



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

SAFETY EVALUATION BY THE OFFICE OF NUCLEAR REACTOR REGULATION

REGARDING ACTIONS TAKEN IN RESPONSE TO

BULLETIN 79-13 "CRACKING IN FEEDWATER SYSTEM PIPING"

NORTHERN STATES POWER COMPANY

PRAIRIE ISLAND NUCLEAR GENERATING PLANT UNIT NOS. 1 AND 2

DOCKET NOS. 50-282 AND 50-306

Introduction

On June 19 and July 16, 1979 the Northern States Power Company (NSP) responded to our May 25, 1979 request for information regarding possible cracking in auxiliary feedwater lines at the Prairie Island Nuclear Generating Plant Unit Nos. 1 and 2. In the responses all information was supplied except the inspection results from the January 1980 refueling outage for Unit No. 2.

Background

On May 20, 1979, Indiana and Michigan Power Company notified the NRC of cracking in two feedwater lines at their D.C. Cook Unit 2 facility. The cracking was discovered following a shutdown on May 19 to investigate leakage inside containment. Leaking circumferential cracks were identified in the 16-inch feedwater elbows adjacent to two steam generator nozzle to elbow welds. Subsequent radiographic examinations revealed cracks in all eight steam generator feedwater lines at this location on both Units 1 and 2.

On May 25, 1979, a letter was sent to all PWR licensees by the Office of Nuclear Reactor Regulation which informed licensees of the D.C. Cook failures and requested specific information on feedwater system design, fabrication, inspection and operating history. To further explore the generic nature of the cracking problem, the Office of Inspection and Enforcement requested licensees of PWR plants in current outages to immediately conduct volumetric examination of certain feedwater piping welds. As a result of these actions several other licensees reported cracking in the steam generator nozzle to feedwater piping weld vicinity. On June 25, 1979, IE Bulletin 79-13 was issued. The Bulletin required inspection of the steam generator nozzle-to-pipe welds and adjacent areas within 90 days and reinspection of these welds, the feedwater piping welds to the first support, the feedwater piping to containment penetration and the auxiliary feedwater to main feedwater piping connection at the next refueling outage.

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Evaluation

In conformance with the Bulletin the Prairie Island Plant Unit No. 1 initial radiographic and visual examinations has been completed and no evidence of cracking in the feedwater piping has been found.

From the results of instrumentation installed at several plants which have experienced feedwater piping cracks and other modeling and analyses by a utility sponsored Owners Group, significant cyclic stresses occur in the feedwater piping in the vicinity of the steam generator nozzle from mixing and stratification of cold auxiliary feedwater with hot water from the steam generator during low flow conditions. Metallurgical analyses of the cracked feedwater piping has identified the mode of failure as fatigue assisted by corrosion.

The Owners Group is expected to complete their investigations and make recommendations for changes in design and operating procedures by February 1980. In addition, the NRC has instituted a Pipe Crack Study Group to review this and other pipe cracking problems in PWR's. It is anticipated that the Pipe Crack Study Group will complete its work by June 1980 and provide recommendations to be implemented by Staff as new criteria for operating plants, if required.

Although cracking has not been identified through the inspections performed to date for the Prairie Island Plant, the staff feels that the cyclic stress induced by the thermal transients present when cold auxiliary feedwater at low rates is injected into the main feedwater may result in cracking at these facilities. The staff and the Owners Group both have performed independent analyses and have determined that flawed piping could withstand challenges from operating and faulted loads including seismic and limited water hammer loads without loss of piping integrity. Pipe breaks have occurred in the past in feedwater piping as the result of water hammer loads. However, measures such as "J" tubes have been instituted and operational changes have occurred to minimize the possibility of water hammer. In the unlikely event of a feedwater pipe break from a severe water hammer, the consequences have been analyzed as a design base accident and measures have been established to deal with the event.

Conclusion

We conclude that the nondestructive inspections performed and scheduled and the analyses performed for flawed piping ensure that the piping integrity until the recommendations of the Owners Group and the Pipe Crack Study Group have been evaluated. Should the Staff determine that further actions are required after evaluation of the Owners Group and Pipe Crack Study recommendation, the licensees will be notified at that time.

Date: February 6, 1980