Response to Non-Concurrence Regarding Safety Evaluation for Topical Report MRP-227, "Pressurized Water Reactor Internals Inspection and Evaluation Guidelines"

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Regarding the issue of requiring the use of EVT-1 quality visual examinations in lieu of the VT-3 quality visual examinations identified in MRP-227, Revision 0 for certain components potentially subject to cracking mechanisms (stress corrosion cracking (SCC), irradiation-assisted stress corrosion cracking (IASCC) or fatigue), the staff has reviewed the list of "Primary" and "Expansion" inspection category components, or groups of like components (e.g., bolts), subject to cracking mechanisms for which a VT-3 examination has been assigned.

Component	Cracking Mechanism(s)	Likelihood of Failure*	Consequence of Failure*
Babcock & Wilcox (B&W) lower core barrel and upper core barrel lower grid shock pads	SCC	Likely to occur	Marginal safety concern
B&W core barrel locking devices, locking welds, baffle-to-former bolts, and internal baffle-to-former bolts	IASCC	Likely to occur	Marginal safety concern
B&W lower grid dowel-to-guide block welds	SCC	Not likely to occur	Marginal safety concern
B&W X-750 dowel-to-upper/lower fuel assembly support pad welds	SCC	Not likely to occur	Marginal safety concern
Combustion Engineering (CE) peripheral instrument guide tubes in control element assembly shroud assembly	SCC, Fatigue	Low likelihood of failure	Medium damage
CE core support column welds	SCC, IASCC, Fatigue	Medium likelihood of failure	Low damage
Other CE instrument guide tubes	SCC, Fatigue	Medium likelihood of failure	Low damage
Westinghouse baffle-edge bolts	IASCC, fatigue	High likelihood of failure	Medium damage
Westinghouse baffle-former assembly	IASCC	High likelihood of failure	Low damage
Westinghouse thermal shield flexures	Fatigue	Medium likelihood of failure	Low damage
Westinghouse bottom mounted instrumentation column bodies	Fatigue	Medium likelihood of failure	Low damage

*Terminology used in these columns is from MRP-227 and, although similar, varies between the CE/Westinghouse and B&W categorization programs. See MRP-227 for further details.

The staff has concluded that allowing the use of a VT-3 quality visual examination provides for an adequate level of quality and safety for these components for a number of reasons. First, the staff notes that although VT-3 examinations have not traditionally been credited for identifying cracking, they have been proven to be capable of doing so by operating experience. For example, SCC in Westinghouse X-750 guide tube support pins (split pins) was identified and managed through VT-3 examinations until the replacement of these pins with 316 stainless steel support pins (split pins) was achieved. VT-3 examinations have likewise been accepted for the examination of some boiling water reactor internals components (e.g., jet pump bolts on the mechanical clamp joining the inlet to the mixer, control rod drive (CRD) tube sleeve-to-alignment lug welds, CRD guide tube and fuel support alignment pin-to-core plate welds, etc.) where cracking mechanisms are being inspected for under the Boiling Water Reactor Vessel and Internals Project inspection and evaluation guidelines. The staff also recognizes that the quality of inspections achieved using the VT-3 inspection standard from the American Society of Mechanical Engineers Code has improved over the years as critical parameters (surface cleaning, lighting, character height specification for qualification, etc.) have been refined.

In addition, the staff notes that the components for which VT-3 examinations have been credited are very flaw tolerant, either because of the size of the component in question and the length of flaw required to begin to postulate the potential for failure, or because a group of like components is considered in which multiple like components must fail in order to compromise the functionality of the group (e.g., Westinghouse baffle-edge bolts, for which although there is a high likelihood of seeing degradation of some bolts, the likelihood of observing enough degraded bolts to realize the potential “medium” safety consequence is much lower). The staff also notes that, with the exception of only two component groupings on the list, the consequences of their failure are either “low” or “marginal” providing additional assurance that even if the components were to fail, the effects of their failure would be manageable and that the affected plant could be placed in a safe shutdown condition. Further, VT-3 examinations for cracking were not specified in MRP-227 in cases where the data would potentially be used in a fracture mechanics analysis to demonstrate the structural integrity of the vessel internals. If a more precise measurement of the extent of cracking is necessary for performing a flaw evaluation to justify continued operation of a component, the staff would expect that a follow-up EVT-1 or ultrasonic examination would be conducted. So, although EVT-1 examinations are certainly understood to be more precise when determining specific flaw lengths or when attempting to identify short, tight flaws due to IASCC or SCC, when inspecting flaw tolerant, generally low safety significance components where the identification of short, tight flaws is not necessary to ensure their continued functionality, a VT-3 examination is deemed to be adequate for the purpose.

In summary, the staff determined that requiring licensees to perform EVT-1 examinations instead of VT-3 examinations for the aforementioned components would add a level of burden (inspection time/outage critical path time, expense, etc.) to the licensees’ programs which would be inconsistent with the value to be gained by doing so.