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

SAFETY EVALUATION BY THE OFFICE OF NUCLEAR REACTOR REGULATION

RELATING TO RELIEF FROM THE ASME BOILER AND PRESSURE VESSEL CODE, SECTION XI, "RULES FOR INSERVICE INSPECTION OF NUCLEAR POWER PLANT COMPONENTS - DIVISION I"

NIAGARA MOHAWK POWER CORPORATION

NINE MILE POINT NUCLEAR STATION, UNIT NO. 1

DOCKET NO. 50-220

FACILITY OPERATING LICENSE NO. DPR-63

INTRODUCTION

During the 1986 Refueling and Maintenance Outage, the Reactor Building Closed Loop Cooling (RBCLC) Heat Exchanger No. 13 failed the ASME Boiler and Pressure Vessel Code Section XI Inservice Inspection hydrostatic pressure test. Leakage through the shell to tube sheet weld was observed. Investigation identified the source of leakage to be a through-wall crack approximately 10 inches long on a copper silicon tube sheet to carbon steel shell weld. The leakage rate is less than 0.022 gallons per hour at operating pressure and is well within the system makeup capability of approximately 60 gallons per minute.

Section 3.2.6.a.1 of the Technical Specifications (TS) requires quality group A, B and C components to satisfy the requirements of Section XI of the ASME Boiler and Pressure Vessel Code. The RBCLC Heat Exchangers are classified as quality group C components. Section XI, paragraph IWA-4120, requires that repairs shall be performed in accordance with the original design specification and construction code of the component. The original code for construction of these heat exchangers is ASME Section VIII-1965. Due to the metallurgical properties of the dissimilar metal tube sheet to shell weld, the licensee does not believe that an acceptable weld repair can be made at this time. A stress analysis of the heat exchanger combining dead weight, thermal and seismic loads has been performed using the load combinations specified in the Second Supplement to the Final Safety Analysis Report. The analysis indicates that the loads in the weld can be carried even with a 50 percent reduction of the weld thickness. The licensee will, however, install supporting straps between the waterbox and the shell. This repair will be conducted in accordance with the rules of the ASME Boiler and Pressure Vessel Code Section III, Subsection NF. Niagara Mohawk's 10 CFR Part 50 Appendix B QA program will be used in lieu of the NCA 4000 requirements.

By letter dated January 22, 1987, as supplemented March 9, 1987, in accordance with 10 CFR 50.55a(g)(5)(iii) and the TS, the licensee requested relief to install the supporting straps and continue operation of these heat exchangers until no later than the Spring 1988 refueling and maintenance outage. This

request was based upon the long lead time required to procure new heat exchangers, if necessary (approximately 8 months), the need to operate all three heat exchangers during high lake temperature conditions, and the fact that a permanent repair in accordance with Section XI was impractical considering the complexity of the heat exchanger weldment.

EVALUATION

The RBCLC system provides cooling water to designated reactor auxiliary systems and components, as well as designated balance of plant systems and components. Some of the systems served by RBCLC are: Reactor Recirculation Pump Motor Coolers, Drywell Air Coolers, Shutdown Cooling Heat Exchangers, Control Room Chillers, Feedwater Pumps (High Pressure Coolant Injection), Non-Regenerative Clean-Up Heat Exchanger, and Spent Fuel Pool Heat Exchanger. The RBCLC system was originally designed to contain three 50 percent capacity, horizontally mounted, counter flow, tube and shell type heat exchangers. The tube side of the heat exchangers is cooled by service water. Each heat exchanger has a design heat removal load of 68 million BTU/hr. During normal operations, two heat exchangers are in service and one is in standby. However, during the late summer and early fall, when the lake temperature is at its highest, all three heat exchangers are in operation. This change in operation is due to the addition of loads to the system since it was originally designed.

Since the tubesheet material is very difficult to weld and replacement equipment is not available, the licensee performed a temporary repair involving only the steel shell of the heat exchangers. This consisted of welding straps between the water boxes and shell. This welding was performed in accordance with ASME Section III. This provides assurance against gross structural failure of the heat exchangers by utilizing the straps to carry the design loads.

A stress analysis of the welded straps was performed by the licensee to evaluate the structural integrity of the heat exchanger. The analysis conservatively assumed that the potential cracked welds between the shell and the tubesheet carried no load. The result of the licensee's analysis showed that the stress level in the straps under the maximum operating pressure loading condition is within the ASME Code Section III, Subsection NF allowables. The licensee stated that loads due to seismic, thermal, and deadweight were also considered.

Based on a review of the information provided by the licensee, we have determined that the licensee's analysis provides a reasonable assurance that the design of the welded straps is capable of maintaining the structural integrity for the interim period until a permanent repair or replacement is implemented.

The licensee proposed to monitor and chart the leakage rate monthly. If any significant increase in leakage is detected, the licensee will perform further non-destructive examinations and evaluate any indications of crack growth. If the leakage exceeds 6.0 gpm (10 percent of makeup flow), the licensee will declare the heat exchanger inoperable.

The other two heat exchangers in the system have not exhibited signs of leakage. However, ultrasonic examination of these heat exchangers could not conclusively demonstrate the integrity of the tube sheet to shell welds. Consequently, the licensee believes that installing supporting straps on these heat exchangers would be a reasonable precaution and will do so.

The staff has concluded that relief from the ASME Boiler and Pressure Vessel Code, Section XI requirement that repairs shall be performed in accordance with the Owner's Design Specification and Construction Code of the component or system, is justifiable. The interim repairs to ensure structural integrity have been in accordance with the design allowables for Section NF of Section III of the ASME Boiler and Pressure Vessel Code. The leakage limit of 6 gpm for each heat exchanger coupled with the interim repairs performed and the supporting analyses provides reasonable assurance that the system would be able to perform its intended design function. Further, the licensee has committed to repair or replace the affected heat exchanger during the Spring 1988 refueling outage.

Based on the fact that ultrasonic examination of the other RBCLC heat exchangers could not conclusively demonstrate the integrity of the tube sheet to shell welds, the staff recommends that further non-destructive examination of the other two heat exchangers be performed to evaluate if the weldments are sound. Further, if any unacceptable flaws or leakage are found, the heat exchangers should be repaired in accordance with the original design and construction code or be replaced.

CONCLUSION

Based on the considerations discussed above, the staff concluded (1) that relief may be granted pursuant to paragraph 10 CFR 50.55a(g)(6)(i) based on our finding that certain requirements of Section XI of the ASME Boiler and Pressure Vessel Code are impractical, and (2) that granting relief where the Code requirements are impractical is authorized by law and will not endanger life or property, or the common defense and security, and is otherwise in the public interest considering the burden that could result if they were imposed on the facility. This relief is effective through the Spring 1988 refueling outage.

ACKNOWLEDGEMENT

Principal Contributor: H. Conrad

Dated: March 20, 1987