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

SAFETY EVALUATION BY THE OFFICE OF NUCLEAR REACTOR REGULATION

RELATED TO AMENDMENT NO. 67 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 December 13, 1994, as supplemented April 3, 1995, the Niagara Mohawk Power Corporation (the licensee) submitted a request for changes to the Nine Mile Point Nuclear Station, Unit 2, (NMP-2) Technical Specifications (TSs). The requested changes would increase the allowable main steam line isolation valve (MSIV) leakage from the current 6.0 scfh to 24 scfh for any one MSIV. The April 3, 1995, letter provided clarifying information that did not change the initial no proposed significant hazards consideration determination.

2.0 EVALUATION

In order to demonstrate the adequacy of NMP-2 engineered safety features designed to mitigate the radiological consequences of the design basis accidents (DBAs) with a maximum MSIV leak rate of 96 scfh total from all four main steam lines, the licensee assessed the offsite and control room radiological consequences which could result from the occurrence of a postulated loss-of-coolant accident (LOCA) and presented the results of that assessment in their submittal. In the safety evaluation (SE) for License Amendment No. 56, dated August 30, 1994, the NRC staff previously assessed the offsite radiological consequences of a LOCA using a 60-minute secondary containment drawdown time. In the present SE, the staff considered the current 24 scfh MSIV total leak rate from four main steam lines in MSIV leakage transport path to the environment following a postulated LOCA.

In this evaluation, the NRC staff recalculated the radiological consequences associated with MSIV leakage path. It is assumed that the radiological consequences associated with the other radioactivity transport paths would be negligibly affected by the proposed amendment; therefore, they were not recalculated. The procedures used in the staff's calculation of the radiological consequences associated with MSIV valve leakage were based upon (1) the TID-14844 source term, consistent with the guidelines provided in the applicable sections of the Standard Review Plan (SRP, NUREG-0800), Regulatory Guides and (2) assumptions and parameters used in the staff's original SER (NUREG-1047) for NMP-2, except the following deviation. Until recently the assumption used by the staff for operating plants in calculating radiological consequences of potential DBAs was based upon a conservative assumption that the limiting leakage allowed by the Technical Specification is released

directly into the environment. No credit was taken for the integrity and leaktightness of the main steam piping and condenser to provide holdup and plateout of fission products. In this safety review and other recent reviews, the staff has accepted credit for radioactive iodine removal in the main steam lines, drain lines and main condenser by hold-up, decay and deposition.

Dose contributions to the whole body from the increased MSIV leakage were recalculated based upon the ratio of the proposed leakage rate limit of 96 scfh to the current limit of 24 scfh. No credit was given for holdup and decay of noble gases in the main steam lines and condenser. The staff's recalculated offsite and control room operator doses resulting from a postulated LOCA and the parameters and assumptions used in the staff's recalculation are provided in Tables 1 and 2 of this SE, respectively. The power level assumed in Table 2 (3489 MWt) bounds the current core power level (3467 MWt) and is conservative.

2.1 Iodine Transport Model

Basic chemical and physical principles predict that gaseous iodine and airborne iodine particulate material will deposit on surfaces. Several laboratory and in-plant studies have demonstrated that gaseous iodine deposits by chemical adsorption, and that particulate iodine deposits through a combination of sedimentation, molecular diffusion, turbulent diffusion, and impaction. Gaseous iodine exists in nuclear power plants in several forms: elemental (I_2), hypoiodous acid (HOI), organic (CH_3I), and particulate. In accordance with RG 1.3, the staff assumed 91 percent of iodine is in the elemental form (includes hypoiodous acid), 5 percent in the particulate form, and 4 percent in the form of organic iodides.

Each of these forms deposits on surfaces at a different rate, described by a parameter known as the deposition velocity. The elemental iodine form, being the most reactive, has the largest deposition velocity, and organic iodide has the smallest. Further, studies of in-plant airborne iodine show that iodine (elemental and particulate) deposited on the surface undergoes both physical and chemical changes and can either be resuspended as an airborne gas or become permanently fixed to the surface. The data also show that the iodine can change its form so that iodine deposited as one form (usually elemental) can be resuspended in the same or in another form (usually organic). Conversion can be described in terms of resuspension rates that are different for each iodine species. Chemical surface fixation can similarly be described in terms of a surface fixation rate constant.

The transport of gaseous iodine in elemental and particulate forms has been studied for many years and several groups proposed different models to describe the observed phenomena (References 1 through 5). The staff used the model specifically developed by an NRC contractor (Reference 6) for iodine removal in boiling-water reactor main steam lines and the main condenser following a LOCA.

The staff model treats the MSIV leakage pathway as a sequence of small segments for which instantaneous and homogeneous mixing is assumed. The mixing computed for each segment is passed along as input to the next segment. The number of segments depends upon the parameters of the line and flow rate and can be as many as 100,000 for a long, large-diameter pipe and a low flow.

Each line segment is divided into five compartments that represent the concentrations of the three airborne iodine species, the surface that contains iodine available for resuspension, and surface iodine that has reacted and is fixed on the surface.

The staff's model considers three iodine species: elemental, particulate, and organic. A fourth species, hypoiodous acid, was considered for the purpose of the staff's model to be a form of elemental iodine. All iodine in the segment undergoes radioactive decay. The resulting concentration from each segment of the deposition compartment serves as the input to the next segment.

The GE model, as well as the one developed and used by the staff, is based on time-dependent temperature adsorption phenomena with instantaneous and perfect mixing in a given volume. Both models use the same MSIV leakage pathways. However, they differ in the treatment of buildup of iodine in the main steamlines and condenser. GE assumed steady state iodine in equilibrium in a large volume while the staff model assumed transient buildup of iodine in a finite number of small volumes. The staff does not consider these differences to be significant since the resulting iodine deposition and removal rates in the main steam lines and condenser are in good agreement.

The staff's transport model also assumed iodine transport through the condenser as a dilution flow rather than the plug flow as in the steam lines. The staff assumed that the iodine input into the condenser mixes instantaneously with a volume of air in the condenser and that the diluted air exhausts at the same time and same rate as the input air (MSIV leakage) flows into the condenser. The staff developed the equations for iodine deposition velocities, resuspension rates, and surface fixation rates as a function of temperature using published data found in the literature. The equations and data are contained in the contractor's report (Reference 6). The equation for the deposition velocity of elemental iodine is based on the least-squares fit to the available data. Deposition velocity equations for HOI and organic iodine are based on the values at 30 °C; due to the lack of data at elevated temperatures, their temperature dependence is assumed to be similar to elemental iodine. Resuspension and fixation equations as a function of temperature are based on measurements available in the literature at ambient temperature. The staff assumed that resuspension and fixation rates will increase with increasing temperature.

The technical references and the GE and staff models indicate that particulate and elemental iodine would be expected to deposit on surfaces with rates of deposition varying with temperature, pressure, gas composition, surface material, and particulate size. Therefore, the staff believes that an appropriate credit for the removal of iodine in the MSLs and main condensers

should be provided in the radiological consequence assessment following a DBA. Sections III(c) and VI of Appendix A to 10 CFR Part 100 require that structures, systems, and components necessary to ensure the capability to mitigate the radiological consequences of accidents that could result in exposures comparable to the dose guidelines of Part 100 be designed to remain functional during and after a safe-shutdown earthquake (SSE). Thus, the MSL, portions of its associated piping, and the main condenser are required to remain functional if credit is taken for deposition of iodine and if the SSE occurs. Consequently, the staff's past practice has been to classify these components as safety-related and seismic Category I. In addition, Appendix A to 10 CFR Part 100 requires that the engineering method used to ensure that the safety functions are maintained during and after an SSE involves the use of either a suitable dynamic analysis or a suitable qualification test.

For the purpose of providing a credit for iodine holdup and plateout, the staff's model requires that the main steam piping (including its associated piping to the condenser) and the condenser remain structurally intact following an SSE, so they can act as a holdup volume for fission products.

By the term "structurally intact," the staff assumes the steamline will retain sufficient structural integrity to transport the relatively low flow rate ($\leq 2\ ft^3/min$) of MSIV bypass leakage throughout the steam lines and condenser. The staff considers, in its radiological consequence assessment, that the condenser is open to the atmosphere via leakage through the low pressure turbine seals. Thus, it is only necessary to ensure that gross structural failure of the condenser will not occur.

The staff has evaluated the transport of gaseous iodine in elemental and particulate forms from leakage past the MSIV's. The staff's calculated thyroid doses following a postulated LOCA are listed in Table 1, and the staff finds that the calculated doses are within the acceptance criteria.

2.2 Control Room Habitability

On August 30, 1994, the NRC issued License Amendment No. 56 for NMP-2. In the SE which accompanied that amendment, the staff evaluated the control room operator doses following a postulated LOCA in accordance with SRP Section 6.4 and found the calculated doses were within the guidelines of SRP Section 6.4. In the present evaluation, the staff considered the fission product releases from the low pressure turbine seal due to the MSIV leakage (up to 300 scfh total) through the MSIV drain lines and the main condensers. The staff assumed a ground level release of airborne fission products from the turbine building as a fission product diffusion source and the control room emergency air intake as a single point receptor.

The staff's recalculated control room operator doses following a postulated LOCA are listed in the Table 1. The recalculated whole-body and equivalent organ doses (thyroid) are still within the guidelines of SRP Section 6.4, and therefore, the staff's conclusions are not affected and remain the same.

2.3 Results

Several technical references (Reference 1 - 5) including an NRC contractor's report (Reference 6) indicate that particulate and elemental iodine would be expected to deposit on surfaces with rates of deposition varying with temperature, pressure, gas composition, surface material, and particulate size. The staff, therefore, concludes that an appropriate credit for the removal of iodine in the main steam lines and main condensers should be provided in the radiological consequence assessment following a DBA.

The staff has reviewed the licensee's analysis and has performed an independent reassessment of the radiological consequences resulting from the MSIV leakage transport pathway. The calculated thyroid and whole-body doses are listed in Table 1. Based on the above evaluation and the calculated radiological consequences shown in Table 1, the staff concludes that the MSIV leak rate limit of 96 scfh total from four main steam lines is acceptable and that the radiological consequences of a postulated LOCA will be within the acceptance criteria set forth in 10 CFR Part 100 and the control room operator dose acceptance criteria specified in GDC-19 of Appendix A to 10 CFR Part 50.

3.0 REFERENCES

1. Vapor Deposition Velocity Measurements and Consolidation for I_2 and CsI, NUREG/CR-2713, S. L. Nicolosi and P. Baybutt, May 1982.

2. Fission Product Deposition and Its Enhancement Under Reactor Accident Condition: Deposition on Primary-system Surfaces, BMI-1863, J.M. Genko et al., May 1969.

3. Transmission of Iodine Through Sampling Lines, 18th DOE Nuclear Airborne Waste Management and Air Cleaning Conference, P.J. Unrein, C.A. Pelletier, J.E. Cline, and P.G. Voilleque, October 1984.

4. Deposition of ^{131}I in CDE Experiments, National Reactor Testing Station, Idaho Nuclear (IN)-1394, Nebeker et al., 1969.

5. In-Plant Source Term Measurements at Prairie Island Nuclear Generating Station, NUREG-/CR-4397, J.W. Mandler, A.C. Salker, S.T. Croney, D.W. Akers, N.K. Bihl, L.S. Loret, and T.E. Young, September 1985.

6. MSIV Leakage Iodine Transport Analysis, J.E. Cline and Associates, Inc., 1991.

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. 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 (60 FR 3675). 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 Contributor: D. Carter

Date: August 10, 1995

Table 1 Radiological Consequences of Loss-of-Coolant Accident (rem)

	EAB		LPZ	
	Thyroid	Whole Body	Thyroid	Whole Body
Bypass and MSIV Leakage	18	0.12	122.3	0.9
ESF component leakage	4	2.0	10	0.38
Containment leakage	56	0.1	30	0.10
Total	78	2.22	162.3	1.35

	Thyroid		Whole Body	
Control Room Operator Doses	22.6		1.0	

Table 2 Assumptions Used to Evaluate the MSIV Leakage Contribution

Core Thermal Power (MWt):	3489
MSIV Total Leak Rate: (24scfh/MSIV)	96 scfh
Core Radionuclide Fractions Released to Drywell (%)	
Noble Gases:	100
Iodines:	50
Forms of Iodine Species (%)	
Elemental:	91
Organic:	4
Particulate:	5
Iodine Dose Conversion Factors:	ICRP-30
Suppression pooldecontamination factor	
Nobel gas	1
Organic iodine	1
Elemental iodine	10
Particulate	10
Containment Free Volume (ft^3):	4.73×10^5
Control room free volume (ft^3):	3.81×10^5
Secondary containment free volume:	3.88×10^6
Secondary containment mixing efficiency:	50%
Standby gas treatment system:	
Filter efficiency	99%
Flow rate	2670 ft^3/min
Drawdown time:	60 minutes
Atmospheric Dispersion Factors (sec/m^3)	
0 - 1 hour, Exclusion Area Boundary:	8.4×10^{-4}
0 - 1 hour, Low Population Zone:	7.9×10^{-6}
1 - 2 hour, Exclusion Area Boundary:	3.4×10^{-5}
1 - 2 hour, Low Population Zone:	1.4×10^{-5}
2 - 8 hour, Low Population Zone:	8.4×10^{-6}
8 - 24 hour, Low Population Zone:	4.5×10^{-6}
1 - 4 day, Low Population Zone:	1.5×10^{-6}
4 - 30 day, Low Population Zone:	3.2×10^{-7}
Control Room Atmospheric Dispersion Factors (sec/m^3)	
0 - 8 hours:	2.13×10^{-4}
8 - 24 hours:	1.66×10^{-4}
1 - 4 days:	9.88×10^{-5}
4 - 30 days:	4.70×10^{-5}

August 10, 1995

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: ISSUANCE OF AMENDMENT FOR NINE MILE POINT NUCLEAR STATION, UNIT 2 (TAC NO. M91115)

Dear Mr. Sylvia:

The Commission has issued the enclosed Amendment No. 67 to Facility Operating License No. NPF-69 for the Nine Mile Point Nuclear Station, Unit 2. The amendment consists of changes to the Technical Specifications in response to your application transmitted by letter dated December 13, 1994, as supplemented April 3, 1995.

The amendment revises Table 3.6.1.2-1 to allow a maximum leakage of 24.0 scfh for each of the 8 main steam isolation valves instead of the current 6.0 scfh.

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:

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

Enclosures: 1. Amendment No. 67 to NPF-69
2. Safety Evaluation

cc w/encls: See next page

DOCUMENT NAME: G:\NM2\NMP291115.AMD

To receive a copy of this document, indicate in the box: "C" = Copy without attachment/enclosure "E" = Copy with attachment/enclosure "N" = No copy

OFFICE	PDI-1:LA		PDI-1:PM		OGC		PDI-1:D	N		
NAME	SLittle		GEdison:dt		R Bachmann		LMarsh			
DATE	7/28/95		7/28/95		8/ /95		8/10/95			

OFFICIAL RECORD COPY