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NRC REGULATORY ISSUE SUMMARY 2018-06
CLARIFICATION OF THE REQUIREMENTS FOR REACTOR PRESSURE VESSEL UPPER
HEAD BARE METAL VISUAL EXAMINATIONS

ADDRESSEES

All holders of, or applicants for, a pressurized-water reactor (PWR) operating license or construction permit under Title 10 of the *Code of Federal Regulations* (10 CFR) Part 50, "Domestic Licensing of Production and Utilization Facilities," and 10 CFR Part 52, "Licenses, Certifications, and Approvals for Nuclear Power Plants," except those that have certified that they have permanently ceased operations and have permanently removed all fuel from the reactor vessel.

INTENT

The U.S. Nuclear Regulatory Commission (NRC) is issuing this regulatory issue summary (RIS) to clarify the requirements for bare-metal visual examination, which can be either a visual examination of the bare metal of the upper head or a visual testing (VT)-2 examination under the insulation to meet the requirements of notes 1 and 4 in Table 1 of American Society of Mechanical Engineers (ASME) Code Case N-729-4, "Alternative Examination Requirements for PWR Reactor Vessel Upper Heads with Nozzles Having Pressure-Retaining Partial-Penetration Welds Section XI, Division 1." This RIS requires no action or written response on the part of an addressee.

BACKGROUND INFORMATION

Pressure-boundary leakage of borated water from upper head penetrations can cause corrosion of the low-alloy steel, which can compromise the structural integrity of the head. PWR licensees are required by 10 CFR 50.55a(g)(6)(ii)(D) to augment their inservice inspection program to implement ASME Code Case N-729-4. This Code Case provides alternative examination requirements and acceptance standards for PWR reactor vessel upper heads with nozzles having pressure-retaining partial-penetration welds to those standards found in the ASME Code, Section XI, Table IWB-2500-1, "Examination Category B-P, All Pressure Retaining Components." Code Case N-729-4 requires licensees to perform a visual examination of the reactor vessel upper head at an interval that depends on the material from which the head, penetration nozzles, and welds are fabricated.

In 2002, at the Davis-Besse Nuclear Power Station, Unit 1, a significant amount of reactor coolant leaked onto the head from a location not associated with the control rod drive mechanism (CRDM), obscuring the leakage through the nozzle and the resulting corrosion of the upper head.

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Two recent events illustrate how the requirements of Code Case N-729-4 can be misinterpreted by licensees.

In 2015, boric acid deposits, including boric acid at the annulus of several nozzles, were observed on the upper head of a PWR. In accordance with ASME Code Case N-729-4, Subsection 3142.1(b), the licensee is required to identify the deposits as a relevant condition of possible nozzle leakage. In this event, the licensee did not believe the deposits to be relevant conditions of possible nozzle leakage and cleaned the surface of the head using aggressive cleaning methods, without further analysis. Upon further consideration, the licensee recognized that because the deposits were removed, they could not conclusively attribute the leakage to a source other than the nozzle. Therefore, the licensee was required to meet the acceptance criteria for supplemental examination in Subsection 3142.2, "Acceptance by Supplemental Examination," or those for repair or replacement in paragraph (b) of Subsection 3142.3, "Acceptance by Corrective Measures or Repair/Replacement Activity."

A similar sequence of events took place at a different PWR in 2016 when boric acid deposits were detected by the licensee on the upper head. A large amount of boric acid leaked onto the head from a location not associated with the CRDM nozzles, covering several CRDM nozzles and lightly coating almost the entire upper head. The licensee performed the required supplemental examinations on the heavily affected nozzles, but the lighter boric acid deposits were not identified as relevant conditions of possible nozzle leakage in accordance with ASME Code Case N-729-4, Subsection 3142.1(b). The licensee cleaned the surface of the head using aggressive cleaning methods before performing subsequent visual examination, or other analyses needed, to determine the source of leakage.

SUMMARY OF ISSUE

Subsection 3141(c) defines "Relevant conditions for the purposes of the VE include evidence of reactor coolant leakage, such as corrosion, boric acid deposits, and discoloration." Subsection 3142.1(b)(1) of ASME Code Case N 729-4 states "Components with relevant conditions require further evaluation. This evaluation shall include determination of the source of the leakage and correction of the source of leakage in accordance with -3142.3." Subsection 3142.2 of ASME Code Case N-729-4 states, "A nozzle with relevant conditions indicative of possible nozzle leakage shall be acceptable for continued service if the results of supplemental examinations [-3200(b)] meet the requirements of -3130." Alternatively, Subsection 3142.3(a) of ASME Code Case N-729-4 states, "A component with relevant conditions not indicative of possible nozzle leakage is acceptable for continued service if the source of the relevant condition is corrected by a repair/replacement activity or by corrective measures necessary to preclude degradation." Therefore, correctly assessing whether the boric acid present constitutes "possible nozzle leakage" is critical to the determination of whether supplemental examinations are required.

Consistent with the definition of "relevant conditions," areas of corrosion, boric acid deposits, or discoloration at or near a nozzle annulus are relevant conditions and need to be assessed to determine if they are relevant conditions indicative of possible nozzle leakage. It is worth noting that the acceptance criteria for the relevant conditions described in N-729-4 are the same for primary water stress corrosion cracking-susceptible and primary water stress corrosion cracking-resistant material. The affected components are unacceptable for continued service until the requirements of Subsections 3142.1(b)(1), (b)(2), and (c) are met. An indication that some leakage may have come from a source other than a control rod drive nozzle does not remove the possibility that some or all of the leakage possibly came from a nozzle.

While Subsection 3142.1(b)(1) requires the licensee to determine the source of leakage, the methodology for identifying the source of leakage is not specified in ASME Code Case N-729-4. It is the NRC's position that relevant conditions (e.g., boron deposits) should be examined in the as-found condition. If leakage through a nozzle cannot be excluded by examining the as-found condition of the relevant conditions at a nozzle annulus (e.g., by assessment of boron deposit tenacity using light cleaning methods or by boron deposit chemical analysis), the requirements of ASME Code Case N-729-4, Subsection 3142.1, Subsection 3142.2, or Subsection 3142.3(b) must be met. Tightly adherent boron deposits at or near the nozzle annulus not removed using light cleaning methods are evidence that the deposits formed during plant operation. Removal of deposits at or near the nozzle annulus using aggressive cleaning methods without first examining the as-found condition precludes a meaningful further evaluation of the source of the leakage.

The NRC expects that licensees will review this information for applicability to their inservice inspection program.

BACKFITTING AND ISSUE FINALITY DISCUSSION

This RIS provides clarification regarding the appropriate methods for bare-metal visual examination under ASME Code Case N-729-4, "Alternative Examination Requirements for PWR Reactor Vessel Upper Heads with Nozzles Having Pressure-Retaining Partial-Penetration Welds Section XI, Division 1." This RIS requires no action or written response beyond that already required by the NRC regulations. Therefore, this RIS does not represent backfitting as defined in 10 CFR 72.62(a) or 50.109(a)(1), nor is it otherwise inconsistent with any issue finality provision in 10 CFR Part 52. Consequently, for this RIS, the NRC staff did not perform a backfit analysis or further address the issue finality criteria.

FEDERAL REGISTER NOTIFICATION

A notice of opportunity for public comment on this RIS was published in the *Federal Register* (83 FR 10407) on March 9, 2018. Nine comments were received from ASME, Dominion Engineering, Inc., the Electric Power Research Institute, and Exelon Generation Co., LLC. The NRC staff's evaluation of the comments is publically available through ADAMS under Accession No. ML18178A140.

CONGRESSIONAL REVIEW ACT

This RIS is a rule as defined in the Congressional Review Act (5 U.S.C. §§ 801–808). However, the Office of Management and Budget (OMB) has not found it to be a major rule as defined in the Congressional Review Act.

PAPERWORK REDUCTION ACT STATEMENT

This RIS does not contain new or amended information collection requirements that are subject to the Paperwork Reduction Act of 1995 (44 U.S.C. 3501 et seq.). Existing information collection requirements were approved by the Office of Management and Budget (OMB), approval number 3150-0011.

Public Protection Notification

The NRC may not conduct or sponsor, and a person is not required to respond to, a collection of information unless the document requesting or requiring the collection displays a currently valid OMB control number.

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REGULATORY ISSUE SUMMARY 2018-XX, "ASME CODE CASE N-729-4 REQUIREMENTS FOR REACTOR PRESSURE VESSEL UPPER HEAD BARE METAL VISUAL EXAMINATIONS," DATE: December 10, 2018

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***email concurrence**

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