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

SAFETY EVALUATION BY THE OFFICE OF NUCLEAR REACTOR REGULATION

RELATED TO AMENDMENT NO. 56 TO FACILITY OPERATING LICENSE NO. NPF-69

NIAGARA MOHAWK POWER CORPORATION

NINE MILE POINT NUCLEAR STATION, UNIT 2

DOCKET NO. 50-410

1.0 INTRODUCTION

By letter dated July 1, 1994, Niagara Mohawk Power Corporation (NMP-2 or the licensee) submitted a request for changes to the Nine Mile Point Nuclear Station, Unit 2, Technical Specifications (TSs). The requested changes would revise the drawdown time testing requirement of TS 4.6.5.1.c.1 and the secondary containment inleakage testing requirement of TS 4.6.5.1.c.2. These revisions would support a revised design basis radiological analysis which would support an increase in secondary containment drawdown time from 6 to 60 minutes by taking credit for fission product scrubbing and retention in the suppression pool. The current design basis radiological analysis does not take credit for the pressure suppression pool as a fission product cleanup system as permitted in NUREG-0800, Section 6.5.5, "Pressure Suppression Pool as a Fission Product Cleanup System." The proposed amendment would also take credit for additional mixing of primary containment and engineered safety feature systems leakage with 50 percent of the secondary containment free air volume prior to the release of radioactivity to the environment. In the revised analysis, mixing is assumed to occur at the onset of a Design Basis Loss-of-Coolant Accident (LOCA) as the primary containment and the engineered safety feature systems leak into secondary containment. The current analysis takes credit for mixing within secondary containment only after achieving a -0.25 inch water gauge (WG) pressure in secondary containment with respect to the outside surrounding atmosphere. The licensee's radiological evaluation for this accident, which reflects these proposed changes and an assumed drawdown time to 60 minutes, has determined that the radiological doses remain below 10 CFR Part 100 guidelines values and General Design Criterion 19 criteria. The revised radiological doses, as calculated by the licensee, are lower than the doses currently presented in the Updated Safety Analysis Report (USAR).

2.0 BACKGROUND

In order that our review of the licensee's submittal is sufficiently complete and comprehensive, it is necessary to recount the following chronological findings from the NRC staff's radiological consequence analyses performed for Nine Mile Point Nuclear Station, Unit 2 (NMP-2) design basis LOCA.

(1) Safety Evaluation Report (NUREG-1047) (February 1985)

In Section 15.6.5.2 of the NMP-2 Safety Evaluation Report (SER), the NRC staff stated in part, the following findings:

> "The applicant has proposed to maintain all isolation valves in the main steamlines and related drain lines so that total bypass leakage will be less than 6 standard cubic feet per hour (scfh) through these lines. This is a small fraction of the leakage usually measured in existing U.S. boiling-water reactors or similar design, and places great reliance upon the novel valve design. The applicant has informed the staff that a Swiss plant also using this valve design has experienced difficulties in achieving low leakage. The staff has used 6 scfh in computing LOCA dose consequences in Table 15.1, but considers this as an open item pending additional information concerning the operating experience, and successful preoperational testing of the valves."

Using 6 scfh total bypass leakage and the original 90-second drawdown time, the staff calculated the following LOCA offsite doses:

	EAB (rem)		LPZ (rem)	
	Thyroid	Whole Body	Thyroid	Whole Body
LOCA	224	2.6	292	2.4
10 CFR Part 100 Guidelines	300	25	300	25

Subsequently, experience with the ball-type MSIVs during preoperational testing at NMP-2 and laboratory prototype testing has failed to demonstrate that these valves will function as anticipated. The licensee replaced the NMP-2 ball-type main steam isolation valves (MSIVs) with wye pattern globe valves, manufactured by Rockwell, which are similar to those being used in other BWRs.

(2) Supplement No. 2 to NUREG-1047 (November 1985)

In Amendment No. 21 of the NMP-2 Final Safety Analysis Report (FSAR), the licensee identified 20 additional new potential pathways by which containment leakage could bypass the secondary containment. The staff reevaluated LOCA dose consequences in Supplement No. 2 using: (1) the additional 20 new potential bypass pathways, (2) the original 90 second drawdown time, and (3) the TS limit (6 scfh per MSIV) for the MSIV leakage and stated the following, in part, in Section 15.6.5 of Supplement No. 2:

"The applicant submitted two analyses of flows through the bypass leak paths, corresponding to isothermal and adiabatic gas expansions, respectively. Both analyses accounted for slow depressurization of the containment because of leakage, and the cooling of the pipes carrying the bypass flow. The depletion of molecular and particulate iodine fission products was modeled using deposition rate equations developed by an NRC contractor (NUREG/CR-2713). Both analyses concluded that virtually no molecular or particulate iodine would survive passage through the bypass leakage paths, and that iodine could escape to the environment principally as organic vapor (iodomethane), and only after considerable delay in transiting the bypass pathways."

"Following applicable portions of SRP [Standard Review Plan] Sections 6.5.3 and 15.6.5, Appendices A and D, wherever possible, the staff performed an independent analysis. The SRP suggests that the staff assume that bypass leakage occurs at the proposed Technical Specification limit for each valve. Such an assumption is conservative, but prevents any physically consistent treatment of flow variation with temperature. The staff, therefore, assumed constant laminar flow at the Technical Specification limiting rate. This assumption is a deviation from the SRP and more realistically models the release that would occur in such an accident."

"All available information indicated that particulate matter and molecular iodine would be expected to deposit on surfaces, with rates of deposition varying with temperature, pressure, gas composition, surface material, and particulate size. Since these parameters cannot be predicted reliably, the staff assumed simple first-order depletion at a constant rate of 10% per hour. Organic iodine was assumed to pass without depletion. Bypass leakage was assumed to enter the environment at ground level."

Therefore, in Supplement No. 2, the staff recalculated, the following revised LOCA doses:

	EAB (rem)		LPZ (rem)	
	Thyroid	Whole Body	Thyroid	Whole Body
LOCA	55	0.8	265	2.0
10 CFR Part 100 Guidelines	300	25	300	25

(3) Supplement No. 4 to NUREG-1047 (September 1986)

In FSAR Amendment 23, the licensee increased the drawdown time from 90 seconds to 120 seconds and also identified, in their letter dated June 30, 1986, 8 more additional bypass pathways that had not been incorporated in the staff's previous LOCA dose analysis as reported in Supplement 2 to the SER. The staff reevaluated LOCA doses in Supplement 4 and stated the following, in part, in Section 15.6.5:

> "The staff notes that the resulting doses are significantly different from those reported in Supplement 2. This is primarily attributable to the different atmospheric dispersion coefficients used in the analyses. For the bypass contribution reported in Supplement 2, the dispersion factors used were those reported in the SER dated February 1985, not the updated factors reported in Section 2 of Supplement 2 dated November 1985. The staff has used the approved updated dispersion factors given in Section 2.3.4 of Supplement 2. Since the revised dispersion coefficients are a factor of 2 to 3 lower than the original values, the resulting bypass dose contribution is lower in spite of the increased leakage rate."
>
> "For the containment leakage contribution reported in the Supplement 2, elevated release dispersion factors were used for the first 2 hours. In this supplement the staff has used, for the containment contribution, the more conservative assumption of a ground release for the first 129 seconds. This results in the increased containment leakage dose relative to that in Supplement 2."

The staff recalculated, in Supplement 4, the following LOCA doses using the revised atmospheric dispersion coefficients.

	EAB (rem)		LPZ (rem)	
	Thyroid	Whole Body	Thyroid	Whole Body
Bypass Leakage	18	0.12	98	0.45
Containment Leakage	35	0.67	14	0.83
ESF Leakage	4	0.10	10	0.10
Total	57	0.89	122	1.38

(4) Supplement No. 5 to NUREG-1047 (October 1986)

In Section 6.4 of Supplement No. 5, the staff performed an independent NMP-2 control room habitability assessment. In its assessment, the staff accepted the licensee's proposed atmospheric diffusion model for determining

atmospheric relative concentrations (χ/Qs) at control room air intakes. The staff further concluded that the NMP-2 control room habitability system meets the General Design Criterion (GDC) 19 requirements.

3.0 EVALUATION

3.1 Radiological Evaluation

By letter dated July 1, 1994, the licensee submitted a request for a license amendment to increase secondary containment pressure drawdown time for the purpose of inleakage testing evaluation from 2 to 60 minutes following design basis LOCA. This request is represented in changes to: (1) NMP-2 TS 4.6.5.1.c.1, drawdown time testing, and (2) TS 4.6.5.1.c.2, inleakage testing, both for SECONDARY CONTAINMENT INTEGRITY.

In its evaluation, the NRC staff performed an independent radiological consequence assessment as a result of design basis LOCA at the NMP-2 site boundaries and for control room operators as a result of increased secondary containment pressure drawdown time. In its analysis, the NRC staff assumed that containment leakage is released directly to the environment bypassing secondary containment (thus bypassing the standby gas treatment system (SGTS)) for 60 minutes from the onset of a LOCA.

The NRC staff considered in its previous analyses the following three potential fission-product leakage pathways from the primary containment to the environment:

(1) containment leakage
(2) leakage bypassing secondary containment including MSIV leakage
(3) leakage from engineered safety feature (ESF) systems outside containment

In this evaluation, the staff performed radiological consequence analyses for containment leakage pathway only since: (1) no new bypass pathways were identified in this request and the TS limits for the MSIV leakage have not been changed, and (2) no changes are proposed for design basis assumptions used in evaluating leakages from ESF systems outside containment. Therefore, the staff's previously calculated doses resulting from the pathways 2 and 3 should remain the same as presented in Supplement No. 4 to NUREG-1047.

The recalculated doses at the Exclusion Area Boundary (EAB) and Low Population Zone (LPZ) as well as control room operator doses through pathway 1 are presented in Table 1 of this safety evaluation (SE) along with previously calculated doses through pathways 2 and 3 as presented in Supplement No. 4. The assumptions and parameters used in this evaluation are provided in Tables 2 through 4 of this SE. The major assumptions that differ from those used in NUREG-1047 are as follows:

(1) containment leakage is released directly to the environment bypassing secondary containment (thus bypassing SGTS) for 60 minutes from the onset of a LOCA.

(2) revised atmospheric relative concentrations (χ/Qs) reported in Supplement No. 2 (November 1985) to the NMP-2 SER.

(3) control room χ/Q values reported in FSAR Table 15.6-3 (4.b) and accepted by the staff in Supplement No. 5 to NMP-2 SER.

(4) dose conversion factors based on ICRP Publication 30, "Limits for Intakes of Radionuclides by Workers."

(5) fission-product attenuation credit in the main steamlines as given in Supplement Nos. 2 and 4 (September 1986) to the SER.

(6) fission-product attenuation credit (decontamination factor of 10) in the pressure suppression pool.

(7) secondary containment 50 percent air mixing credit at the onset of a LOCA as the primary containment and ESF systems leak into secondary containment.

Summary of Radiological Evaluation

Based on the above evaluation, we find that the requested secondary containment pressure drawdown time of 60 minutes is acceptable. The bases for our acceptance are that: (1) the distances to the exclusion area and low population zone outer boundaries for the NMP-2 are still sufficient with the increased pressure drawdown time of 60 minutes to provide reasonable assurance that the calculated radiological consequence of a postulated design basis LOCA will meet the dose guideline values given in 10 CFR Part 100, and (2) the increased drawdown time also meets control room operator dose limits given in GDC 19.

Table 1

RADIOLOGICAL CONSEQUENCES
OF
DESIGN BASIS LOSS OF COOLANT ACCIDENT

(rem)

	EAB		LPZ	
	Thyroid	Whole Body	Thyroid	Whole Body
Bypass Leakage	18	0.12	98	0.45
Containment Leakage	56	1.98	30	0.38
ESF Leakage	4	0.10	10	0.10
Total	78	2.2	138	0.93

CONTROL ROOM OPERATOR DOSE
(rem)

Thyroid	Whole body
20.4	0.6

Table 2 Assumptions Used to Evaluate the Loss-of-Coolant Accident

Parameter	Value
Power level	3489 MWt
Fraction of core inventory released	
Noble gases	100%
Iodine	50%
Iodine initial plate-out fraction	50%
Iodine chemical species	
Elemental	91%
Particulate	5%
Organic	4%
Suppression pool decontamination factor	
Noble gas	1
Organic iodine	1
Elemental iodine	10
Particulate	10
Iodine dose conversion factors	ICRP-30
Primary containment bypass leakage	1.31%/day
Standby gas treatment system	
Filter efficiency	99%
Flow rate	2670 ft^3/min
Drawdown time	60 minutes
Primary containment free volume	4.73E+5 ft^3
Secondary containment free volume	3.88E+6 ft^3
Secondary containment mixing efficiency	50 percent

Table 3 Atmospheric Dispersion (χ/Q) Values Used in Accident Evaluations

Time period	χ/Q value (sec/m^3)	
0-01 hour EAB	8.4E-4	Ground-level release
0-01 hour LPZ	7.9E-6	Ground-level release
1-02 hour EAB	3.4E-5	Elevated/fumigation
1-02 hour LPZ	1.4E-5	Elevated/fumigation
2-08 hour LPZ	8.4E-6	Elevated
8-24 hour LPZ	4.5E-6	Elevated
1-04 day LPZ	1.5E-6	Elevated
4-30 day LPZ	3.2E-7	Elevated

Table 4
CONTROL ROOM ATMOSPHERIC RELATIVE CONCENTRATIONS (χ/Q)
(second/cubic meter)

0-8 hour	2.13E-4
8-24 hour	1.66E-4
1-4 day	9.88E-5
4-30 day	4.70E-5

3.2 Modification of Surveillance Test Drawdown Time Limit

NMP-2 TS 4.6.5.1.c.1 currently specifies that the SGTS be periodically tested to demonstrate that it can drawdown the secondary containment pressure to 0.25 inches of water negative gauge pressure in less than 120 seconds. However, since LOCA conditions and test conditions differ considerably, the licensee proposed that the surveillance test acceptance criteria be adjusted to reflect test conditions. Accordingly, the licensee has analyzed the secondary containment pressure response for both the accident condition and the test condition. The analysis indicates that the same SGTS performance that is capable of reducing secondary containment pressure to 0.25 inches of water negative pressure under LOCA conditions (i.e., with LOCA heat loads) in 1 hour, is capable of reducing the secondary containment pressure to 0.25 inches of water negative gauge pressure in 66.7 seconds under normal surveillance test conditions (which do not include the primary-to-secondary containment heat load). We have reviewed the licensee's analysis and have determined that it is acceptable. Since the revised radiological dose models assume a 1-hour exfiltration period, a 66.7 second drawdown test will verify operability of the SGTS. Accordingly, the proposed change to the surveillance test is acceptable.

3.3 Modification of SGTS Flow rate

NMP-2 TS 4.6.5.1.c.2 currently requires the SGTS to be operated for 1 hour once per 18 months while maintaining a secondary containment pressure of greater than or equal to 0.25 inches of water negative gauge pressure while not exceeding a flow rate of 3190 cfm. The license proposed to reduce this

flow rate to not to exceed 2670 cfm. The proposed flow rate of 2670 cfm is consistent with the assumed secondary containment leak rate during the drawdown period.

The operability of the SGTS is demonstrated by TS 4.6.5.3.b which requires a SGTS flow rate of 4000 cfm ± 10%. Operation of the SGTS at the reduced secondary containment leak rate of not to exceed 2670 cfm is conservative since the lower flow rate provides additional effluent residence time in the charcoal beds of the SGTS. Therefore, this proposed change is acceptable.

4.0 STATE CONSULTATION

In accordance with the Commission's regulations, the New York State official was notified of the proposed issuance of the amendment. The State official had no comments.

5.0 ENVIRONMENTAL CONSIDERATION

The amendment changes a requirement with respect to installation or use of a facility component located within the restricted area as defined in 10 CFR Part 20 and changes the surveillance requirements. The NRC staff has determined that the amendment involves no significant increase in the amounts, and no significant change in the types, of any effluents that may be released offsite, and that there is no significant increase in individual or cumulative occupational radiation exposure. The Commission has previously issued a proposed finding that the amendment involves no significant hazards consideration, and there has been no public comment on such finding (59 FR 37074). Accordingly, the amendment meets the eligibility criteria for categorical exclusion set forth in 10 CFR 51.22(c)(9). Pursuant to 10 CFR 51.22(b) no environmental impact statement or environmental assessment need be prepared in connection with the issuance of the amendment.

6.0 CONCLUSION

The Commission has concluded, based on the considerations discussed above, that: (1) there is reasonable assurance that the health and safety of the public will not be endangered by operation in the proposed manner, (2) such activities will be conducted in compliance with the Commission's regulations, and (3) the issuance of the amendment will not be inimical to the common defense and security or to the health and safety of the public.

Principal Contributors:
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Date: August 30, 1994

A copy of the related Safety Evaluation is enclosed. A Notice of Issuance will be included in the Commission's next regular biweekly Federal Register notice.

Sincerely,

ORIGINAL SIGNED BY:

Donald S. Brinkman, Senior Project Manager
Project Directorate I-1
Division of Reactor Projects - I/II
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Docket No. 50-410

Enclosures: 1. Amendment No. 56 to NPF-69
2. Safety Evaluation

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