April 14, 1987

Docket No. 50-410

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Mr. C. V. Mangan, Senior Vice President
Niagara Mohawk Power Corporation
301 Plainfield Road
Syracuse, New York 13212

Dear Mr. Mangan:

SUBJECT: DRAFT SAFETY EVALUATION REPORT FOR NINE MILE POINT 2 MAIN STEAM ISOLATION VALVE LEAKAGE CONTROL SYSTEM

Enclosed is a draft Safety Evaluation Report concerning the evaluation of the deletion of the main steam isolation valve (MSIV) leakage control system (LCS) when using wye-pattern globe valves at Nine Mile Point Unit 2 (NMP-2). The enclosed draft is being sent to you in response to your request and does not represent a final NRC decision.

A final NRC decision is expected to be included in our response to your request for an amendment to the NMP-2 license and technical specifications dated March 11, 1987. Two Notices of Consideration of Issuance of Amendment have been issued concerning your March 11, 1987 request. The associated amendments to the license and the Technical Specifications, as well as the final determination with respect to your need for an MSIV LCS, cannot be issued until the 30 day comment period for these notices has expired.

Furthermore, if the deletion of the MSIV LCS is determined to be acceptable, subsequent changes concerning the MSIVs or containment bypass leakage, such as changing the MSIV allowable leak rate in the Technical Specifications, or continued excessive leakage, may require a reevaluation of the need for an MSIV LCS.

If you have any questions concerning the enclosed draft Safety Evaluation Report please contact the Licensing Project Manager, Mary Haughey (301) 492-7136.

Sincerely,

Robert A. Capra, Director
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Division of Reactor Projects, I/II

Enclosure:
As stated

cc: See next page

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Nine Mile Point Nuclear Station
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UNITED STATES
NUCLEAR REGULATORY COMMISSION
WASHINGTON, D. C. 20555

SAFETY EVALUATION REPORT BY THE OFFICE OF NUCLEAR REACTOR REGULATION

RELATING TO WYE PATTERN GLOBE VALVES (MSIVs) WITHOUT A LEAKAGE CONTROL SYSTEM

NIAGARA MOHAWK POWER CORPORATION

NINE MILE POINT, UNIT 2

DOCKET NO. 50-410

## 1.0 INTRODUCTION

The Main Steam Line Isolation Valves (MSIVs) of a Boiling Water Reactor (BWR) are designed to isolate the Reactor Pressure Vessel (RPV) in the event of a design basis steam line break downstream of the MSIVs, a design basis Loss of Coolant Accident (LOCA), or any other event that would warrant containment isolation. This is required by 10 CFR Part 50 Appendix A, General Design Criteria (GDC) 54 and 55. The closure of the MSIVs should terminate releases of radioactivity from the RPV for accidents within the design bases, and ensure that offsite and onsite dose guidelines of 10 CFR Part 100, and 10 CFR Part 50, Appendix A, GDC 19, respectively, are not exceeded.

In April 1979, the licensee selected 24 inch positive seal ball-type MSIVs to replace the wye pattern globe valves and the leakage control system as described in the Nine Mile Point Unit 2 Preliminary Safety Analysis Report. Because of the unique design of the positive valve seal, the leakage from the ball valves was expected to be very low. Therefore, a leakage control system was not considered necessary for the ball-type MSIVs. This conclusion was documented in a letter to G. K. Rhode of Niagara Mohawk Power Corp. from R. L. Tedesco, dated January 2, 1981.

Experience with the ball-type MSIVs during preoperational testing at Nine Mile Point Unit 2 and laboratory prototype testing have failed to demonstrate that these valves will function as anticipated. Delamination of the tungsten carbide coating on the ball was observed, which is believed to have been caused by wearing of the stellite seat. This resulted in excessive seat leakage. Also, during the initial valve test at system temperatures in an offsite prototype facility, packing leakage developed. In view of these engineering problems and a schedular concern, the licensee informed NRC in a letter dated March 11, 1987 (NMP2L 1004), that the Nine Mile Point Unit 2 ball type MSIVs will be replaced with wye pattern globe valves, manufactured by Rockwell, that are similar to those being used in other BWRs. Shop acceptance test results indicate that the wye pattern globe valves leak between 2 and 4 scfh, which meet the Technical Specification limit of 6 scfh (limit for ball type MSIVs). Further, the new valves will close in 3 to 5 seconds, also in accordance with the Technical Specifications.

By letter dated March 18, 1987 (NMP2L 1007), the licensee requested that a Leakage Control System (LCS) not be required. Regulatory Guide 1.96 "Design of Main Steam Isolation Valve Leakage Control Systems for Boiling Water Reactor Nuclear Power Plants", describes a basis for implementing General Design Criteria (GDC) 54 with regard to a leakage control system (LCS) for the MSIVs to ensure that the radiological consequences of design basis accidents do not exceed the dose guidelines of 10 CFR Part 100. The licensee proposed an alternative to a LCS using NUREG-1169 as guidance, pending final resolution of Generic Issue C-8, MSIV Leakage and LCS Failures. A realistic fission product transport model developed by the BWROG in NUREG-1169 was used by the licensee to assess the offsite and onsite dose consequences of alternate means of managing post-accident MSIV leakage using both safety-grade and non-safety-grade systems that could be available for service after a Loss of Coolant Accident (LOCA). The licensee's radiological analysis takes credit for the isolated condenser (main steam line condensate drains open to the condenser) as a MSIV post-accident leakage management method. The analysis demonstrates that the 10 CFR Part 100 dose guidelines will not be exceeded at leakage rates substantially in excess of the Technical Specification limit of 6 scfh. The analysis further indicates that a total MSIV leak rate of 150 SCFH for all main steam lines (38 scfh/steam line) would not result in control room personnel doses in excess of 10 CFR Part 50, Appendix A, GDC 19.

By letter dated March 31, 1987 (NMP2L 1014), the licensee has provided the following additional information requested by the staff:

1. A comparison of the Nine Mile Point 2 Rockwell MSIVs to Rockwell valves used at other nuclear power plants for the intended service;

2. A compilation of industry leak rate testing results and experience;

3. An evaluation of items 1 and 2 above, and a comparison to the NUREG-1169 analysis performed for Unit 2, including an estimate of leakage performance over the first operational cycle; and

4. A discussion of the maintenance practices planned at Unit 2 to enhance low leakage characteristics.

## 2. EVALUATION

### 2.1 Leakage Control System

Beginning about 1970, the staff's concern over the possible dose consequences of MSIV leakage at or above the Technical Specification leakage limit led to the requirement that a Leakage Control System be installed in new plants. Until a couple of years ago a majority of the "as found" MSIV leakage values were often in excess of Technical Specification limits. In some cases, MSIV leakage rates were greatly in excess of the Technical Specification value, such that a LCS would have been ineffective because of flow limitations in its design.

As a result of these concerns, the staff prioritized the MSIV leakage and LCS failures as a high priority Generic Issue (C-8). Independently, the BWR Owners Group (BWROG) formed the MSIV Leakage Control Committee to determine the cause of the high leakage rates associated with many of the MSIVs and to develop recommendations to reduce the leakage rates.

The licensee has concluded that a MSIV Leakage Control System is not necessary since Nine Mile Point 2 has a means of collecting, treating, and discharging from the stack MSIV leakage using existing systems. This can be accomplished by:

1. A passive steamline drain system which automatically opens on loss of air power and first stage turbine pressure to the main condenser;

2. Electric boilers capable of providing steam to the steam jet air ejectors, offgas system, and turbine gland seal and exhaust system; and

3. In the event of a LOCA and/or loss of offsite power, NMP2 has the capability to re-establish condenser vacuum, the operation of the steam jet air ejector, the operation of the gland seal and exhaust system, and the offgas steam once offsite power is restored.

## 2.2 MSIV Leakage Experience

To assess the expected MSIV leakage characteristics for Nine Mile Point Unit 2, leakage tests at operating plants using the Rockwell wye pattern globe valves that are similar to the MSIVs being installed at Nine Mile Point Unit 2 were reviewed. A total of 39% of the "as found" leakage test results were 6 scfh or below, which is the Technical Specification limit for Nine Mile Point Unit 2. Cumulatively, 85% of all test results were less than 38 scfh. In the future the leakage rate percentage below 6 scfh as well as below 38 scfh could conceivably be higher, mainly due to the adoption of the recent BWR Owners Group recommendations. These recommendations include improvements in test methods, maintenance procedures, training and tooling. In addition, all other BWRs have MSIV Technical Specification leak rates of 11.5 scfh or above. The Technical specification limit by itself does not ensure that the refurbished valves will not leak above 6 scfh. The higher Technical Specification leak rates greater than 6 scfh, however, do bias the percentage of leakage rate results below 6 scfh on the low side. It can be concluded that a sound maintenance program should limit valve leakage degradation and increase leakage test results within Technical Specification values.

## 2.3 MSIV Design Changes

Based on experience with Rockwell designed MSIVs for BWR service, the licensee made MSIV design changes using information provided by other BWR operating plants, valve suppliers, General Electric Co., and an evaluation of Inspection and Enforcement Bulletins, Notices and Circulars applicable to Nine Mile Point Unit 2 MSIVs. These design changes include:

1. Disc-piston connection configuration changed from a spherical backseat to resolve disc-to-piston separation questions;

2. Numatic air valves replaced with Norgren air valves to resolve sticking air valve spools;

3. Improved stem/stem-disc and main disc/piston connection (joints) to resolve stem/stem-disc and main disc to piston separation potential;

4. Spring flange bronze bushing used to reduce the tendancy for galling/friction between yoke guides and tubes;

5. New spring divider material used to reduce the tendancy for galling/scoring of the yoke guide tubes; and

6. Modified packing chamber design with graphite rings were used to replace asbestos packing to enhance packing and stem leak.lightness capability.

2.4 Radiological Assessment

In the event that leakage values are in excess of the Technical Specification limit, 10 CFR Part 100 offsite and 10 CFR Part 50, Appendix A, GDC 19 control room operator dose guidelines would not necessarily be exceeded. The 39 scfh leak rate, that 85% of the leakage tests met, is important from the standpoint that the calculated doses have been found to be within the controlling design basis accident dose guideline valves of 10 CFR Part 50, Appendix A, GDC 19. Based on NUREG-1169 methodology, and using realistic assumptions of the holdup volume and surfaces of the main condenser and main steamlines and fission product attenuation elsewhere, offsite and control room doses were evaluated. The licensee's analysis indicated that 10 CFR Part 100 offsite doses would be met. The licensee indicated that the control room was limiting and that a combined MSIV leak rate of 150 scfh for all main steam lines (38 scfh per main steam line) would not result in control room personnel doses in excess of 10 CFR Part 50, Appendix A, GDC 19.

On the basis of our review, we conclude that the licensee's radiological evaluation, which takes credit for the isolated condenser, is reasonable. This analysis is a departure from the Standard Review Plan and Regulatory Guides in that some realistic assumptions were utilized for assessing control room habitability (GDC 19) if a design basis LOCA were to occur and the MSIVs leaked at rates in excess of their Technical Specification limit of 6 scfh.

For such an accident during which the MSIVs leaked at rates of 6 scfh, or less, the staff and licensee have both determined that the dose guidelines of GDC 19 would be met. These analyses followed the guidance of the Standard Review Plan with two exceptions. The first exception was the modeling of atmospheric dispersion. The second was credit for post-accident fission product attenuation in the steamlines.

with a leak rate limit of 6SCFH.

The staff also has reasonable assurance that the 38 scfh leak rate per main steam line represents an upper bound when one considers the expected improved leakage values for the Nine Mile Point Unit 2 valves, provided that effective and careful MSIV maintenance is followed. The licensee expects deterioration in the MSIV leakage to result in leakage rates less than 16 scfh at the end of the first operating cycle.

The overall risks from accident sequences in which MSIV leakage is a significant factor are low without a LCS, and post accident management schemes (including those stated above) were shown to produce significant offsite dose reductions in lieu of a LCS. MSIV leakage was concluded to be a trivial safety concern, and MSIV leakage control was shown to not be risk significant (most of the risk being from accidents resulting in core melt and containment failure). However, for accidents that do not result in containment failure, MSIV leakage can still be important. Several leakage treatment methods which make use of the holdup volume and surface of main steam lines and condensers, and fission product attenuation elsewhere, were evaluated and indicated lower offsite dose consequences than with a LCS. Nine Mile Point Unit 2 design features are similar to the NUREG-1169 base plant and, therefore, the conclusions of NUREG-1169 are considered applicable to Nine Mile Point Unit 2. NUREG-1169 concluded that the low public exposure (isolated condenser and 11.5 scfh leak rate - $5.9 \times 10^{-6}$ man rem/plant year whole body public exposure; LCS and 11.5 scfh leak rate - $1.0 \times 10^{-4}$ man rem/plant year whole body public exposure) does not justify a LCS.

## 2.5 Technial Specification Changes

The replacement ~~were~~ wye pattern globe MSIVs are air-operated (AOV) valves and the ball MSIVs were hydraulically operated. This necessitates valve nomenclature changes in Technical Specification Table 3.6.1.2-1 and 3.6.3-1 from 2MSS*HYV6A, B, C, D and 2MSS*HYV7A, B, C, D to 2MSS*AOV6A, B, C, D and 2MSS*AOV7A, B, C, D.

## 2.6 MSIV Maintenance and Procedures

The staff is reasonably assured that the wye pattern globe valves being installed in Nine Mile Point Unit 2 without a leakage control system, but with a post accident leakage treatment method, can perform their function without exceeding the dose guideline valves of 10 CFR Part 100 and GDC 19 of 10 CFR Part 50. This assurance is dependant on proper maintenance practices, and potential operator actions/emergency operating procedures to limit MSIV radioactivity releases. By letter dated April 7, 1987, the licensee has committed to implement the following prior to criticality.

1. vendor recommended maintenance boring, grinding, and lapping tools will be available for refurbishment as needed to restore MSIVs to less than 6 scfh leakage,

2. maintenance procedures based upon MSIV instruction manuals, vendor and General Electric recommendations (including careful maintenance, supervision and inspections to indicate incipient failures);

3. training programs for MSIV maintenance personnel;

4. operating procedures for the post-accident control and treatment of MSIV leakage to limit radioactivity releases as recommended by BWROG in NEDO-30324; and

5. emergency operating procedures to limit radioactivity release through the MSIVs as recommended by the BWROG in NEDO-30324.

## 3.0 CONCLUSIONS

On the basis of the evaluation above, the staff concludes that Nine Mile Point Unit 2 may resume plant operation without a leakage control system, but with post-accident leakage management. This conclusion is based on a sound MSIV maintenance program committed to by the licensee which includes: maintenance procedures, tooling and equipment, personnel training, operating and emergency procedures, management and inspection.

At the Technical Specification leak rate of 6 scfh, the dose guideline valves of 10 CFR Part 100 and GDC 19, calculated for a design basis LOCA, will not be exceeded. In the event that the Technical Specification limit is exceeded, 10 CFR Part 100 offsite and 10 CFR Part 50 GDC 19 control room operator dose guidelines calculated using the methodology from NUREG-1169 would not be exceeded.