paragraph III.C.3 of the rule and establishes that “no reduction in the amount of testing is permitted unless authorized by the Director of NRR.”

### 3.0 TECHNICAL EVALUATION

EPRI reports BWRVIP-86-A, "BWR Vessel and Internals Project, Updated BWR Integrated Surveillance Program (ISP) Implementation Program" (ADAMS Accession No. ML023190487), and BWRVIP-86, Revision 1-A, "BWR Vessel and Internals Project, Updated BWR Integrated Surveillance Program (ISP) Implementation Plan" (ADAMS Package Accession No. ML131760082), establishes an acceptable alternative to all existing BWR plant-specific RPV surveillance programs for the purpose of maintaining compliance with the requirements of Appendix H to 10 CFR Part 50 through the end of the 40-year and 60-year operating periods, respectively.

As indicated in the NRC's safety evaluation dated February 1, 2002 (ADAMS Accession No. ML020380691), which was incorporated into "BWR Vessel and Internals Project, Updated BWR Integrated Surveillance Program (ISP) Implementation Program," of BWRVIP-86-A:

The BWRVIP shall submit any changes regarding the ISP testing matrix, withdrawal schedule, or testing and reporting of individual capsule results to the NRC for review and approval prior to implementing these changes. Further, the BWRVIP will perform testing and submit surveillance capsule reports to the NRC in accordance with the provisions found in Appendix H to 10 CFR Part 50 on behalf of BWR licensees.

In addition, as indicated in Section 6.3, "Protocol for Informing NRC of Changes to the ISP Capsule Withdrawal Schedule," of BWRVIP-86, Revision 1-A:

Although the capsule withdrawal schedule identifies a Year and an EFPY [effective full power year] for each withdrawal, ISP and ISP(E) capsules will be withdrawn for testing in the year shown in the schedule (plus or minus one year, to align with outage schedules). The NRC will be informed only if the EFPY at that year is less than that shown in the schedule; if the EFPY will be less, then the BWRVIP must reevaluate and inform the NRC how the ISP intends to address the shortfall in capsule EFPY/fluence.

Currently, BWRVIP-86, Revision 1-A, identifies that an "ISP(E)" capsule, which provides data

for the first license extension, is scheduled to be withdrawn from DAEC in approximately 2027. By letter dated January 18, 2019 (ADAMS Accession No. ML19023A196), the NRC staff was notified that DAEC expects to cease power operation in the fourth quarter of 2020. Therefore, it will not be possible to withdraw and test the ISP(E) capsule in accordance with the currently approved plan.

The NRC staff noted that as identified in BWRVIP-86, Revision 1-A, the DAEC surveillance capsules provide representative data: (1) for the target plate materials in Brunswick, Units 1 and 2, Columbia, DAEC, Limerick, Unit 2, Peach Bottom, Unit 3, and Susquehanna, Unit 2, and (2) for the target weld material in DAEC only. The representative plate heat contained in the DAEC capsules is B0673-1 and the representative weld heat is "SMAW" [shielded metal arc weld]. Since DAEC will be ceasing operation and is the only plant that makes use of the SMAW weld heat data, the data from the ISP(E) capsule is now only required for the B0673-1 plate material.

The BWRVIP explained that the withdrawal of the DAEC ISP(E) capsule following plant closure in 2020 will provide for a lower fluence than that projected in BWRVIP-86, Revision 1-A. Specifically, as showed in in BWRVIP-86, Revision 1-A, the fluence of the capsule in 2027 was estimated to be  $3.54 \times 10^{18}$  n/cm<sup>2</sup> (E>1 MeV). Based on the most current DAEC fluence evaluation, the fluence of the capsule in 2020 is estimated to be  $3.04 \times 10^{18}$  n/cm<sup>2</sup> (E>1 MeV). The BWRVIP compared the estimated capsule fluence in 2020 as compared to the 1/4T fluence values of the target plate materials in Brunswick, Units 1 and 2, Columbia, DAEC, Limerick, Unit 2, Peach Bottom, Unit 3, and Susquehanna, Unit 2.

Based on this comparison, the NRC staff noted that the estimated fluence of the DAEC ISP(E) capsule when withdrawn in 2020, will be at least 100 percent of the estimated 1/4T fluence for all six of the target plate materials. The BWRVIP indicated that the data from the DAEC ISP(E) capsule will only be used to provide representative data for the target plate materials in six plants participating in the BWRVIP ISP and that the capsule fluence will exceed 100 percent of the end-of-license extension (EOLE) 1/4T fluence for all six of these materials.

The BWRVIP stated that the DAEC ISP(E) capsule fluence at the 2027 withdrawal was expected to be less than 100 percent of the EOLE 1/4T fluence for the DAEC target plate material. However, the DAEC ISP(E) capsule fluence was expected to be significantly greater than 100 percent of the EOLE 1/4T fluence for the other six target plate materials. The NRC staff noted that this indicates that DAEC was the limiting plant in terms of selecting the 2027 withdrawal date in BWRVIP-86, Revision 1-A.

Based on its review, the NRC staff finds the change to the ISP test schedule for the DAEC ISP(E) capsule to be withdrawn in 2020 acceptable and does not impact any of the participants in the BWRVIP ISP because of the following:

- The DAEC ISP(E) capsule fluence is still expected to be greater than 100 percent of the EOLE 1/4T fluence for the six target plate materials that rely on this capsule (i.e., Brunswick, Units 1 and 2, Columbia, DAEC, Limerick, Unit 2, Peach Bottom, Unit 3, and Susquehanna, Unit 2), which is consistent with the results in BWRVIP-86, Revision 1-A.
- The representative weld heat ("SMAW") is only applicable to DAEC and no other participants in the BWRVIP rely on the data from this representative weld heat.

- The data from the representative plate heat ("B0673-1") is no longer necessary to support monitoring changes in the fracture toughness properties of the DAEC reactor vessel due to DAEC expecting to cease power operation in the fourth quarter of 2020.

#### 4.0 CONCLUSION

The NRC staff concludes the change to the ISP test schedule for the DAEC ISP(E) capsule to be withdrawn in 2020 will not change the overall effectiveness of the ISP. Accordingly, based on the expectation that DAEC will be ceasing power operation in the fourth quarter of 2020, the staff concludes that the change to the ISP test schedule for the DAEC ISP(E) capsule for withdrawal in 2020 is acceptable.

Principal Contributors: On Yee, NRR/DMLR/MVIB  
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Date: July 23, 2019