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L-20-115

10 CFR 50.55a

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

SUBJECT:
Beaver Valley Power Station, Unit No. 2
Docket No. 50-412, License No. NPF-73
10 CFR 50.55a Request Number 2-TYP-4-RV-07 for Bottom Mounted Instrumentation Penetration Examinations

In accordance with 10 CFR 50.55a(z)(2), Energy Harbor Nuclear Corp. hereby requests Nuclear Regulatory Commission (NRC) approval of request 2-TYP-4-RV-07 that proposes an alternative for the reactor vessel bottom mounted instrumentation penetration examinations at Beaver Valley Power Station Unit No. 2 (BVPS-2).

Because of the hardship produced by the recent Coronavirus-2019 (COVID-19) pandemic and the resulting national state of emergency, Energy Harbor Nuclear Corp. is requesting expedited NRC approval of this request. The proposed alternative would defer the reactor vessel bottom mounted instrumentation examinations until the next refueling outage.

A pre-submittal meeting for 10 CFR 50.55a Request Number 2-TYP-4-RV-07 was held between Energy Harbor Nuclear Corp. and the NRC staff on March 31, 2020. Energy Harbor Nuclear Corp. requests approval of this proposed alternative prior to commencement of the next BVPS-2 refueling outage, currently scheduled to begin April 12, 2020.

The enclosed request identifies the affected components, applicable code requirements, and a description and basis for the proposed alternative.

There are no regulatory commitments contained in this submittal. If there are any questions, or if additional information is required, please contact Mr. Phil H. Lashley, Acting Manager, Nuclear Licensing and Regulatory Affairs, at (330) 315-6808.

Sincerely,

Rod L. Penfield

Enclosure:
10 CFR 50.55a Request Number: 2-TYP-4-RV-07

cc: NRC Region I Administrator
NRC Resident Inspector
NRR Project Manager
Director BRP/DEP
Site BRP/DEP Representative

10 CFR 50.55a Request Number: 2-TYP-4-RV-07

Proposed Alternative
In Accordance with 10 CFR 50.55a(z)(2)

--Hardship or Unusual Difficulty
without Compensating Increase in Level of Quality or Safety--

1. ASME Code Component(s) Affected

The affected components are the Beaver Valley Power Station Unit No. 2 (BVPS-2) reactor vessel Bottom Mounted Instrumentation (BMI) penetrations 1 through 50. These Class 1 penetrations are identified as 2REV-BMI-PENE-OD.

2. Applicable Code Edition and Addenda

American Society of Mechanical Engineers (ASME) Boiler and Pressure Vessel (BPV) Code, Division 1, Section XI, 2013 Edition.

ASME BPV Code Case N-722-1, "Additional Examinations for PWR Pressure Retaining Welds in Class 1 Components Fabricated with Alloy 600/82/182 Materials, Section XI, Division 1."

3. Applicable Code Requirement

10 CFR 50.55a(g)(6)(ii)(E) states in part: "All licensees of pressurized water reactors must augment their in-service inspection program by implementing ASME Code Case N-722-1, subject to the conditions specified in paragraphs (g)(6)(ii)(E)(*2*) through (*4*) of this section."

Code Case N-722-1 states in Table 1, "Examination Categories," for Item B15.80 "RPV bottom-mounted instrument penetrations," that all BMI penetration pressure boundaries and adjacent ferritic surfaces must be visually examined every other refueling outage.

4. Reason for Request

On March 13, 2020, the President of the United States declared a national emergency due to the spread and infectious nature of the Coronavirus-2019 (COVID-19) virus and resulting pandemic. The most recent guidance from the Centers for Disease Control and Prevention (CDC) includes recommendations for social distancing by maintaining approximately six feet from other personnel to limit the spread of the virus. On March 28, 2020, the Governor of Pennsylvania issued a Stay at Home order for Beaver County and the surrounding counties of Allegheny and Butler. Furthermore, on March 28, 2020, the Department of Homeland Security identified workers in the nuclear energy sector as essential critical infrastructure workers.

To prevent the spread of COVID-19 at BVPS, and to protect the health and safety of plant personnel while maintaining responsibilities to support critical infrastructure, Energy Harbor Nuclear Corp. intends to reduce the amount of personnel on-site, which will pose a hardship for completing the currently planned spring 2020 (2R21) refueling outage work scope. Energy Harbor Nuclear Corp. is also contingency planning in case some of its workforce becomes unavailable due to the COVID-19 outbreak. With the current work scope and potential loss of personnel, there is the potential that the company may not be able to complete the refueling outage in a timely manner, which could negatively impact critical infrastructure that is needed during this time.

BVPS-2 is scheduled to start 2R21 on April 12, 2020. At BVPS-2, the examination of BMI penetrations requires setup by construction trades to establish a temporary fall protection connection point, install temporary lighting, remove a hatch in the reactor support structure, and remove insulation. Also required are other contract and onsite staff to establish ventilation, perform radiological surveys, and perform the examination. The BMI inspection was last performed in 2R19 and is therefore required in 2R21 as specified by Code Case N-722-1. BVPS-2 operating cycles are approximately 18 months in duration.

This request is submitted due to an expected hardship obtaining and maintaining onsite staff levels sufficient to prepare, perform, and recover from the visual examination of the BMI penetrations.

5. Proposed Alternative and Basis for Use

Energy Harbor Nuclear Corp. is requesting relief to defer the inspection of the BVPS-2 BMI penetrations to the next refueling outage (2R22), which is scheduled for fall 2021. After this deferral, the normal code case examination frequency of every other refueling outage will be followed.

Performing this examination in 2R21 is a hardship due to expected challenges with obtaining and maintaining staffing levels sufficient for the examination in 2R21. Deferral of this examination would also reduce the risk of exposure (social distancing) for critical contract and direct hire personnel to the COVID-19 virus. The proposed alternative is based on satisfactory past inspections, chemical mitigation, low likelihood of occurrence, and leak detectability. Based on these factors, Energy Harbor Nuclear Corp. has identified performance of the BVPS-2 BMI examinations in 2R21 as a hardship without a compensating increase in the level of quality and safety in accordance with 10 CFR 50.55a(z)(2).

The primary degradation mechanism addressed by Code Case N-722-1 is primary water stress corrosion cracking (PWSCC). This degradation mechanism occurs when a susceptible material is exposed to a primary water environment, elevated stress levels, and high operating temperatures. In the case of a BMI penetration weld, the flaw eventually can become a through-wall condition allowing leakage onto and degradation of the carbon steel lower head of the reactor vessel.

A review of operating experience at other nuclear plants revealed that only one Westinghouse plant has experienced BMI nozzle leakage. The two leaks found at the Westinghouse plant were associated with a lack of fusion in the original construction weld. The two leaks were identified relatively early in the life of that plant and would likely have been identified by this point in the operating life of BVPS-2, if similar flaws existed in BVPS-2. Additionally, one Combustion Engineering (CE) plant has experienced BMI nozzle leakage. The leakage in the BMI nozzle at the CE plant was attributed to a void in the weld material that promoted PWSCC in the weld and nozzle materials. No conditions similar to the operating experience reviewed are known to exist at BVPS-2.

BMI penetration visual inspections were performed at BVPS-2 during the 2R12 refueling outage (fall 2006), the 2R13 refueling outage (spring 2008), the 2R14 refueling outage (fall 2009), the 2R15 refueling outage (spring 2011), the 2R17 refueling outage (spring 2014), and the 2R19 refueling outage (spring 2017). No indications of pressure boundary leakage or corrosion of the adjacent ferritic steel components were observed during the examinations.

With regard to risk, zinc addition to the primary reactor coolant is a method used in the industry to reduce the risk of PWSCC. Zinc addition to the primary reactor coolant was implemented at BVPS-2 in October of 2010, and the zinc deposits have been building since that time. The progress of the zinc buildup on the primary system surfaces is measured in terms of ppb-months, which is the product of the concentration of zinc in the chemical mitigation and the time over which it has been applied. In the fall of 2017, the plant reached 300 ppb-months, at which time significant chemical mitigation against PWSCC has been achieved. This significantly benefits the resistance to cracking in Alloy 600/82/182 materials throughout the plant, including the BMI penetration welds.

Also relevant to risk, WCAP-16372-P is the “Beaver Valley Alloy 600 Decision Advisor Report” that was prepared by Westinghouse in 2005 to recommend actions for various Alloy 600 components in response to industry experiences at the time. The analysis performed in WCAP-16372 utilized the crack growth rates contained in MRP-21 for weld material and MRP-55 for base material. This report determined that the probability of PWSCC initiation and flaw growth leading to a leak in the BMI penetrations is under 1 percent at the end of plant life including the current license extension. Probability of crack initiation was determined using a Weibull failure model, and the crack growth model developed in MRP-55 was used to determine the anticipated crack growth rates in the BMI penetration materials. This analysis assumed 50 Effective Full Power Years (EFPY) of operation. Currently BVPS-2 is at 27.8 EFPY, approximately half-way to the life required to reach the <1 percent probability. These probabilities were calculated without taking zinc addition into account, and the report states that a significant reduction in risk (approximately half in one example) is introduced with the zinc addition. This provides reasonable assurance that at this point in the life of BVPS-2 the detection of a leak during 2R21 due to PWSCC is unlikely.

It is also noteworthy that due to the operating temperature of the BMI penetrations being approximately cold leg temperatures, they are less susceptible to PWSCC.

Without inspecting the penetrations directly, leakage may still be detected if present. The general area around the lower reactor is examined as part of the pressure test program walkdown during Mode 3 start-up. A leak or increase in radiation levels within containment would be captured in the containment sump and detected by radiation monitoring during operation if a leak were to develop. Also, BVPS-2 has an integrated leakage monitoring program that monitors reactor coolant system (RCS) leakage. This program monitors various tank levels and the RCS temperature, and determines whether leakage is occurring based upon the overall RCS inventory. The program provides actions that must be taken if the RCS leakage exceeds pre-determined action levels. Action levels range from leaks greater than 0.1 gallons per minute (gpm), 0.15 gpm, and 0.3 gpm. If an unidentified RCS leak is greater than 1 gpm, the plant Technical Specification (TS) 3.4.13, RCS Operational Leakage, outlines the timely actions required to maintain safe operability for recovery, including a shutdown. These detection methods ensure that leakage would not go undetected for long periods of time.

The BVPS-2 RCS inventory is calculated by Reactor Coolant System Water Inventory Balance procedures, with a surveillance test requirement to be performed every 72 hours. The RCS Integrated Leakage Program provides guidance where the RCS leakage is quantified and compared to the recent history of RCS leakage to better understand if current changes are outside normally expected values.

The RCS Integrated Leakage Program includes guidance to determine if any program action level criteria are exceeded. The action level criteria are provided in the following table.

Action Level	***Action Level Criteria***
Level 1	*Is the rolling average of the last seven performances of Unidentified RCS leak rate greater than 0.1 gpm?*
Level 1	*Are the last nine consecutive Unidentified RCS leak rates greater than baseline mean?*
Level 2	*Are the last two consecutive Unidentified RCS leak rates greater than 0.15 gpm?*
Level 2	*Are the last two consecutive Unidentified RCS leak rates greater than [mean Unidentified RCS Leakage ÷ 2 Standard Deviation]?*
Level 3	*Is this Unidentified RCS leak rate greater than 0.3 gpm?*
Level 3	*Is this Unidentified RCS leak rate greater than [mean + 3 Standard Deviation]?*

The 0.1 gpm is consistent with WCAP-16465-NP, Pressurized Water Reactor Owners Group Standard RCS Leakage Action Levels and Response Guidelines for Pressurized Water Reactors, and is one-tenth of the Technical Specification (TS) limit for unidentified leakage. The RCS Integrated Leakage Program includes the requirement to identify the leakage source and could include entering containment to identify the source of the

leakage. If the source of the leakage is found and isolated, the program directs operation personnel to re-perform an RCS leak rate calculation to confirm that the source of leakage has been addressed.

The RCS leakage quantity is reviewed against the TS associated with RCS leakage criteria. Depending on the source identified, a shutdown could be required in accordance with TS Limiting Condition for Operation (LCO) 3.4.13 that has the following specific limits:

a. No pressure boundary LEAKAGE,
b. 1 gpm unidentified LEAKAGE,
c. 10 gpm identified LEAKAGE, and
d. 150 gallons per day primary to secondary LEAKAGE through any one steam generator (SG).

A through-wall leak from a BMI nozzle would constitute pressure boundary leakage.

Should any of these limitations be exceeded the appropriate LCO condition would be entered, and the required actions performed within the specified completion time, including plant shutdown, if required.

In summary, satisfactory past examinations, chemical mitigation, low likelihood of occurrence, and leak detectability provide reasonable assurance of structural integrity for one additional operating cycle between examinations of the BMI penetrations and surrounding ferritic material. Due to COVID-19 issues, Energy Harbor Nuclear Corp. requests approval to defer the visual examination from the currently planned BVPS-2 spring 2020 refueling outage (2R21) to the next BVPS-2 refueling outage (2R22) and resume the requirement in Code Case N-722-1 after that for examination every other outage.

6. Duration of Proposed Alternative

This proposed alternative will remain in effect until the next reasonable opportunity for examination. Currently, this opportunity would be during the next refueling outage (2R22) in fall 2021. After performing the examination in 2R22, the normal code case required frequency of every other outage would resume.

7. References

1. LTR-PSDR-16-008-P, Technical Basis for Optimization or Elimination of Liquid Penetrant Exams for the Embedded Flaw Repair Beaver Valley Unit 2. Westinghouse Electric Company LLC: 2016

2. Materials Reliability Program: PWR Bottom Mounted Nozzle (BMN) Nondestructive Examination Technical Basis (MRP-411). EPRI, Palo Alto, CA: 2020. 3002007948.

3. Materials Reliability Program: Inspection and Evaluation Guidelines for Reactor Vessel Bottom-Mounted Nozzles in U.S. PWR Plants (MRP-206). EPRI, Palo Alto, CA: 2009. 1016594.

4. Materials Reliability Program: Inspection Data Survey Report (MRP-219, Revision 12). EPRI, Palo Alto, CA: 2018. 3002007933.

5. Materials Reliability Program: PWR Bottom Mounted Nozzle (BMN) Issue Response Handbook (MRP-372 Revision 1). EPRI, Palo Alto, CA: 2015. 3002005497.

6. WCAP-16372, Beaver Valley Alloy 600 Decision Advisor Report. Westinghouse Electric Company LLC, Pittsburgh, PA: 2005.

7. WCAP-16465-NP, Pressurized Water Reactor Owners Group Standard RCS Leakage Action Levels and Response Guidelines for Pressurized Water Reactors.