April 2, 1999

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

SUBJECT: ISSUANCE OF AMENDMENT FOR NINE MILE POINT NUCLEAR STATION, UNIT NO. 1 (TAC NO. MA4317)

Dear Mr. Mueller:

The Commission has issued the enclosed Amendment No. 166 to Facility Operating License No. DPR-63 for the Nine Mile Point Nuclear Station, Unit No. 1 (NMP1). The amendment consists of changes to the Technical Specifications (TSs) in response to your application transmitted by letter dated November 30, 1998.

This amendment changes TS 3.1.2, "Liquid Poison System," and the associated Bases to correct the required concentration and volume of boron solution.

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

Sincerely,

Original signed by:

Darl S. Hood, Senior Project Manager
Project Directorate I-1
Division of Licensing Project Management
Office of Nuclear Reactor Regulation

Docket No. 50-220

Enclosures: 1. Amendment No. 166to DRP-63
2. Safety Evaluation

cc w/encls: See next page



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|---|---|---|---|---|---|---|---|---|---|---|
| NAME | DHood:lcc | DSH | SLittle | | SBajwa | | RBachmann | | ~~TCollins~~ TWertmel | |
| DATE | 02/19/99 | | 02/18/99 | | 02/22/99 | | 02/23/99 | | 02/22/99 | |

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Official Record Copy

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

April 2, 1999

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Division of Licensing Project Management
Office of Nuclear Reactor Regulation

Docket No. 50-220

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cc w/encls: See next page

Nine Mile Point Nuclear Station
Unit No. 1

Regional Administrator, Region I
U.S. Nuclear Regulatory Commission
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DATED: April 2, 1999

AMENDMENT NO. 166 TO FACILITY OPERATING LICENSE NO. DRP-63 NINE MILE POINT NUCLEAR POWER STATION UNIT NO. 1

Docket File
PUBLIC
PDI-1 Reading
J. Zwolinski
S. Bajwa
S. Little
D. Hood
OGC
G. Hill (2), T-5 C3
W. Beckner
T. Collins
ACRS
R. Blough, Region I
R. Norsworthy (e-mail only RCN)

cc: Plant Service list

DATED: April 2, 1999

AMENDMENT NO. 166 TO FACILITY OPERATING LICENSE NO. DRP-63 NINE MILE POINT NUCLEAR POWER STATION UNIT NO. 1

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

NIAGARA MOHAWK POWER CORPORATION

DOCKET NO. 50-220

NINE MILE POINT NUCLEAR STATION, UNIT 1

AMENDMENT TO FACILITY OPERATING LICENSE

Amendment No. 166
License No. DRP-63

1. The Nuclear Regulatory Commission (the Commission) has found that:

   A. The application for amendment by Niagara Mohawk Power Corporation (the licensee) dated November 30, 1998, complies with the standards and requirements of the Atomic Energy Act of 1954, as amended (the Act) and the Commission's rules and regulations set forth in 10 CFR Chapter 1;

   B. The facility will operate in conformity with the application, the provisions of the Act, and the rules and regulations of the Commission;

   C. There is reasonable assurance (i) that the activities authorized by this amendment can be conducted without endangering the health and safety of the public, and (ii) that such activities will be conducted in compliance with the Commission's regulations;

   D. The issuance of this amendment will not be inimical to the common defense and security or to the health and safety of the public; and

   E. The issuance of this amendment is in accordance with 10 CFR Part 51 of the Commission's regulations and all applicable requirements have been satisfied.

2. Accordingly, the license is amended by changes to the Technical Specifications as indicated in the attachment to this license amendment, and paragraph 2.C.(2) of Facility Operating License No. DRP-63 is hereby amended to read as follows:

(2) Technical Specifications and Environmental Protection Plan

The Technical Specifications contained in Appendix A and the Environmental Protection Plan contained in Appendix B, both of which are attached hereto, as revised through Amendment No.166 are hereby incorporated into this license. Niagara Mohawk Power Corporation shall operate the facility in accordance with the Technical Specifications and the Environmental Protection Plan.

3. This license amendment is effective as of the date of its issuance to be implemented within 30 days.

FOR THE NUCLEAR REGULATORY COMMISSION

S. Singh Bajwa, Director
Project Directorate I-1
Division of Licensing Project Management
Office of Nuclear Reactor Regulation

Attachment:
Changes to the Technical
Specifications

Date of Issuance: April 2, 1999

ATTACHMENT TO LICENSE AMENDMENT NO. 166

TO FACILITY OPERATING LICENSE NO. DRP-63

DOCKET NO. 50-220

Replace the following pages of the Appendix A Technical Specifications with the attached pages. The revised pages are identified by Amendment number and contain vertical lines indicating the areas of change.

| Remove | Insert |
|---|---|
| 45 | 45 |
| 48 | 48 |

| LIMITING CONDITION FOR OPERATION | SURVEILLANCE REQUIREMENT |
|---|---|
| c. The liquid poison tank shall contain a minimum of 1325 gallons of boron bearing solution. The solution shall have a sufficient concentration of sodium pentaborate enriched with Boron-10 isotope to satisfy the equivalency equation.<br><br>$\frac{C}{13\% \text{ wt}} \times \frac{628300}{M} \times \frac{Q}{86 \text{ GPM}} \times \frac{E}{19.8\% \text{ Atom}} \geq 1$<br><br>Where: C = Sodium Pentaborate Solution Concentration (Wt %)<br><br>M = Mass of Water in Reactor Vessel and Recirculation piping at Hot Rated Conditions (501500 lb)<br><br>Q = Liquid Poison Pump Flow Rate (30 GPM nominal)<br><br>E = Boron-10 Enrichment (Atom %)<br><br>d. The liquid poison solution temperature shall not be less than the temperature presented in Figure 3.1.2.b.<br><br>e. If Specifications "a" through "d" are not met, initiate normal orderly shutdown within one hour. | Remove the squibs from the valves and verify that no deterioration has occurred by actual field firing of the removed squibs. In addition, field fire one squib from the batch of replacements.<br><br>Disassemble and inspect the squib-operated valves to verify that valve deterioration has not occurred.<br><br>(2) <u>At least once per month -</u><br><br>Demineralized water shall be recycled to the test tank. Pump discharge pressure and minimum flow rate shall be verified.<br><br>b. <u>Boron Solution Checks</u>:<br><br>(1) <u>At least once per month -</u><br><br>Boron concentration shall be determined.<br><br>(2) <u>At least once per day -</u><br><br>Solution volume shall be checked. In addition, the sodium pentaborate concentration shall be determined and conformance with the requirements of the equivalency equation shall be checked any time water or boron are added or if the solution temperature drops below the limits specified by Figure 3.1.2.b. |

The liquid poison system (Section VII-C)* acting alone does not prevent fuel clad damage for any conceivable type of Station transient. This system provides a backup to permit reactor shutdown in the event of a massive failure of the control rods to insert.

The liquid poison system is designed to provide the capability to bring the reactor from full design rating (1850 thermal megawatts) to a cold, xenon free shutdown condition assuming none of the control rods can be inserted. A concentration of 109.8 ppm of boron-10 (the boron isotope with a high neutron cross section) in the reactor coolant will bring the reactor from full design rating (1850 thermal megawatts) to greater than 3 percent $\Delta k$ subcritical (0.97 $k_{eff}$) considering the combined effects of the control rods, coolant voids, temperature change, fuel doppler, xenon, and samarium.

In order to provide good mixing, the injection time has to be greater than 17 minutes.[2] The rate of boron-10 injection must also be sufficient to achieve hot shutdown during ATWS events.

The liquid poison storage tank minimum volume assures that the above requirements for boron solution insertion are met with one 30 gpm liquid poison pump. The quantity of Boron-10 isotope required to be stored in solution includes an additional 25 percent margin beyond the amount needed to shutdown the reactor to allow for any unexpected non-uniform mixing. The relationship between sodium pentaborate concentration and sodium pentaborate Boron-10 enrichment must satisfy the equivalency equation:[1]

$$\frac{C}{13\%\ wt} \times \frac{628300}{M} \times \frac{Q}{86\ GPM} \times \frac{E}{19.8\%\ Atom} \geq 1$$

Where:
- C = Sodium Pentaborate Solution Concentration (Wt %)
- M = Mass of Water in Reactor Vessel and Recirculation piping at Hot Rated Conditions (501500 lb)
- Q = Liquid Poison Pump Flow Rate (30 GPM nominal)
- E = Boron-10 Enrichment (Atom %)

The tank volume requirements include consideration for 197 gallons of solution which is contained below the point where the pump takes suction from the tank and therefore cannot be inserted into the reactor.

The solution saturation temperature varies with the concentration of sodium pentaborate. Figure 3.1.2.b includes a 5°F margin above the saturation temperature to guard against precipitation. Temperature and liquid level alarms for the system are annunciated in the Control Room.

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*FSAR

(1) GE Topical Report NEDE-31096-P-A, "Anticipated Transients Without Scram. Response to ATWS Rule 10 CFR 50.62."

(2) GE Report NEDC-30921, "Assessment of ATWS Compliance Alternatives."

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

SAFETY EVALUATION BY THE OFFICE OF NUCLEAR REACTOR REGULATION

RELATED TO AMENDMENT NO. 166 TO FACILITY OPERATING LICENSE NO. DRP-63

NIAGARA MOHAWK POWER CORPORATION

NINE MILE POINT NUCLEAR STATION, UNIT NO. 1

DOCKET NO. 50-220

## 1.0 INTRODUCTION

By letter dated November 30, 1998, Niagara Mohawk Power Corporation (NMPC or the licensee) proposed a license amendment to change the Technical Specifications (TSs) for Nine Mile Point Nuclear Station, Unit No. 1 (NMP1). The proposed changes would correct TS 3.1.2, "Liquid Poison System," and the associated TS Bases. Specifically, in the Bases for TS 3.1.2, the boron-10 concentration of 120 ppm (which is incorrectly calculated using atomic percent instead of weight percent) would be changed to 109.8 ppm. In TS 3.1.2, the minimum volume of boron bearing solution in the liquid poison tank would be increased from 1185 gallons to 1325 gallons.

## 2.0 BACKGROUND

The Liquid Poison System is described in Section VII C of NMP1's Updated Final Safety Analysis Report (UFSAR) and shown in UFSAR Figure VII-6. The system consists of an ambient pressure storage tank with an immersion heater to maintain temperature of a sodium pentaborate solution, two high pressure positive displacement pumps for injecting the solution into the reactor, two explosive-actuated shear-plug isolation valves for injection, a mixing sparger for the storage tank, a test tank, two isolation check valves and additional valves, piping, and associated instrumentation. The system is manually actuated from the control room. It is designed to provide the capability to bring the reactor from a full design rating of 1850 megawatts thermal to greater than 3% delta k subcritical (0.97 $k_{eff}$) if none of the control rods can be inserted, and considering the combined effects of coolant voids, temperature change, fuel Doppler, xenon, and samarium. It is also designed to satisfy 10 CFR 50.62, "Requirements for Reduction of Risk from Anticipated Transients Without Scram (ATWS) Events for Light-Water-Cooled Nuclear Power Plants," which requires that:

> Each boiling water reactor must have a standby liquid control system (SLCS) with the capability of injecting into the reactor pressure vessel a borated water solution at such a flow rate, level of boron concentration and boron-10 isotope enrichment, and accounting for reactor pressure vessel volume, that the resulting reactivity control is at least equivalent to that resulting from injection of 86 gallons per minute of 13 weight percent sodium pentaborate decahydrate solution at the natural boron-10 isotope abundance into a 251-inch inside diameter reactor pressure vessel for a given core design.

The NMP1 Liquid Poison System satisfies both of its design requirements by pumping a predetermined amount of sodium pentaborate solution, containing enriched boron-10, from the storage tank to the core inside the reactor pressure vessel at a specified rate. The boron isotope in this solution has a high thermal neutron absorption cross section and, therefore, effectively shuts down the core's chain reaction. The required volume of boron bearing solution is determined by the enrichment and concentration of the boron-10 that is equivalent to maintaining a concentration of 600 ppm of naturally occurring boron within the reactor pressure vessel. NMP1 TS 3.2.1 and it's TS Bases specify the equivalency equation for satisfying 10 CFR 50.62 as a function of the pumping capacity (flow rate), solution concentration, and boron enrichment. In determining the quantity of boron-10 solution required to shutdown NMP1 (1103 gallons), NMPC includes a 25% margin to allow for unexpected non-uniform mixing of the boron-10 in the reactor coolant. The total volume of sodium pentaborate solution stored in the tank (1325 gallons) includes 197 gallons that is located below the pump suction (where it is unavailable for injection to the core), plus an additional 25 gallons for conservatism.

## 3.0 EVALUATION

As stated in NMP1 TS 3.1.2, the boron bearing solution in the liquid poison tank is required to have a sufficient concentration of sodium pentaborate enriched with boron-10 isotope to satisfy the equivalency equation:

$$\frac{C}{13\%\ wt} \times \frac{628300}{M} \times \frac{Q}{86\ GPM} \times \frac{E}{19.8\%\ Atom} \geq 1$$

Where: C = Sodium Pentaborate Solution Concentration (Wt %)

M = Mass of Water in Reactor Vessel and Recirculation piping at Hot Rated conditions (501500 lb)

Q = Liquid Poison Pump Flow Rate (30 GPM nominal)

E = Boron-10 Enrichment (Atom %)

In a prior application for license amendment dated March 7, 1988, NMPC proposed a change to the TS Bases for the Liquid Poison System regarding the required minimum concentration of the neutron absorber in the reactor coolant that would bring the reactor from its full design rating to greater than 3% delta k subcritical Specifically, NMPC proposed to change the concentration of 600 ppm of naturally occurring boron used in the sodium pentaborate solution to 120 ppm boron-10. The proposed change was approved by the NRC staff in License Amendment 101 dated October 31, 1988. However, NMPC has now determined that the 120 ppm concentration of boron-10 in the reactor coolant was incorrect because it had been calculated using atomic percent rather than weight percent. The correct concentration of boron-10 in the reactor coolant that provides a shutdown capability equivalent to 600 ppm of naturally occurring boron and satisfies the requirements of the Liquid Poison System is 109.8 ppm boron-10.

In the prior application for license amendment dated March 7, 1988, NMPC proposed that the volume-concentration limits of TS Figure 3.1.2a be replaced with the required minimum volume of boron bearing solution contained in the Liquid Poison System storage tank. However, in that

application, NMPC incorrectly calculated the volume of solution in the tank using atomic percent, rather than the weight percent required concentration of boron-10. NMPC also used a reduced pump flow capacity of 27 gpm to incorporate a 10% degradation allowed by Section XI of the American Society of Mechanical Engineers Boiler and Pressure Vessel Code. The use of 27 gpm is inconsistent with the NMP1 TS 3.1.2c equivalency equation which specifies a pump injection rate of 30 gpm. The use of 27 gpm is also inconsistent with the approved General Electric Report NEDE-31096-P-A, "Anticipated Transients Without Scram-Response to ATWS Rule 10 CFR 50.62," which specifies the use of nominal or design flow rates (i.e., 30 gpm for NMP1). With these errors, and allowing for a 25% margin to account for non-uniform mixing and 197 gallons for the unusable volume, NMPC had incorrectly determined that the minimum required volume of the boron bearing solution in the tank was 1185 gallons. Using the correct weight percent of boron-10, a pump injection rate of 30 gpm, and adding a 25% margin to provide for non-uniform mixing, the correct minimum volume available for injection would be 1103 gallons. Adding 197 gallons to account for the unusable tank volume below the pump suction and adding an additional 25 gallons of margin that NMPC proposes for conservatism, the allowable minimum volume of boron bearing solution in the tank becomes 1325 gallons. Accordingly, the proposed TS change to increase the minimum contents of the liquid poison tank from 1185 gallons to 1325 gallons of boron bearing solution is acceptable.

Maintaining a minimum volume of 1325 gallons of sodium pentaborate solution in the storage tank, together with the requirements of the equivalency equation, ensures that sufficient boron-10 would be injected into the reactor pressure vessel to achieve a concentration of 109.8 ppm of boron-10 in the reactor coolant.

The 86 gpm flow rate for standby liquid control systems specified in 10 CFR 50.62 (quoted in Section 2.0 of this NRC Safety Evaluation) is based upon two-pump operation. Because the size of the NMP1 injection piping can only accommodate the output of a single pump, the control scheme for the NMP1 Liquid Poison System is based upon one-pump operation. The equivalency equation normalizes NMP1's flow rate of 30 gpm to the nominal or design flow rate of NEDE-31096-P-A so that the 10 CFR 50.62 requirements are met. Using one 30 gpm pump, 1103 gallons of sodium pentaborate solution would be injected into the reactor pressure vessel in about 37 minutes, which meets the injection time of greater than 17 minutes specified in the TS Bases for the Liquid Poison System. This ensures adequate mixing.

In summary, the NRC staff concludes that the proposed TS changes maintain compliance with 10 CFR 50.62 and the intended design function of the Liquid Poison System (to bring the reactor from a full design rating of 1850 megawatts thermal to greater than 3% delta k subcritical if none of the control rods can be inserted, giving appropriate consideration to the combined effects of coolant voids, temperature change, fuel Doppler, xenon, and samarium). Accordingly, the proposed TS changes are 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 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 (63 FR 71970). 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. Hood

Date: April 2, 1999