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MRP Materials Reliability Program MRP 2016-003

(via email)

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To: Document Control Desk
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Washington, DC 20555-001

From: Bernie Rudell, Exelon, MRP Integration Chairman
Anne Demma, EPRI, MRP Program Manager

Subject: Submission of *Materials Reliability Program: Topical Report for Primary Water Stress Corrosion Cracking Mitigation by Surface Stress Improvement (MRP-335, Revision 3),* EPRI, Palo Alto, CA: 2013. 3002007392. [Freely Available at www.epri.com]

References:

1. Summary of Meeting with Electric Power Research Institute on Topical Report for Primary Water Stress Corrosion Cracking Mitigation by Surface Stress Improvement (MRP-335, Rev. 2). December 9, 2015. [NRC ADAMS Accession No.: ML15335A005].
2. Letter from B. C. Rudell and A. Demma to U.S. NRC, "Materials Reliability Program (MRP) Comments on the NRC Draft Safety Evaluation on the Topical Report 'Materials Reliability Program: Primary Water Stress Corrosion Cracking Mitigation by Surface Stress Improvement (MRP-335 Revision 2)' (TAC No. MF2429)," MRP 2015-036, October 27, 2015.
3. U.S. NRC, Draft Safety Evaluation of the Electric Power Research Institute MRP-335, Revision 1, "Materials Reliability Program: Topical Report for Primary Water Stress Corrosion Cracking Mitigation by Surface Stress Improvement [Peening]" (TAC No. MF2429), September 29, 2015. [NRC ADAMS Accession No. ML15245A046]

This letter transmits two copies of the subject topical report revision, MRP-335R3. The topical report proposes inspection requirements for Alloy 82/182 dissimilar metal piping butt welds (DMWs) and Alloy 600 reactor pressure vessel head penetration nozzles (RPVHPNs) and their Alloy 82/182 J-groove attachment welds in pressurized water reactor (PWR) plants mitigated against primary water stress corrosion cracking (PWSCC) via peening surface stress improvement. The topical report includes performance criteria for peening implementation. Until NRC has generically approved inspection relief for peening within 10 CFR 50.55a (such as approval of ASME Code Case N-729-5 or N-770-4), application-specific relief must be approved by NRC before implementing alternative inspection requirements for peening.

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At the December 9, 2015 public meeting between U.S. NRC and MRP [1], NRC staff and industry discussed NRC responses to MRP comments [2] on the draft Safety Evaluation (SE) [3] on the previous revision of the topical report, MRP-335R2. Based on these responses, there appeared to be a misunderstanding on what was proposed in MRP-335R2. As a result, MRP asked NRC to stop review of MRP-335R2, with intention of submitting MRP-335R3. MRP-335R3 incorporates clarifications and additional deterministic and probabilistic analyses intended to address the concerns expressed by NRC staff in the draft SE and during the December 9, 2015 and February 4, 2016 public meetings.

Table 1 below identifies the categories of revisions to MRP-335R2 to produce MRP-335R3. The changes incorporated in this revision are discussed below. MRP-335R3 directly incorporates five of the nine topical report conditions in the draft SE [3]. The other revisions to the topical report are intended to address the NRC concerns associated with the other four conditions.

If NRC staff has any outstanding concerns subsequent to review of MRP-335R3, MRP requests discussion of these concerns at a public meeting or on a conference call prior to NRC drafting the SE on MRP-335R3. Please contact the EPRI Project Manager, Paul Crooker, in this regard.

<u>Clarification on Crack Arrest</u>
Throughout MRP-335R3, it is clarified that the inspection relief takes no credit for crack arrest subsequent to peening. As demonstrated by the analysis of the topical report, the post-peening (follow-up and inservice inspection (ISI)) examinations address the small range of shallow flaw depths that are too small to be reliably detected during the pre-peening examination. The deterministic and probabilistic analyses apply the bounding stress effect meeting the performance criteria and thus do not credit crack arrest regardless of crack depth. Note that some sensitivity cases are included in Sections 5.2.2.1 and 5.2.2.2 of the topical report under headings marked "Example Representative Peening Stress Profile" solely for the purpose of illustrating the effect of a post-peening stress profile more compressive than that required by the performance criteria. These sensitivity cases show minimal additional safety or leakage margin.

<u>Matrix of Deterministic Cases (Section 5.2.3 of MRP-335R3)</u>
A matrix of deterministic crack growth cases that model growth to through-wall penetration and leakage was inserted in MRP-335R3 as Section 5.2.3. These cases model growth for a range of initial flaw depths at the time of peening up to the non-destructive examination (NDE) detectability limit. Flaws at least as deep as the NDE detectability limit are detectable during the follow-up and ISI examinations. The matrix consists of 72 cases for mitigated components and 72 cases for unmitigated components (288 cases total for DMWs and RPVHPNs), in which the initiating location, flaw orientation, operating temperature, crack growth rate material variability factor, initial crack aspect ratio, weld residual stress profile, and, for the case of DMWs, effective bending moment are varied. The inspection schedule for the matrix of cases, which is shown in Tables 5-4 and 5-12, is applied to determine during which inspection a crack is predicted to be detected, or if the crack is predicted to lead to a leak.

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Table 1. Differences between MRP-335R2 and MRP-335R3

#	Difference	Sections Affected in MRP-335R3	NRC Draft Condition Addressed
1	Clarify text that arrest of shallow flaws is not net necessary to justify the inspection credit provided by the Topical Report.	Throughout including 1.3, 2.3.5, 2.5.1, 2.5.2, 3.7, 5.1, 5.2.2.1, 5.2.2.2, 5.4, 6.1, A.3.3, A.5.5, A.9.3, B.3.3	5.3.1 & 5.3.3
2	Add a matrix of deterministic crack growth cases that model growth to through-wall penetration and leakage.	Sections 5.2, 5.2.3, 5.4, 6.2	5.3.1 & 5.3.3
3	Add the set of supplemental probabilistic cases. These cases show a minimal risk benefit of draft Conditions 5.3.1 and 5.2.1 with regard to safety and leakage frequency.	Sections 5.3.1, 5.3.2, 5.4, 6.2, A.9.3, B.9.3	5.2.1 & 5.3.1
4	Add discussion on the basis for the surface stress limit.	Section 2.3.4.1	5.2.2 & 5.3.1
5	Insert requirement that uncertainty in residual stress measurement be considered when assessing the surface stress after peening, plus references on use of XRD stress measurement for welds.	Sections 2.3.6, 4.2.8.1, 4.3.8.1, 6.3	5.3.1
6	Insert background information on plant corrective action programs, plus requirement for investigation of any PWSCC detected after last follow-up inspection.	Table 1-1 and Section 3.9	5.3.3
7	Insert information on benefit of VT-2 visual examination under the insulation through multiple access points to prevent significant boric acid corrosion.	Section 2.5.5	5.2.1
8	Add figures defining the peening coverage zone for RPVHPNs, plus the technical basis, including reference of MRP-95R1 (EPRI 1011225, which is now freely available from www.epri.com)	Sections 2.3.3, 4.3.1, 4.3.8.1, and Figs. 4-1 thru 4-4	5.2.2

#	Difference	Sections Affected in MRP-335R3	NRC Draft Condition Addressed
9	Make clear that the probabilistic modeling approach is similar to approaches that have been applied for more than 12 years to model PWSCC of various Alloy 600/82/182 PWR components, and that the modeling is not dependent on the xLPR approach.	Sections A.2, A.3, A.3.2, A.4.1, A.5.1, A.5.2, A.5.4, A.6, A.8.1.1, A.8.1.4, A.8.2.8	N/A
10	Incorporate Draft Condition 5.1.1 (For cold-leg DMWs, the follow-up inspection shall be performed no earlier than the third refueling outage following the application of peening).	Section 4.2.3 and Table 4-1	5.1.1
11	Incorporate Draft Condition 5.1.2 (The inspection of a 25% sample of DMW as proposed in MRP-335R2 is prohibited).	Section 4.2.4 and Tables 4-1 and 4-2	5.1.2
12	Incorporate Draft Condition 5.1.3 (The peening coverage for DMWs shall be extended at least ¼-inch beyond the susceptible material).	Sections 4.2.1 and 4.2.8.1	5.1.3
13	Incorporate Draft Condition 5.3.2 (The use of the "alternative performance criterion" to allow a reduction of the minimum depth of compression is prohibited).	Section 4.2.1 and removed Section 4.2.8.1.3	5.3.2
14	Incorporate Draft Condition 5.3.4 by making more explicit that a relief request must be submitted for NRC review and approval.	Table 1-1 and Section 6.3	5.3.4
15	Clarify requirements for peening if re-peening is performed on head nozzle after nozzle defects are corrected.	Section 4.3.5	N/A

Tables 5-5 through 5-10 and 5-13 through 5-18 of MRP-335R3 indicate the inputs applied for each case. These tables also report the time to grow from the initial depth to the detectability limit, the time to grow from the detectability limit to leakage, the inspection when detection is predicted, and the crack aspect ratio and length predicted when the crack depth reaches the detectability limit. The supplemental cases in Tables 5-11 and 5-19 investigate the effect of changes to the crack growth rate material variability factor for select cases in the main matrix.

As shown in the summary Table 5-3, a large fraction of cases with peening show no leakage subsequent to extension of inspection intervals. Any leakage occurring prior to the extension of inspection intervals would not have been prevented had the component not been peened, as those leaks occur when the inspection interval is the same as for an unmitigated component. All but one of the peened cases that are predicted to result in leakage assume the combination of a high tensile weld residual stress profile, the highest operating temperature for their category, and 95th percentile crack growth rate behavior. There is a very low probability of cases like this occurring in practice. Furthermore, the frequency of cases with leakage is much reduced compared to unpeened components inspected per the current requirements for unmitigated components. The supplemental cases in Tables 5-11 and 5-19 show that the range of crack growth rate material behavior that could result in leakage given the other input parameters is narrower with peening mitigation than without. As is the case for unmitigated heads, any cracking in the J-groove welds of RPVHPNs is addressed by the visual examinations for leakage. Peening reduces the probability of leakage due to weld cracking by preventing future initiations, and MRP-335R3 maintains the same basic visual examination schedule as is currently required for unmitigated RPVHPNs.

In summary, it is concluded that the inspection requirements of MRP-335R3 are effective to prevent leakage. As also demonstrated by the probabilistic analyses, peening mitigation in accordance with MRP-335R3 results in a large reduction in the likelihood of leakage, further reducing the leakage risk below the current low level demonstrated by plant experience for unmitigated components. Finally, the deterministic results also show how the long-term ISI examinations address the residual risk of slow-growing pre-existing flaws.

Note that the timing of the first follow-up examination for peened DMWs operating at reactor hot-leg temperature (within 5 years after peening) in Section 4.2.3 and Table 4-1 of MRP-335R3 was set on the basis of the deterministic approach. This represents a change versus the timing for the first follow-up examination for these components in MRP-335R2.

Basis for Surface Stress Limit (Section 2.3.4.1 of MRP-335R3)

The new Section 2.3.4.1.1 of MRP-335R3 presents the results of an extensive literature review of PWSCC initiation testing for Alloys 600/82/182/132. This literature review focused on data from specimens that were stressed near or below the conventional yield point at the test temperature. Consistent with the yield strength range applicable to Alloy 600 J-groove nozzles, laboratory testing for Alloy 600 materials with yield strengths up to 65 ksi (448 MPa) were considered. Researchers often cited the yield strength as the threshold stress for PWSCC initiation, and only two data points were identified with initiation for applied stress below the best-estimate at-temperature yield strength. Adjustment of these two data points to a tensile surface stress of 10 ksi on a conservative basis, conservatively assuming that PWSCC initiation can occur in the absence of plasticity effects, results in predicted initiation times of 568 and 611 years. This literature review concluded that for stresses approaching that of the at-temperature yield stress, PWSCC initiation will not occur over plant service periods (i.e., at least 80 years).

As discussed in Section 2.3.4.1.2, in a large majority of cases, the room-temperature yield stress for PWR plant Alloy 600 materials is in the range of 35-60 ksi. The yield strength for Alloys

600/82/182 at the upper end of operating temperatures relevant to peening mitigation (i.e., 618°F (325°C)) is estimated to be 80% of that at room temperature. Thus, 20 ksi is a conservatively low limit for the tensile stress required for PWSCC initiation over plant service periods. The surface stress limit of +10 ksi (tensile) per the MRP performance criteria for RPVHPNs provides substantial additional margin for post-peening stresses to prevent initiation.

Consideration of Uncertainty in Peening Surface Residual Stress (Sections 4.2.8.1 and 4.3.8.1 of MRP-335R3)

In Revision 3, the performance criteria require that the uncertainty in residual stress measurements be considered when assessing the surface stress after peening. Specifically, the performance criteria require that a combination of demonstration testing and analysis be used to demonstrate the capability of the peening method to produce the required post-mitigation stress state, including the residual stress plus normal operating stress at the peened surface. The basis for that consideration shall be documented in the application-specific qualification report and be included in relief requests for inspection relief. As this concern regarding uncertainty in measurements is required to be accounted for, it is not necessary for additional margin to be included in the performance criteria of the topical report.

Supplemental Probabilistic Analysis Cases (Summarized in Sections 5.3.1.2 and 5.3.2.2 of MRP-335R3)

Probabilistic analyses are applied in the topical report to assess the benefit of peening on the probability of pressure boundary leakage or rupture assuming reduced frequency of inspection. As discussed on page A-1 of MRP-335R3, the modeling approach is similar to the ones that have been applied for more than 12 years to assess PWSCC and appropriate inspection intervals.

Four probabilistic sensitivity cases have been added to MRP-335R3 to investigate the merit of draft Conditions 5.3.1 and 5.2.1:

- **DMW:** Total stress compressive to nominal compressive residual stress depth (draft Condition 5.3.1)
- **RPVHPN:** Total stress compressive to nominal compressive residual stress depth (draft Condition 5.3.1)
- **RPVHPN:** Separate out draft Condition 5.3.1 peening penetration depth effect from compressive surface stress effect
- **RPVHPN:** Perform bare-metal VE volumetric examination every cycle after peening (bounds effect of draft Condition 5.2.1)

The results for these sensitivity cases are presented in Sections 5.3.1.2 and 5.3.2.2 of MRP-335R3. The inputs for these cases are defined in Sections A.9.3 and B.9.3. These sensitivity cases show that draft Conditions 5.3.1 and 5.2.1 would provide a minimal additional risk benefit with regard to nuclear safety and leakage frequency for peened components.

Key Modeling Conservatisms of MRP-335R3

The probabilistic modeling generally reflects a best-estimate approach with uncertainties treated using statistical distributions. However, with regard to some detailed aspects of the modeling,

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conservative simplifications were necessary to make the simulation tractable. Section 5.4 of MRP-335R3 discusses the modeling assumptions that tend to make the analysis results conservative. The following modeling conservatisms for RPVHPNs are especially noteworthy:

- The probability of a direct VE visual examination identifying a leaking penetration is assumed to be only 90%. The probability of detection for successive VE examinations of the same leaking nozzles is assumed to be correlated such that the probability of detection is reduced below 90% if a leaking penetration is not identified by the first VE after a flaw is modeled to penetrate to the nozzle annulus.
- It is assumed that flaws initiating on the J-groove weld would grow to the nozzle annulus and cause leakage without any chance of growing into the nozzle base metal and becoming detectable via the periodic ultrasonic testing performed from the nozzle ID prior to leakage occurring.
- A through-wall 30° circumferential flaw located at the top of the weld is assumed to be produced immediately upon nozzle leakage (i.e., cracking to the nozzle annulus). This assumption was maintained from the approach taken in MRP-105 as part of the technical basis for the inspection requirements for unmitigated RPVHPNs in N-729-1. In most cases, circumferential cracking in the nozzle tube at or near the top of the weld has not been detected for leaking RPVHPNs.
- As discussed above, the 10 ksi (tensile) surface stress limit (peening residual stress and normal operating stress) of the MRP performance criteria is conservatively below the stress threshold for PWSCC initiation over plant service periods. An extensive literature review of PWSCC initiation test data revealed only two data points with initiation below the specimen yield strength at test temperature. Adjustment of these two data points to a tensile surface stress of 10 ksi on a conservative basis, conservatively assuming that PWSCC initiation can occur in the absence of plasticity effects, results in predicted initiation times of 568 and 611 years.

Considering the margin against PWSCC initiation inherent in the 10 ksi stress limit and the requirement that residual stress measurement uncertainty be explicitly treated in the application-specific relief request, the analyses in MRP-335R3 appropriately credit peening meeting the MRP performance criteria as preventing future initiations. The topical report requires that peening be demonstrated to meet the performance criteria through a qualification program. As discussed in Section 2.1 of MRP-335R3, peening mitigation shall be performed in accordance with a quality assurance program meeting the requirements of Appendix B to 10 CFR 50 and the utility's plant specific commitments.

Plant Corrective Action Programs (Section 3.9 of MRP-335R3)

Per Section 3.9 of MRP-335R3, an investigation is required per the existing plant corrective action program if PWSCC indications are detected subsequent to the last follow-up examination. Corrective action programs are required by 10 CFR 50 Appendix B Criterion XVI, and reports under the corrective action program are available for review by NRC resident inspectors. The purpose of the follow-up investigation is to assess any evidence that PWSCC initiation occurred subsequent to the peening. As demonstrated by the deterministic and probabilistic analyses, the residual risk of a pre-existing flaw is addressed by the long-term ISI examinations. Thus, detection of PWSCC subsequent to the follow-up examinations should not necessarily result in a conclusion that the required peening stress effect was not achieved. Section 3.9 lists several activities that could be considered as part of the corrective action evaluation, depending on the circumstances of the detected indications.

Benefit of VT-2 Visual Examination Under the Insulation through Multiple Access Points to Detect Evidence of Leakage (Section 2.5.5 of MRP-335R3)

MRP-335R3 requires VT-2 visual examinations of the head under the insulation through multiple access points for all refueling outages in which a bare-metal VE volumetric examination is not required. This type of visual examination is another opportunity for precluding significant boric acid corrosion (BAC) and limits the time between inspections under the insulation for evidence of leakage to one fuel cycle.

As discussed in Section 2.5.5.2 of MRP-335R3, performance of a visual examination under the insulation each refueling outage is highly effective in detecting leakage prior to the potential for significant BAC of the low-alloy steel head material. This conclusion is supported by plant experience with dozens of leaking RPVHPNs, more general plant experience with PWSCC, and full-scale mock-up testing of leaking J-groove nozzles. Cases with discernible BAC in operating PWRs have been accompanied by substantial amounts of boric acid deposits, readily detectable by visual examinations under insulation, and the mockup testing demonstrated that large volumes of boric acid deposits accompany the leakage necessary to produce significant BAC damage to reactor vessel heads. Section 2.5.5.2 cites the relevant references. Furthermore, PWSCC growth rates are much slower at reactor cold-leg temperature versus head temperatures near reactor hot-leg temperature such that the time for the leak rate to increase is much extended. MRP-335R3 requires a VE during each refueling outage other than for heads operating at reactor cold-leg temperature.

Peening Coverage Zone for RPVHPNs (Section 2.3.3 and Figures 4-1 through 4-4 of MRP-335R3)

The peening coverage zone proposed in Figures 4-1 through 4-4 of MRP-335R3 ensures that areas susceptible to PWSCC initiation are mitigated. The basis for the coverage shown in these figures is presented in Section 2.3.3 of MRP-335R3. Weld residual stresses for representative RPVHPN analysis cases are reported in MRP-95R1, which is also the basis for the NDE coverage for RPVHPNs specified by Figure 2 of ASME Code Case N-729-1. The stress results show that the region of elevated tensile stresses that may lead to PWSCC initiation extend below the weld toe a reduced distance on the nozzle OD compared to that on the nozzle ID. This behavior is the result of the through-wall bending stress component produced by shrinkage of the J-groove weld. Figures 4-1 through 4-4 of MRP-335R3 specify identical peening coverage to the NDE coverage of Figure 2 of ASME Code Case N-729-1 with the exception of a portion of the nozzle OD below the weld. The surface stress in this region, which is not part of the pressure boundary, is shown by the analyses not to exceed the 20 ksi tensile stress limit that is also the basis for the NDE coverage in Figure 2 of N-729-1. The difference in the specification of the RPVHPN base material coverage for NDE versus that for peening coverage is the result of the difference in the purpose of these two activities. The purpose of the NDE is to determine whether there is a grown PWSCC flaw inside the nozzle examination *volume*, whereas the peening is performed to prevent PWSCC initiation on a particular *surface*. Defining the peening coverage in this manner avoids the application time for peening areas below the weld on the nozzle OD that are not susceptible to PWSCC initiation.

Clarification on Requirements for Re-Peening Subsequent to Repair

During the February 4, 2016 public meeting, NRC staff asked for clarification on the requirements of the MRP topical report regarding re-peening of a head penetration subsequent to correction of NDE indications. For Revision 3 of MRP-335, a sentence was added to two locations in Section 4.3.5 to clarify that follow-up volumetric or surface examinations in accordance with Note (11) of Table 4-3 are required for the individual re-peened nozzle. In most cases, a PWSCC indication would be detected during an outage in which all nozzles were already being volumetrically examined. In the case that an examination performed in accordance with Table 1 or -2420 of ASME Code Case N-729-1 reveals a leak or a flaw not acceptable for continued service, -2430 of N-729-1 would require volumetric or surface examinations of all nozzles, plus a direct VE visual examination of the head if not already completed. Also note that Section 4.3.5 of Revision 3 includes clarification regarding the timing of the preservice examination required by IWA-4000 in the case of re-peening following repair/replacement activities.

Conclusions

The inspection requirements for unmitigated Alloy 600/82/182 PWR pressure boundary components were developed by MRP to maintain an acceptably low effect on nuclear safety of the PWSCC concern. These inspection requirements also result in low probability of through-wall cracking and leakage, ensuring defense in depth. The goal of the topical report was to develop inspection requirements for components mitigated via peening that maintain this acceptably low effect on nuclear safety of the PWSCC concern. As shown by probabilistic analyses, the requirements of this report actually result in an increased nuclear safety margin, plus a large reduction in the probability of leakage occurring. The leakage prevention benefit of peening performed in accordance with the requirements of this report is further demonstrated through an extensive matrix of deterministic crack growth cases. In summary, peening mitigation implemented in accordance with the requirements of this topical report provides a substantial risk benefit for a risk that is already low.

MRP concludes that Revision 3 of the topical report addresses the concerns expressed by NRC staff in the draft SE [3]. In summary:

- MRP-335R3 clarifies that arrest of shallow flaws is not credited in the analyses that are the basis for the level of inspection relief specified in the topical report.
- Draft NRC Conditions 5.1.1, 5.1.2, 5.1.3, 5.3.2, and 5.3.4 have been directly incorporated into MRP-335R3.
- Draft NRC Condition 5.3.1 has been addressed by added deterministic analyses in MRP-335R3 that demonstrate inspection requirements are effective to prevent pressure boundary leakage without this condition. Consistent with the probabilistic analyses, the deterministic analyses show a large leakage prevention benefit of peening meeting the bounding stress effect of the performance criteria of MRP-335R3. Furthermore, the

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probabilistic analyses show a very limited risk benefit for draft Condition 5.3.1, both in terms of nuclear safety and leakage risk. MRP-335R3 also includes an extensive review of laboratory testing for PWSCC initiation that shows that the MRP-335R3 stress limits conservatively prevent new initiations, and MRP-335R3 requires that the uncertainty in surface residual stress measurements explicitly be considered in the peening qualification.

- Draft NRC Condition 5.3.3 is addressed by added deterministic analyses showing that the long-term ISI examinations required by MRP-335R3 address the residual risk of slow-growing pre-existing flaws. Thus, detection of PWSCC subsequent to the follow-up examinations should not necessarily result in a conclusion that the required peening stress effect was not achieved and that the inspection schedule must revert to that for unmitigated components. In this circumstance, MRP-335R3 requires an investigation within the existing plant corrective action program to assess any evidence that PWSCC initiation occurred subsequent to the peening.
- Draft NRC Condition 5.2.1 is not necessary because the topical report requires a visual examination under the insulation for evidence of pressure-boundary leakage during every refueling outage for peened top heads. Plant experience and mockup testing show that the VT-2 examination under the insulation through multiple access points is highly effective in detecting leakage prior to the potential for significant boric acid corrosion of the low-alloy steel head material. Furthermore, probabilistic modeling shows a limited risk benefit for the nozzle ejection frequency of the more frequent bare-metal VE visual examinations that the draft condition would require for heads operating at reactor cold-leg temperature.
- Draft NRC Condition 5.2.2 is addressed by MRP-335R3 by including figures defining appropriate minimum peening coverage areas for RPVHPNs. These figures have identical coverage to that specified by the draft condition (i.e., Figure 2 of ASME Code Case N-729-1) with the exception of a portion of the nozzle OD below the weld. The surface stress in this region, which is not part of the pressure boundary, is shown by analyses not to exceed the 20 ksi tensile stress limit that is also the basis for the NDE coverage in Figure 2 of N-729-1.

If you should have any questions concerning this letter, please contact Paul Crooker, EPRI MRP Project Manager, at (pcrooker@epri.com) or 650-855-2028.

Sincerely,

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cc: Joe Holonich, NRC
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