

A Study on Improvement Approaches of Socket Welds inspection in Nuclear Power Plants

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The socket welds with small-diameter pipes of 2 inches or less typically require surface inspections in nuclear power plants. However, as part of enhanced in-service inspections in Korean nuclear power plants, ultrasonic testing of the volumetric method is additionally performed in conjunction with surface inspections. The 1-skip inspection of phased array ultrasonic testing is used for small-diameter socket welds due to their complex geometry and thin thickness. The conventional phased array ultrasonic testing typically employs a 3.5 MHz phased array ultrasonic probe and a manual encoder scanner to detect defects that may occur during operation. Simulation should also be considered essential for comprehending signals and proving the high reliability of the technique. In this study, the conventional phased array ultrasonic testing technique used on-site is introduced by comparing the simulation results. The specimens have socket welds on pipes with diameters of 0.75, 1, and 2 inches, and they include defects such as lack of fusion, incomplete penetration, and cracks. Additionally, various approaches to enhance inspection reliability have been explored through experiments involving phased array ultrasonic probes of different frequencies, scanners, and advanced signal process techniques. We investigated that these improved approaches have the potential possibilities and effectiveness based on the results.