TOPICAL REPORT EVALUATION

Report Identification: BAW-10013

Report Title: Study of Intergranular Separations in Low Alloy Steel Heat-Affected Zones Under Austenitic Stainless Steel Weld Cladding

Report Date: December 1971 with revised pages 2-1, 2-2, 2-3, 5-3 and 5-4 dated February 15, 1972

Originating Organization: Babcock and Wilcox

Reviewed By: Materials Engineering Branch, AEC Directorate of Licensing, September 1972

SUMMARY OF TOPICAL REPORT

Intergranular separations in low alloy steel heat-affected zones under austenitic stainless steel weld claddings have been detected in reactor vessels constructed by various manufacturers which were clad by high-heat-input weld cladding processes.

B&W investigations revealed that the subject flaws are present only in SA-508, Class 2 forgings manufactured to a coarse grain practice, and clad by high-heat-input submerged arc processes such as the 6 wire, strip, and the 2-wire. No anomalies were observed in SA-533 Grade B, Class 1 plate materials clad by any of the high-heat-input processes. Their fracture mechanics studies revealed that a critical crack size, on the order of 4 inches, is required to initiate fast fracture. This is several orders of magnitude greater than the maximum flaw size (i.e., 0.156 inch in depth and 0.500 inch in length) plus a predicted growth of 0.058 inch over a 40 year period due to design fatigue cycles, and it is considered by B&W that the subject flaws would have no detrimental effect on the integrity of B&W vessels under all operating conditions during the design life of the vessel.

SUMMARY OF REGULATORY EVALUATIONS

We consider the findings of B&W that the flaws are present only in SA-508 Class 2 coarse grain forgings, but not in SA-533 Grade B, Class 1 plates when clad by high-heat-input processes valid, since they have been confirmed by other investigators. We have reviewed B&W's fracture

mechanics analysis and agree with their statement regarding critical crack size. However, their calculations on crack growth are based on controlled short term experiments, which do not necessarily reflect actual reactor operating conditions. However, even if the crack growth were several times greater than calculated, the initial maximum flaw size plus such a value would still be relatively insignificant when compared to the critical crack size, which was determined to be of approximately 4 inches.

SUMMARY OF REGULATORY POSITION

We concur with B&W's finding that the integrity of a vessel having flaws such as described in the subject report would not be compromised during the life of the plant. This report is acceptable and may be referenced in future case applications where similar underclad grain boundary separations have been detected. However, such flaws should be avoided and we recommend that future applicants state in their PSARs what steps they plan to take in this regard.