January 14, 2000

Mr. John H. Mueller
Chief Nuclear Officer
Niagara Mohawk Power Corporation
Nine Mile Point Nuclear Station
Operations Building, Second Floor
P. O. Box 63
Lycoming, NY 13093

SUBJECT: NINE MILE POINT NUCLEAR STATION, UNIT NO. 1 - EVALUATION OF FLAW INDICATIONS IN RECIRCULATION SYSTEM PIPING (TAC NO. MA6511)

Dear Mr. Mueller:

By letter dated September 14, 1999, the Niagara Mohawk Power Corporation (NMPC) submitted for NRC review its examination results of the reactor recirculation system safe-end to elbow welds, and the associated flaw evaluation for the detected flaws for Nine Mile Point, Unit 1 (NMP1). The ultrasonic (UT) examination of these welds was conducted during the 1999 refueling outage (RFO15). The examination results reveal two indications in one safe-end to elbow weld and one indication each in three additional safe-end to elbow welds of the reactor recirculation system. The flaws range from 0.08 inch to 0.32 inches in depth and 0.5 inch to 67.5 inches in length. These indications exceed the specifications of Table IWB-3514-2 of Section XI of the American Society of Mechanical Engineers (ASME) Code for allowable planar flaws in austenitic steels. Consequently, NMPC intended to demonstrate through an analytical flaw evaluation that NMP1, could be operated without repair of the welds through the present operating cycle.

We completed the review and found that NMPC's flaw evaluation meet the rules of the ASME Code and the requirements specified in NUREG-0313, Revision 2. Since the predicted flaw depth at the end of the present operating cycle is less than the allowable flaw length based on IWB-3641, we determined that NMP1 could be operated without repair of the recirculation system safe-end to elbow welds until the end of the present operating cycle. Details of our review may be found in the enclosed safety evaluation. This completes our efforts on the subject matter.

Sincerely,

/RA/

Peter S. Tam, Senior Project Manager, Section 1
Project Directorate I
Division of Licensing Project Management
Office of Nuclear Reactor Regulation

Docket No. 50-220

Enclosure: As stated

cc w/encl: See next page

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DATED: January 14, 2000

SAFETY EVALUATION, LICENSE NO. DRP-63 NINE MILE POINT UNIT NO. 1

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cc: Plant Service list

SAFETY EVALUATION BY THE OFFICE OF NUCLEAR REACTOR REGULATION

RECIRCULATION SAFE-END TO ELBOW WELD INDICATIONS EVALUATION

NINE MILE POINT NUCLEAR STATION UNIT NO. 1

NIAGARA MOHAWK POWER CORPORATION

DOCKET NO. 50-220

1.0 INTRODUCTION

By letter dated September 14, 1999, Niagara Mohawk Power Corporation (the licensee) submitted for NRC review its examination results of the reactor recirculation system safe-end to elbow welds, and the associated flaw evaluation for the detected flaws at Nine Mile Point Nuclear Station, Unit 1 (NMP1). The ultrasonic (UT) examination of these welds was conducted during the 1999 refueling outage number 15 (RFO15). The examination results reveal two indications in one of the safe-end to elbow welds, one surface flaw and the other subsurface, and indication of a surface flaw in each of the three additional safe-end to elbow welds of the reactor recirculation system. The subsurface flaw is 0.32 inches in depth and 0.5 inch in length; the surface flaws range from 0.08 inch to 0.20 inch in depth and 17.3 inches to 67.5 inches in length. These indications exceed the specifications of Table IWB-3514-2 of Section XI of the American Society of Mechanical Engineers (ASME) Code for allowable planar flaws in austenitic steels. Consequently, the licensee intended to demonstrate through an analytical flaw evaluation that the unit could be operated without repair of the welds through the present operating cycle.

2.0 FLAW EVALUATION

2.1 Licensee's Evaluation

The licensee's flaw evaluation consists of two parts: the calculation of the allowable flaw depth and the calculation of the predicted flaw depth at the end of the requested period. In the first part the licensee used Tables of IWB-3641-1 for normal and upset conditions and IWB-3641-2 for emergency and faulted conditions from Section XI of the ASME Code. The normal and upset loading included pressure and deadweight, and the emergency and faulted loading included, in addition, seismic shutdown earthquake (SSE) loading. Since the weld was of gas tungsten-arc weld (GTAW), the licensee did not include the effect due to thermal expansion in accordance with the Code. These ASME tables were derived from limit load analysis similar to Appendix C methodology, but with a 360° circumferential flaw instead of the finite-length flaw (<360°) of Appendix C. Using the appropriate loading and the stress intensity S_m of 17.5 ksi (at 550°F) for the Type 316 stainless steel, the licensee obtained the predicted flaw depths of 0.661 inch for the normal conditions and 0.577 inch for the faulted conditions. The faulted conditions are limiting.

In the calculation of the predicted flaw depth at the end of the requested period (730 days), the licensee employed the methodology of NUREG-0313, Revision 2, to estimate the flaw growth due to intergranular stress corrosion cracking (IGSCC) and Figure A-4300-1 of the ASME Code to estimate the flaw growth due to fatigue. Fourteen startup and shutdown cycles and 10 seismic cycles were considered in the fatigue growth calculation. Based on an assumed initial flaw depth of 0.42 inch for the limiting flaw, the licensee reported an IGSCC growth of 0.155 inch. The corresponding growth due to fatigue was 0.0012 inch. The sum of the above three numbers is 0.576 inch (0.42 + 0.155 + 0.001), which equals the allowable flaw depth of 0.577 inch discussed previously. Hence, the allowable "initial" flaw depth at the beginning of the requested period is 0.42 inch. Since the largest detected flaw depth of 0.20 inch is less than the allowable initial flaw depth of 0.42 inch, the licensee concluded that NMP1 can be operated without repair of the safe-end to elbow welds of the reactor recirculation system until the end of the present operating cycle.

2.2 NRC Staff Evaluation

The licensee's use of Tables of IWB-3641-1 for normal and upset conditions and IWB-3641-2 for emergency and faulted conditions in calculating the allowable flaw depths is conservative because the flaw is assumed to be a 360° circumferential flaw instead of the finite-length configuration for all detected flaws. The remaining allowable flaw depths calculation, such as the type of loads included in the normal and faulted conditions and the exclusion of the thermal expansion effect, is in accordance with the ASME Code. For the IGSCC growth, the licensee used the approach of NUREG-0313, Rev. 2, which is an acceptable methodology for estimating flaw growth due to IGSCC. Using Figure A-4300-1 of the ASME Code to estimate flaw growth due to fatigue is also a standard approach. Hence, the licensee's flaw evaluation is acceptable to the staff.

Instead of comparing the predicted flaw depth at the end of the requested period with the allowable flaw depth, the licensee compared the current flaw depth (at the beginning of the requested period) with the allowable flaw depth adjusted for crack growth. Mathematically, these two approaches are equivalent. However, without proper explanation, the licensee's approach tends to incur confusion. For instance, in Enclosure 3 of the submittal dated September 14, 1999, the label "Allowable Depth" in Section 2.0, "Summary of Results," should be revised to "Allowable Depth Adjusted for Crack Growth," so that the summary would be consistent with the SSFLAW computer output provided by the licensee.

Since the predicted crack depth for the surface flaws at the end of the present operating cycle is less than the allowable flaw depth, and the analysis for the surface flaws bounds that for subsurface flaws, the staff determines that the licensee's flaw evaluation meets the rules of the ASME Code, and continued operation for NMP1 with the flaw indications in the recirculation system safe-end to elbow welds is acceptable.

3.0 REINSPECTION REQUIREMENTS

For boiling-water reactor (BWR) piping weldments, the reinspection requirements are more stringent than those specified in the ASME Code. NUREG-0313, Rev. 2, requires a detected

flaw that has not been repaired (Category F) be reinspected every refueling outage. The flaw may be upgraded to Category E with less frequent reinspection after four successive examinations indicate no adverse change in cracking condition. Since these flaws are new findings which have been evaluated for only one cycle, they should be addressed per the guidance in NUREG-0313, Rev. 2 (i.e., repaired or inspected and re-evaluated at the end of the present operating cycle).

4.0 CONCLUSION

The NRC staff has reviewed the licensee's submittal. The staff determined that the flaw evaluation meets the rules of the ASME Code and the requirements in NUREG-0313, Rev. 2. Since the predicted crack depth at the end of the present operating cycle is less than the allowable flaw depth, the staff determined that continued operation for NMP1 with the flaw indication in the recirculation system safe-end to elbow welds is acceptable until the end of the present operating cycle.

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Date: January 14, 2000

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