



UNITED STATES
NUCLEAR REGULATORY COMMISSION
WASHINGTON, D.C. 20555-0001

SAFETY EVALUATION BY THE OFFICE OF NUCLEAR REACTOR REGULATION
REVIEW OF PROPOSED ALTERNATIVE TO THE ASME CODE
FOR SURFACE EXAMINATION OF WELD REPAIRS TO NONSTRUCTURAL SEAL WELDS
NORTHERN STATES POWER COMPANY
PRAIRIE ISLAND NUCLEAR GENERATING PLANT
DOCKET NOS. 50-282 AND 50-306

1.0 INTRODUCTION

By letter dated January 19, 1996, Northern States Power Company (NSP), the licensee, proposed an alternative to the surface examination requirements of paragraph N-518.4 of the 1968 American Society of Mechanical Engineers (ASME) Boiler and Pressure Vessel Code. The proposed alternative would be used in conjunction with weld repairs to four nonstructural seal welds. The seal welds are on the canopy seal of four control rod drive mechanisms (CRDMs) at penetration locations H6 and G7 on Unit 1 and F6 and G7 on Unit 2.

The welds are used to ensure leak tightness of the thread joint holding the rod travel housing to the CRDM housing. The seal weld is a small groove weld applied to a small protrusion ("canopy") over the end of the threads. Because the threads constitute the pressure boundary, the seal weld is nonstructural. The presence of the canopy protrusion provides a weld surface that avoids fusion of the ends of the threads and allows the seal weld to be more readily removed when necessary.

Paragraph N-518.4 of the 1968 ASME Code, Section III, requires that attachments (welds) to the pressure boundary be inspected by means of a liquid penetrant examination (PT). However, a PT examination of the welds would be difficult. The canopy seals are in a high radiation area of approximately 250 to 450 mR/hour. Additionally, access to the canopy seals is difficult due to the limited clearance between adjacent CRDMs. The separation between the housings is approximately 7 inches. This is not adequate clearance to gain complete access to perform the PT examination. Surface preparation (grinding) of the welds, PT examination, and subsequent cleanup would be difficult to execute properly, would be time consuming, and would incur substantial personnel radiation exposure.

2.0 EVALUATION

Section III of the ASME Code, 1968 Edition, specifies a surface examination of weld-repaired areas (paragraph N-514.2) or welded attachments (paragraph N-518.4). For PT examinations, the acceptance criteria of paragraph N-627 must be met. The most stringent among the acceptance criteria is the requirement for "no linear indications." Later editions of the Code define 1/16 inch as the smallest length of a relevant linear indication.

The proposed alternative would include an 8-power visual examination (by means of a remote video camera) of the in-process automatic welding and a post-weld visual examination with the same camera. Additionally, a fracture mechanics and limit load analysis of the pressure boundary in the region adjacent to the seal welds has been performed by the licensee. The results of the fracture mechanics analysis demonstrated that the predicted critical flaw size in all cases is of significant length and therefore the proposed 8x visual examination will be able to reliably detect much smaller flaws than the calculated critical flaw size. A VT-2 visual examination of the welds would also be performed during a hydrostatic test of the reactor.

The licensee submitted a test report giving the results of a resolution test of the camera equipment used by the welding contractor during the weld repairs. In the test, a wire 0.0005-inch diameter by 0.4-inch long was taped to the surface adjacent to a mockup of the production welds. The wire was filmed using the weld head lighting for illumination. Review of the tape demonstrated the visibility of the test wire with the camera system.

As a further process control during welding, the same video camera was employed to monitor the weld puddle during performance of the production welds. This technique is now commonly employed in the industry with positive results. It enables the welding operator to further verify the welding process, take corrective actions during the course of welding, and to identify potential problem locations prior to weld completion and performance of weld acceptance examinations. With the additional process monitoring this method provides, the probability of undetected weld defects is substantially diminished. Therefore, the proposed alternative is sufficient to ensure weld integrity.

3.0 CONCLUSION

Under the provisions of 10 CFR 50.55a(a)(3)(i), the staff has determined that the licensee's proposed alternative to the ASME Code for surface examination (PT) of the CRDM canopy seal welds will provide an acceptable level of quality and safety. The proposed alternative inspection is authorized for the four stated repairs at Prairie Island Units 1 and 2. Staff authorization of the proposed alternative does not extend to future use without prior staff review.

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