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

May 5, 2000

Mr. Khushwant S. Grewal
114 Coopers Kill Road
Delran, NJ 08075-2008

Dear Mr. Grewal:

I am responding to your letter of March 16, 2000, to Mr. Richard A. Meserve, Chairman of the U.S. Nuclear Regulatory Commission (NRC). In your letter, you expressed concerns about a weld flaw in the Nine Mile Point Nuclear Station, Unit 2, reactor pressure vessel high-pressure core spray (HPCS) nozzle. We telephoned you on April 28, 2000, and confirmed that you were addressing weld KC-32. Between 1990 and the present time, the licensee (Niagara Mohawk Power Corporation) and the NRC have done a significant amount of review on this weld flaw, culminating in NRC safety evaluations dated June 22 and August 27, 1993, and February 12, 1996 (Enclosures 1, 2 and 3).

Weld KC-32 is a weld joining the HPCS nozzle safe-end to the safe-end extension. During the first refueling outage, the licensee detected a flaw indication by using ultrasonic testing (UT) techniques. The size of the flaw indication was reported to be 0.15 inch deep and 1.9 inches long. During the same refueling outage, the licensee applied a mechanical stress improvement process (MSIP) on this weld. The MSIP redistributed the residual stresses in the weld, thereby inducing compressive residual stresses at the inside diameter surface of the weld and continuing through about half of the wall thickness. Compressive residual stresses are desirable because they tend to mitigate the flaw growth since tensile stresses are needed for intergranular stress corrosion crack (IGSCC) propagation. After the application of MSIP, the subject weld was ultrasonically re-examined and the flaw indication was reported to have a size of 0.35 inch deep and 3.4 inches long. The change in measured size of the indication was most probably due to redistribution of stresses associated with the flaw, resulting in shifting of the existing flaw surfaces relative to an occluded oxide layer. This resulted in additional reflectivity in the subsequent ultrasonic measurement. It is also possible the flaw extended as a result of MSIP. Nonetheless, the flaw size subsequent to MSIP continued to meet American Society of Mechanical Engineers Boiler and Pressure Vessel Code safety limits such that repair was not required.

Subsequent to the post-MSIP inspection (first refueling outage, December 1990), the licensee performed an ultrasonic examination of weld KC-32 at a mid-cycle outage (August 1991) during the second fuel cycle, and at the second (April 1992), third (October 1993), fourth (May 1995) and sixth refueling (May 1998) outages. Results were reported in the licensee's letters dated September 22, 1995 (Enclosure 4) and April 7, 2000 (Enclosure 5). The reported flaw sizes vary from 29% (0.25 inch) to 41% (0.35 inch) of wall thickness (0.85 inch) in depth and 8.3% (2.5 inches) to 11.3% (3.4 inches) of circumference in length. These ultrasonic inspection results for the flaw were bounded by the inspection results from the original post-MSIP inspection, thus serving to reinforce the positions that the crack has not grown since it was originally characterized, and that stabilization of the flaw occurred due to application of MSIP which reduced the driving force for flaw extension.

The subject weld was categorized as IGSCC Category F after the application of MSIP. Based on Generic Letter 88-01 (GL 88-01), Category F welds are welds that are without any IGSCC mitigation, and require an inspection every refueling outage. After MSIP, a flawed weld would normally be categorized as a Category E weld (flawed welds mitigated either by weld overlay repair or by stress improvement such as MSIP) and require an inspection at every other refueling outage. However in this case, due to the flaw size results determined by ultrasonic inspection after MSIP, the weld remained categorized as F, thereby requiring inspection every refueling outage. The guidelines in GL 88-01 allow Category F welds to be upgraded to Category E after four successive examinations indicate no significant change in the flaw size. The staff approved the upgrade of weld KC-32 from Category F to Category E by its safety evaluation dated February 12, 1996. This is based on the consideration that no apparent crack growth was detected in the four successive examinations subsequent to the first post-MSIP inspection. The first examination after the upgrade was performed at the sixth refueling outage and no significant flaw growth was detected. The next inspection is scheduled to be performed at the eighth refueling outage (2001).

During the past 10 years, six ultrasonic examinations have been performed on weld KC-32 to monitor the condition of the flaw. The results of these inspections affirmed the basis for the upgrade approved by the staff's February 12, 1996, safety evaluation. These results demonstrate that the MSIP applied to weld KC-32 was effective in mitigating the IGSCC. The licensee's current inspection schedule for weld KC-32 is consistent with the guidelines in GL 88-01. The licensee will continue to inspect weld KC-32 at a frequency of once every two refueling outages to ensure that the structural integrity of the weld is maintained.

In your letter you also specifically commented on the potential relaxation of the residual stresses and the loading effect on flaw measurement. These comments are briefly summarized below:

(1) The effect of thermal fatigue resulting from thermal stratification could relax the beneficial residual stress induced by the MSIP treatment.

(2) The loading resulting from pinned piping hanger support and lead shielding adjacent to the flawed weld could affect the results of ultrasonic examination.

The staff believes that any issues of the type you raise would be evidenced by significant changes in ultrasonic measurements or by trends in ultrasonic measurements that would indicate a developing problem. Such has not been the case with weld KC-32. Should subsequent measurements indicate a problem with KC-32, the licensee is obligated to effect a weld overlay repair (Enclosure 6).

In summary, between 1990 and the present time, the NRC staff has carefully monitored the licensee's inspection results and evaluation of weld KC-32. The results of the staff's review are documented in the safety evaluations cited above. Consistent with its commitment and as approved by the staff's safety evaluation dated February 12, 1996, the licensee did not plan to examine weld KC-32 during refueling outage 7. Currently, no new information has been identified that would necessitate a revision to the NRC-approved examination program. At this time, based on the information available, we conclude that there is reasonable assurance that the unit can continue to be operated safely. If you have any questions, please contact the NRC project manager, Mr. Peter Tam, at 301-415-1451, e-mail pst@nrc.gov.

Sincerely,

Samuel J. Collins, Director
Office of Nuclear Reactor Regulation

Enclosures:
1. Letter, J. E. Menning to B. R. Sylvia, June 22, 1993
2. Letter, J. E. Menning to B. R. Sylvia, August 27, 1993
3. Letter, G. E. Edison to B. R. Sylvia, February 12, 1996
4. Letter, C. D. Terry to NRC, September 22, 1995
5. Letter, R. B. Abbott to NRC, April 7, 2000
6. Letter, C. D. Terry, to NRC, July 8, 1993

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Sincerely,

/RA/

Samuel J. Collins, Director
Office of Nuclear Reactor Regulation

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*See previous concurrence

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

June 22, 1993

Docket No. 50-410

Mr. B. Ralph Sylvia
Executive Vice President, Nuclear
Niagara Mohawk Power Corporation
301 Plainfield Road
Syracuse, New York 13212

Dear Mr. Sylvia:

SUBJECT: SAFETY EVALUATION FOR NIAGARA MOHAWK POWER CORPORATION'S PROPOSAL TO CONTINUE TO OPERATE NINE MILE POINT, UNIT NO. 2, WITH A FLAW IN HIGH PRESSURE CORE SPRAY NOZZLE SAFE END WELD KC-32 (TAC NO. M86013)

By letter dated May 6, 1992, the NRC staff approved a Niagara Mohawk Power Corporation (NMPC) proposal to operate Nine Mile Point Nuclear Station, Unit 2 (NMP-2), for up to a maximum of 9700 hours during the current (third) fuel cycle with a flaw in the weld joining the high pressure core spray nozzle safe end to safe end extension. The staff's letter of May 6, 1992, noted that NMPC had committed to either submit its justification for continuing to operate through to the third refueling outage or repair or replace the weld prior to exceeding 9700 hours of operation. By letter dated March 16, 1993, as supplemented April 30, 1993, NMPC submitted the results of a fracture mechanics analysis that provided justification for up to 11,000 hours of operation in the third fuel cycle. Staff approval of 11,000 hours of operation in the third fuel cycle would allow continued operation of NMP-2 until the scheduled start of the third refueling outage.

The NRC staff has completed its review of the NMPC submittals of March 16 and April 30, 1993. As discussed in the enclosed safety evaluation, we did not accept the results of the fracture mechanics analysis as justification for continued operation. However, based on the considerations that the weld was subjected to the Mechanical Stress Improvement Process and that the results of subsequent ultrasonic examinations have shown no apparent flaw growth, the staff did conclude that the structural integrity of the weld would be

Enclosure 1

maintained during the current fuel cycle, and that operation of NMP-2 for up to 11,000 hours in the current fuel cycle is acceptable.

This concludes the staff's efforts under TAC No. M86013.

Sincerely,

John E. Menning, Project Manager
Project Directorate I-1
Division of Reactor Projects - I/II
Office of Nuclear Reactor Regulation

Enclosure:
Safety Evaluation

cc w/enclosure:
See next page

ENCLOS

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

SAFETY EVALUATION BY THE OFFICE OF NUCLEAR REACTOR REGULATION

RELATED TO AN EVALUATION OF A FLAW INDICATION IN WELD KC-32

NIAGARA MOHAWK POWER CORPORATION

NINE MILE POINT UNIT 2

DOCKET NO. 50-410

1.0 INTRODUCTION

In a letter dated April 24, 1992, Niagara Mohawk Power Corporation (the licensee) submitted for staff review and approval the results of an ultras (UT) examination during the second refueling outage of a flaw in the reactc pressure vessel high pressure core spray nozzle safe end to safe end exten weld (KC-32) at Nine Mile Point Nuclear Station, Unit 2 (NMP-2). The lice proposed at that time to restart NMP-2 for the third fuel cycle without repairing the flaw and to either (1) submit justification for continuing operation until the third refueling outage, three months prior to exceedin 9700 hours of operation in the third fuel cycle, or (2) repair or replace weld prior to exceeding 9700 hours of operation in the third fuel cycle. letter dated March 16, 1993, supplemented with a letter dated April 30, 19 the licensee submitted a justification for continuing operation until the third refueling outage with a total cycle operating time not to exceed 11,C hours.

2.0 DISCUSSION

During an October 1990 inservice inspection of NMP-2, a circumferential indication was found in the 10-inch reactor pressure vessel high pressure spray nozzle safe end to safe end extension weld. The initial UT examinat of the weld indicated a flaw depth of 17.6% of wall thickness and a length 6.3% of the weld circumference. Stress improvement utilizing a Mechanical Stress Improvement Process (MSIP) was performed on the weld after the flaw discovered. A subsequent UT examination indicated a flaw depth of 41% of wall thickness and a length of 11.3% of the weld circumference.

The licensee then committed to perform UT examination of the indication mi through the second fuel cycle, and submitted the results of this examinati to the NRC in a letter dated September 16, 1991. The results of the mid-c examination showed a maximum indication depth of 38% of the wall thickness a length of 11.0% of the weld circumference. This slight decrease in indication size demonstrated that the MSIP had maintained the weld in compression and little or no crack growth had occurred.

On April 24, 1992, the licensee submitted the results of the UT examination performed during the second refueling outage. This examination showed a flaw depth of 29% of the wall thickness and a length of 11.0% of the weld circumference. At that time the licensee proposed to restart NMP-2 for the third fuel cycle without repairing the weld and to either (1) submit justification for continuing operation until the third refueling outage, three months prior to exceeding 9700 hours of operation in the third fuel cycle, or (2) repair or replace the weld prior to exceeding 9700 hours of operation. In a letter dated March 16, 1993, the licensee submitted a justification for continuing operation through to the third refueling outage.

In the original fracture mechanics analysis, submitted on June 28, 1991, the licensee applied the 5% uncertainty associated with UT examination to the analytically predicted crack size. Since uncertainty is associated with the UT sizing of the flaw and not the analysis, and the most recent analysis applied the uncertainty to the value obtained from the UT measurement of the flaw. The results of the most recent analysis were submitted to the NRC staff in a letter dated March 16, 1993, and were proposed as a basis for continuing to operate the unit through to the third refueling outage. The results of the analysis predicted a maximum crack depth of 59.97% of wall thickness for an operating period of 10,900 hours. This result meets the wall thickness requirement of 60% contained in Section XI of the American Society of Mechanical Engineers Boiler and Pressure Vessel Code.

In a letter dated April 30, 1993, which supplemented the March 16, 1993, letter, the licensee informed the NRC of their plans to extend the current (third) fuel cycle from 10,900 hours to a maximum of 11,000 hours. The licensee's fracture mechanics analysis showed that the flaw depth would not reach the Code limit of 60% of wall thickness until a minimum of 11,080 hours of operation.

The staff has reviewed the licensee's fracture mechanics analysis, and performed an independent crack growth calculation. The staff finds that the influence functions used by the licensee in the calculation of the stress intensity factors were based on a model incorporating the actual crack length. This methodology, described in "Circumferential Cracks in Pressure Vessels and Piping - Volume II, ASME PVP Vol. 95, 1983," is less conservative than that recommended by the NRC. The method recommended by the NRC, which assumes a 360° circumferential crack, is detailed in NUREG 0313, Revision 2, "Technical Report on Materials Selection and Processing Guidelines for BWR Coolant Pressure Boundary Piping," and was published in 1988. The staff's analysis, using the NUREG as guidance, calculated a maximum operating time significantly lower than that derived from the licensee's analysis. In view of the uncertainties in the crack growth analysis as well as in the UT technique, it is prudent to employ a conservative methodology for the crack growth evaluation. Therefore, the licensee's fracture mechanics analysis will not be accepted as justification for extended operation.

However, the staff finds the licensee's request to operate NMP-2 until the third refueling outage with a total cycle operating time not to exceed 11,000 hours to be acceptable. This is based on the considerations that this weld was subjected to MSIP and that the results of the subsequent UT examinations have shown no apparent growth of the flaw.

3.0 CONCLUSIONS

Based on a review of the licensee's submittals as discussed above, the staff concludes that the structural integrity of the nozzle safe-end weld KC-32 would be maintained during the current fuel cycle as the growth of the flaw would not be significant. Therefore, NMP-2 can be safely operated until the third refueling outage with a total cycle operating time not to exceed 11,000 hours.

Principal Contributor:
Cheryl Beardslee

Date:

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

August 27, 1993

Docket No. 50-410

Mr. B. Ralph Sylvia
Executive Vice President, Nuclear
Niagara Mohawk Power Corporation
301 Plainfield Road
Syracuse, New York 13212

Dear Mr. Sylvia:

SUBJECT: HIGH PRESSURE CORE SPRAY NOZZLE SAFE-END EXTENSION WELD - NINE MILE POINT NUCLEAR STATION, UNIT 2 (TAC NO. M86964)

By letter dated July 8, 1993, Niagara Mohawk Power Corporation (NMPC) requested NRC staff approval of a change to its previous approach regarding an indication in the weld joining the high pressure core spray (HPCS) nozzle safe end to the safe-end extension. NMPC had intended to replace the safe-end extension during the third refueling outage to remove the flaw. However, in view of the continued favorable ultrasonic inspection results and further analysis, NMPC proposed to not replace the safe-end extension as originally planned, but rather to continue to monitor the flaw at each refueling outage. If ultrasonic inspection shows any growth at any time, then NMPC would implement a weld overlay repair.

The staff has completed review of NMPC's proposal for continued inspection and, if necessary, repair of the flaw in the weld joining the HPCS nozzle safe end to the safe-end extension. As discussed in the enclosed Safety Evaluation, we have concluded that NMPC's proposal, including the weld overlay repair plan, is acceptable.

This completes staff efforts under TAC No. M86964.

Sincerely,

John E. Menning, Project Manager
Project Directorate I-1
Division of Reactor Projects - I/II
Office of Nuclear Reactor Regulation

Enclosure:
Safety Evaluation

Enclosure 2

ENCLOSURE

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

SAFETY EVALUATION BY THE OFFICE OF NUCLEAR REACTOR REGULATION

DISPOSITION OF FLAW IN HIGH PRESSURE CORE SPRAY NOZZLE SAFE-END WELD

NIAGARA MOHAWK POWER CORPORATION

NINE MILE POINT NUCLEAR STATION, UNIT 2

DOCKET NO. 50-410

1.0 INTRODUCTION

By letter dated July 8, 1993, Niagara Mohawk Power Corporation (NMPC or the licensee) requested NRC staff approval of a change to its previously approved approach for dispositioning a flaw in the weld joining the high pressure core spray (HPCS) nozzle safe end to the safe-end extension. NMPC had intended to replace the safe-end extension during the third refueling outage to remove the flaw.

During the first refueling outage, ultrasonic testing identified an indication in the weld joining the HPCS nozzle safe end to the safe-end extension. The licensee concluded that the indication was from the original fabrication, resulting from solidification shrinkage cracking in the weld. The indication was evaluated as a flaw 0.15 inches deep (17.6% of the wall thickness) and 1.9 inches long (6.3% of the circumference). NMPC applied the mechanical stress improvement process (MSIP) to improve the residual stress distribution near the flaw and eliminate the potential for flaw growth. Reinspection subsequent to MSIP showed a flaw size of 0.35 inches deep (41% of the wall thickness) maximum, and 3.4 inches long (11.3% of the circumference). The licensee attributed the increase in ultrasonic response of the flaw to increased ultrasonic reflectivity resulting from the MSIP.

Ultrasonic inspections were again performed during a mid-cycle outage during the second fuel cycle and during the second refueling outage. The mid-cycle inspection indicated a maximum flaw depth of 0.32 inches (38% of the wall thickness) and a length of 3.3 inches (11% of the circumference). Inspection during the second refueling outage revealed a flaw depth of 0.25 inches (29% of the wall thickness) and a length of 3.3 inches (11% of the circumference). The last two ultrasonic inspections have revealed no growth in the flaw, unlike the results of the first post-MSIP inspection. NMPC believes that MSIP stabilized the flaw.

In view of the favorable ultrasonic inspection results and further analysis, NMPC is proposing to not replace the safe-end extension during the third refueling outage as originally planned. The licensee is proposing to ultrasonically inspect the flaw during the upcoming third refueling outage and at each refueling outage thereafter. If ultrasonic inspection shows growth at any time, i.e., to a depth greater than 41% of the wall thickness and/or length greater than 11.3% of the weld circumference, NMPC would implement a weld overlay repair. The licensee considers the risks associated with replacement of the safe-end extension, such as radiation exposure, to not be justified.

2.0 DISCUSSION AND EVALUATION

The staff finds NMPC's proposal to be acceptable for the following reasons:

A. The licensee evaluated the post-MSIP residual stresses in the axial direction based on field measurements of the circumferential pipe contraction. The evaluation showed that these stresses are compressive on the inner half of the wall thickness, extending well beyond the depth on the flaw, even when including welding residual stresses, seismic, and operating loads. The licensee's evaluation is supported by independent tests by Argonne National Laboratory on similar pipe. The analysis showed that the flaw should not grow. In spite of the analysis results, NMPC will monitor the flaw each refueling outage.

B. NMPC is confident that the indication is no deeper than 41% of the wall thickness, no longer that 11.3% of the circumference, and not growing in depth or length. This is supported by the following:

- Flaw depth measurement results have varied from 41 to 29% of wall thickness. This variation is not unexpected for this narrow flaw. Electric Power Research Institute (EPRI) staff have reviewed the data and concurred that the variation in results is reasonable.
- The previous ultrasonic inspections, when combined with the planned inspection during the third refueling outage, cover a significant period of time, i.e., approximately 22,000 hours of operation, or 2 comrlete fuel cycles.
- Previous ultrasonic inspections were performed with examiners, equipment, and procedures qualified at the EPRI Nondestructive Examination Center on samples with actual flaws with known depths.

C. The maximum size of the flaw falls well within the limit of 0.6 times the wall thickness specified in the American Society of Mechanical Engineers (ASME) Code.

D. The affected weld will remain classified as Category F according to Generic Letter (GL) 88-01, "NRC Position on IGSCC in BWR Austenitic Stainless Steel Piping," and NUREG 0313, Rev. 2, "Technical Report on Material Selection and Processing Guidelines for BWR Coolant Pressure Boundary Piping." According to the GL, Category F weldments are to be inspected every refueling outage.

The licensee also submitted its repair plan for approval. NMPC designed a full structural overlay meeting the guidance of GL 88-01 and the requirements of Section XI of the ASME Code. For overlay design purposes the flaw depth was assumed to extend through wall and the length was assumed to extend 360 degrees around the circumference. Accordingly, the weld overlay design is independent of the size of the indication.

3.0 CONCLUSION

The staff has concluded that NMPC's proposal for continued inspection and, if necessary, repair of the flaw in the weld joining the HPCS nozzle safe to safe-end extension is acceptable. The weld overlay repair plan meets the guidance of GL 88-01 and the requirements of the ASME Code, Section XI, and is, therefore, also acceptable.

Principal Contributor:
M. Banic

Date: August 27, 1993

FILE COPY

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

February 12, 1996

Mr. B. Ralph Sylvia
Executive Vice President, Nuclear
Niagara Mohawk Power Corporation
Nine Mile Point Nuclear Station
P.O. Box 63
Lycoming, NY 13093

SUBJECT: HIGH PRESSURE CORE SPRAY (HPCS) NOZZLE SAFE-END EXTENSION (KC-32) WELD INSPECTION FREQUENCY, NINE MILE POINT NUCLEAR STATION, UNIT 2 (TAC NOS. M93744 AND M94350)

Dear Mr. Sylvia:

By letter dated September 22, 1995, you requested NRC staff approval to recategorize the weld (KC-32) joining the High Pressure Core Spray (HPCS) nozzle safe end to the safe end extension. During the first refueling outage, an indication was identified in this weld using UT inspection techniques. Niagara Mohawk Power Corporation (NMPC) applied Mechanical Stress Improvement Process (MSIP) to improve the residual stress distribution in the region of the flaw to eliminate the potential for flaw growth. After MSIP application, UT inspections were again performed during the first refueling outage, at a mid-cycle outage during the second fuel cycle, and at the second, third, and fourth refueling outages. No growth in the flaw was identified. NMPC has determined that the stabilization of the flaw is due to the application of MSIP which has maintained the flaw in compression.

By letter dated July 8, 1993, NMPC committed to conduct a UT reinspection of the flaw at each subsequent refueling outage. Nine Mile Point 2 (NMP2) Technical Specification 4.0.5.f states that an inservice inspection program for piping identified in Generic Letter (GL) 88-01 shall be performed in accordance with staff positions. In accordance with GL 88-01, "NRC Position on IGSCC in BWR Austenitic Stainless Steel Piping," weld KC-32 was categorized as an intergranular stress-corrosion cracking (IGSCC) Category "F" weld which requires that all indications be inspected every refueling outage. Welds that have been treated by stress improvement that are classified as IGSCC Category "F" because they do not meet the applicable Staff positions may be upgraded to Category "E" if no adverse change in crack condition is found after four successive examinations. Category "E" welds are examined once every other outage. NMPC has performed four successive examinations which indicate no adverse change in the cracking condition. One exam was performed at a mid-cycle and three were performed during refueling outages. All four of the exams indicate that MSIP has been effective in mitigating any crack growth and the intent of GL 88-01 has been met.

In a conference call held on February 1, 1996, you addressed the NRC staff's concerns regarding variations in the measured flaw size and the effectiveness of the MSIP in arresting deep cracks. The subject safe end weld had been UT examined five times during the last three fuel cycles after application of MSIP. The reported flaw depth varied from 29% to 41% of wall thickness and its length varied from 8.3% (2.5 inches) to 11.3% (3.4 inches) of the weld circumference. In the conference call, you stated that the variations in the flaw size were caused by uncertainties in the UT examinations and is bounded by the maximum flaw size (41% in depth and 11.3% in length) measured in the December 1990 refueling outage. You also stated that NMPC will perform a weld overlay repair on the subject safe end weld if the flaw depth exceeds 41% of the wall thickness or the flaw length exceeds 11.3% of the weld circumference. Your commitment for weld overlay repair as stated above is similar to that made in your previous submittal dated July 8, 1993. Considering the range of the UT results reported in the last five examinations, the NRC staff finds that the NMPC proposed criteria for weld overlay repair of the subject safe end weld are acceptable. Therefore, the NRC staff grants approval to upgrade the weld (KC-32) joining the nozzle safe end to the safe end extension to Category "E."

Sincerely,

G E Edison

Gordon E. Edison, Senior Project Manager
Project Directorate I-1
Division of Reactor Projects - I/II
Office of Nuclear Reactor Regulation

Docket No. 50-410

cc: See next page

B. Ralph Sylvia
Niagara Mohawk Power Corporation

Nine Mile Point Nuclear Station
Unit 2

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CARL D. TERRY
Vice President
Nuclear Engineering

September 22, 1995
NMP2L 1572

U. S. Nuclear Regulatory Commission
Attn: Document Control Desk
Washington, DC 20555

RE: Nine Mile Point Unit 2
Docket No. 50-410
NPF-69

Subject: ***High Pressure Core Spray (HPCS) Nozzle Safe-End Extension (KC-32) Weld Inspection Frequency***

Gentlemen:

During the first refueling outage at Nine Mile Point Unit 2 (NMP2), Niagara Mohawk Power Corporation (NMPC) identified an indication in the weld joining the High Pressure Core Spray (HPCS) nozzle safe end to the safe-end extension (KC-32) utilizing UT inspection techniques. After evaluating the indication, NMPC applied Mechanical Stress Improvement Process (MSIP) to improve the residual stress distribution in the region of the flaw to eliminate the potential for flaw growth. Subsequent to the application of MSIP, UT inspections were again performed during the first refueling outage, at a mid-cycle outage during the second fuel cycle and at the second, third, and fourth refueling outages. No growth in the flaw has been identified by these inspections as compared with the first post-MSIP UT inspection. NMPC has determined that the stabilization of the flaw is due to the application of MSIP which has maintained the flaw in compression.

By letter dated July 8, 1993, Niagara Mohawk committed to conduct a UT reinspection of the flaw at each subsequent refueling outage. NMP2 Technical Specification 4.0.5.f states that an inservice inspection program for piping identified in Generic Letter (GL) 88-01 shall be performed in accordance with Staff positions. In accordance with Generic Letter 88-01, "NRC Position on IGSCC in BWR Austenitic Stainless Steel Piping," KC-32 was categorized as an IGSCC Category "F" weld which, consistent with our commitment, requires that all indications be inspected every refueling outage. Welds that have been treated by stress improvement that are classified as IGSCC Category "F" because they do not meet the applicable Staff positions may be upgraded to Category "E" if no adverse change in crack condition is found after four successive examinations. Category "E" welds are examined once every other outage. Normally, the four successive exams would be conducted on a refueling outage cycle frequency.

30003

As indicated above, Niagara Mohawk has performed four successive examinations which indicate no adverse change in the cracking condition. One of the exams was performed at a mid-cycle frequency (as mandated by the Staff) and, consequently, only three of four exams were conducted during a refuel outage. However, Niagara Mohawk contends that the four exams indicate that MSIP has been effective in mitigating any crack growth and the intent of GL 88-01 has been met. Further exams will result in unnecessary radiation exposure while inspecting KC-32 at each outage. Accordingly, Niagara Mohawk requests Staff approval to recategorize KC-32 as a category "E" weld. Assuming Staff approval, the next scheduled exam will be refueling outage six. Attachment A provides the results of inspections performed since MSIP was applied in the first refueling outage.

Very truly yours,

C. D. Terry
Vice President - Nuclear Engineering

CDT/JMT/kap
Attachment

xc: Regional Administrator, Region I
Mr. L. B. Marsh, Director, Project Directorate I-1, NRR
Mr. G. E. Edison, Senior Project Manager, NRR
Mr. B. S. Norris, Senior Resident Inspector
Records Management

ATTACHMENT A

KC-32 Inspection Results

Inspection	Length/% of Internal Circumference	Depth/% of Wall Thickness
*Post-MSIP (RF01) (December 1990)	3.40" (11.3%)	0.35" (41%)
Midcycle (August 1991)	3.3" (10.9%)	0.32" (38%)
RFO-2 (April 1992)	2.[illegible]" A[illegible]omated (8.6[illegible]) 3.3" Manual (10.9%)	0.25" (29%)
RFO-3 (October 1993)	2.5" Automated (8.3%) 3.0" Manual (9.9%)	0.25" (29%)
RFO-4 (May 1995)	2.5" Automated (8.3%) 3.0" Manual (9.9%)	0.30" (35%)

* Cannot be counted toward four successive examinations (i.e., the weld experienced no service).

Niagara Mohawk

Richard B. Abbott
Vice President
Nuclear Engineering

Phone: 315.349.1812
Fax: 315.349.4417

April 7, 2000
NMP2L 1951

U. S. Nuclear Regulatory Commission
Attn: Document Control Desk
Washington, DC 20555

RE: Nine Mile Point Unit 2
Docket No. 50-410
NPF-69

Subject: High Pressure Core Spray Nozzle Safe-End Extension Weld (KC-32) Information

Gentlemen:

During telephone discussions held with the NRC Staff, the Staff requested information pertaining to the High Pressure Core Spray nozzle safe-end to safe-end extension weld (KC-32). The discussions dealt with issues surrounding ultrasonic inspections of a weld flaw to determine whether any growth in the flaw had occurred. Attached is the requested information in a question and response format.

Very truly yours,

Richard B. Abbott

Richard B. Abbott
Vice President Nuclear Engineering

RBA/TWP/tmk
Attachment

xc: Mr. H. J. Miller, NRC Regional Administrator, Region I
Ms. M. K. Gamerboni, Action Section Chief PD-I, Section 1, NRR
Mr. G. K. Hunegs, NRC Senior Resident Inspector
Mr. P. S. Tam, Senior Project Manager, NRR
Records Management

ATTACHMENT

1. Question: When was the last inspection performed on the KC-32 weld?

   Response: The last inspection was performed during Refueling Outage (RFO) 6 on May 28, 1998.

2. Question: What methodology was used and what were the results of the inspection (flaw size)?

   Response: The inspection was performed using an automated ultrasonic examination using the "Smart 2000" system. The total length of the flaw was 3.2 inches with a throughwall dimension of 35% (0.30 inches). It should be noted that the length of the flaw corresponds closely to the previous ultrasonic data for RFOs 2, 3, and 4.

3. Question: Discuss any uncertainty or margin involved in the measurement.

   Response: As described in telephone conferences held on March 23, 2000 with the Staff, specific numerical uncertainty values for flaws detected in field locations have not been established. This is consistent with the Electric Power Research Institute's (EPRI's) Performance Demonstration Initiative (PDI) program which qualifies the examiners. The EPRI program uses numerical data only as a method of demonstrating examiner capabilities in correctly grading flaw sizes.

   Numerous scans have been performed on this weld to date (both automated and manual), which have indicated that the flaw depth is no greater than 41% throughwall and is not growing in the length direction. Based on the extent of examinations performed, Niagara Mohawk Power Corporation (NMPC) is confident the indication is no deeper than 41% (.41t) and is not growing in either length or depth. Essentially, the number of examinations performed to date and the consistent results of these examinations have addressed the ultrasonic measurement uncertainty issue.

   NMPC has previously stated that the post-mechanical stress improvement process (MSIP) improves the residual stress distributions in the region of the flaw such that the stresses are compressive on the inner half of the wall thickness. The maximum flaw depth of the KC-32 weld (.41t) is well within the compressive region of the weld as well as within the ASME Code allowable of 60% (.6t). Therefore, there is still adequate margin to the acceptance criteria even assuming the worst case flaw size which has been detected on weld KC-32 (.41t depth and 3.4 inches length).

ATTACHMENT (Cont'd)

4. Question: Provide an explanation of how other issues such as lead shielding weight or a support hanger in the vicinity of the nozzle being pinned affected the ability to accurately detect the flaw. Is NMPC aware of MSIP treatment resulting in crack extension at Peach Bottom nuclear station, which then resulted in the need for weld repair?

Response: Items (a) and (b) below address the two parts of the question.

a. Similar amounts of lead shielding have been used during the various examinations. Any changes in stress loading were insignificant and did not affect the ability to accurately detect the flaw. In addition, the difference in piping stress with lead shielding and with no lead shielding also was insignificant in terms of the ability to detect the flaw.

   A pipe stress evaluation concluded that the difference between the stresses at the nozzle due to pinning of the constant spring (support hanger) and the stresses due to not pinning the constant spring was insignificant and therefore, had no impact on the ability to accurately detect the flaw.

   The overall ability of ultrasonic examinations to detect flaws or cracks, and the techniques used in sizing flaws, are not influenced by stresses induced on the piping by such items as lead shielding and support hangers, either individually or cumulatively. This is supported by consistent, repeatable examination results of the KC-32 weld.

b. Based on a telephone discussion with Peach Bottom nuclear station personnel, no crack growth has been noted that required weld overlays on post-MSIP treated welds.

NIAGARA MOHAWK

NIAGARA MOHAWK POWER CORPORATION/301 PLAINFIELD ROAD, SYRACUSE, N.Y. 13212/TELEPHONE (315) 474-151

July 8, 1993
NMP2L 1395

U. S. Nuclear Regulatory Commission
Attn: Document Control Desk
Washington, D.C. 20555

Re: Nine Mile Point Unit 2
Docket No. 50-410
NPF-69

Gentlemen:

SUBJECT: HIGH PRESSURE CORE SPRAY NOZZLE SAFE-END EXTENSION WELD

This letter requests Nuclear Regulatory Commission (NRC) Staff approval of a change to Niagara Mohawk Power Corporation's (NMPC) previous approach regarding an indication on the safe-end extension on the high pressure core spray (HPCS) nozzle safe end at Nine Mile Point 2 (NMP2). Niagara Mohawk had intended to replace the safe-end extension during the third refueling outage to remove a flaw in a weld adjacent to this safe-end extension. Niagara Mohawk's proposed approach and background information regarding discovery of the flaw, application of the mechanical stress improvement process (MSIP), and subsequent ultrasonic (UT) inspection results are discussed below and in attachment 1 to this letter.

During the first refueling outage at NMP2, Niagara Mohawk Power Corporation (NMPC) identified an indication in the weld joining the HPCS nozzle safe end to the safe-end extension (KC-32) utilizing UT inspection techniques. At that time after evaluating the matter, NMPC applied MSIP to improve the residual stress distribution in the region of the flaw to eliminate the potential for flaw growth. Subsequent to the application of MSIP, UT inspections were again performed during the first refueling outage, at a mid-cycle outage during the second fuel cycle and at the second refueling outage. No growth in the flaw has been identified by the last two inspections as compared with the first post-MSIP UT inspection. NMPC has determined that the stabilization of the flaw is due to the application of MSIP which has maintained the flaw in compression.

Based on the additional data available as a result of UT examinations and further analysis, NMPC has revised its approach for resolving this matter. Our proposed approach is comprised of three elements. First, NMPC now proposes an UT reinspection of the flaw during the third refueling outage, rather than replacement of the safe-end extension. NMPC is confident that the UT inspection will demonstrate no growth in the flaw size. This confidence is based upon the previous mid-cycle and refueling outage inspection results which have confirmed the effectiveness of MSIP in stabilizing the flaw. If the UT inspection to be performed at the third refueling outage confirms our expectation that the flaw is not

A001

Enclosure 6

growing, NMPC proposes no repair or replacement activities at the third refueling outage. Based on the premise that there is no growth in the flaw, NMPC proposes continuing operation through the fourth fuel cycle, without mid-cycle reinspection.

Second, NMPC will conduct an UT reinspection of the flaw at each subsequent refueling outage. If the results of a refueling outage inspection indicate no growth, then operation would continue through the next fuel cycle.

Third, if the UT inspection indicates flaw growth at any time, then NMPC would implement a weld overlay repair. The weld overlay will provide a pressure boundary comparable to the replacement of the safe-end extension. NMPC's approach and its supporting bases are discussed in more detail in attachment 1 to this letter.

It is our expectation that the reinspection will identify no growth in the flaw. If there is no flaw growth, then repair or replacement of the HPCS nozzle safe-end extension is not necessary to ensure public health and safety. Indeed there are risks associated with the implementation of a repair or replacement plan. These risks include the potential of injury to plant personnel and damage to plant equipment. NMPC's approach eliminates radiation exposure associated with a prolonged outage and eliminates the risks associated with these unnecessary replacement or repair activities while ensuring public health and safety. Therefore, it is NMPC's firm belief that replacement or repair activities during the third refueling outage would be unnecessary and an ill advised commitment of time and resources.

Also enclosed, as attachment 2 to this letter, is the revised repair plan to be utilized if the flaw size exceeds the inspection criteria.

The third refueling outage is scheduled to commence on October 1, 1993. NMPC requests that the Staff complete its review of this matter by July 30, 1993 so that our outage plans can be finalized in a timely manner.

Very truly yours,

C. D. Terry
Vice President
Nuclear Engineering

/mls
003937GG
Attachments
pc: Regional Administrator, Region I
Mr. W. L. Schmidt, Senior Resident Inspector
Mr. R. A. Capra, Director, Project Directorate I-1, NRR
Mr. J. E. Menning, Project Manager, NRR
Records Management

Recd
3/21

Adensam/Cam... Tom

ACTION

EDO Principal Correspondence Control

FROM: DUE: 04/03/00 EDO CONTROL: G20000148
DOC DT: 03/16/00
FINAL REPLY:

Khushwant S. Grewal
Delran, New Jersey

TO:

Chairman Meserve

FOR SIGNATURE OF : ** GRN ** CRC NO: 00-0190

Collins, NRR

DESC:

CRACK IN THE RPV NOZZLE AT THE NINE MILE POINT, UNIT 2

ROUTING:

Travers
Paperiello
Miraglia
Norry
Blaha
Burns
Miller, RI
Cyr, OGC

DATE: 03/20/00

ASSIGNED TO: NRR

CONTACT: Collins

SPECIAL INSTRUCTIONS OR REMARKS:

NRR Action: DLPM: Gwolinski
NRR Received: March 21, 2000
NRR Routing: Collins/Zimmerman
J. Johnson
Sheron
NRR Mailroom

ACTION
DUE TO NRR DIRECTOR'S OFFICE
BY: 3/29/00

OFFICE OF THE SECRETARY
CORRESPONDENCE CONTROL TICKET

Date Printed: Mar 20, 2000 14:38

PAPER NUMBER:	LTR-00-0190	**LOGGING DATE:**	03/20/2000
ACTION OFFICE:	EDO		
AUTHOR:	KHUSHWANT GREWAL		
AFFILIATION:	NJ		
ADDRESSEE:			
SUBJECT:	CRACK IN THE RPV NOZZLE AT THE NINE MILE POINT UNIT 2		
ACTION:	Direct Reply		
DISTRIBUTION:	CHAIRMAN, COMRS, SECY/RAS		
LETTER DATE:	03/16/2000		
ACKNOWLEDGED	No		
SPECIAL HANDLING:	SECY TO ACK		
NOTES:	OCM #1821		
FILE LOCATION:	ID&R 5 NINE MILE POINT		
DATE DUE:	04/03/2000	**DATE SIGNED:**	

EDO --G20000148

C01

Mr. Richard A. Meserve
Chairman
U. S. Nuclear Regulatory Commission
One White Flint North
11555 Rockville Pike
Rockville, MD 20852-2738

Khushwant S. Grewal
114 Coopers Kill Road
Delran, NJ 08075-2008
Phone: 856-764-0426
March 16, 2000

Accession ML003702226

Dear Sir:

This is to bring to your attention, my concerns regarding a crack in the RPV nozzle for the High Pressure Core Spray System of the Nine Mile Point Unit 2 (NMP2) nuclear station at Lycoming, NY.

In 1990, a circumferential crack extending over about 20 percent of the circumference with a maximum depth of about 0.4 inch from the inside surface, was detected in the bottom side of the weld between the nozzle and the safe end. To stabilize the crack, MSP treatment - radial compression to induce residual compressive stress at the crack tip - was performed. However, ultrasonic examination after the MSP treatment indicated significant crack extension. Based on the evaluations by GE and the MSP vendor, NRC allowed the plant to be started on the condition that the crack be examined after about 8 months. Subsequent examinations showed the crack size to be smaller than that indicated immediately after the MSP treatment. Consequently NRC, in due course, relaxed the examination requirement to every other refueling outage.

For radiation protection during ultrasonic examination, the High Pressure Core Spray piping adjoining the RPV nozzle is covered with heavy lead blankets. This results in high compressive dead weight stress at the crack and an under-estimate of the size of the crack. The larger crack size indicated after MSP treatment, which was disregarded based on later measurements, was probably realistic for the following reasons:

a. The lead shielding weight was lower at that time.
b. The constant support hanger in the vicinity of the nozzle was pinned. (During subsequent examinations, the hanger was not pinned because it could not be qualified for the seismic load in the pinned condition.)
c. According to GE, MSP treatment at Peach Bottom nuclear plant had resulted in crack extension requiring weld repair.

The long horizontal run of the High Pressure Core Spray piping adjoining the RPV nozzle, is subject to significant thermal stratification during plant operation. The thermal stratification load is not considered in piping stress analysis and consequently in the crack evaluation.

Over a period of time, the beneficial residual stress induced by the MSP treatment may be dissipated by fatigue cycling.

At NMP2, the High Pressure Core Spray nozzle also serves as the RPV inlet for the Standby Liquid Control (boron injection) System. Hence the integrity of this nozzle is of vital safety significance.

In view of the above concerns, I hope that during the current refueling outage, NRC will require a thorough examination of the crack, with the hanger pinned, and the lead shielding distributed on either side of the hanger so as to minimize compressive stress at the crack.

If you have a question, please call.

Sincerely,

K. S. Grewal

Khushwant S. Grewal

Xc: The Plant Manager, NMP2