ATTACHMENT A

NIAGARA MOHAWK POWER CORPORATION

LICENSE NO. DPR-63

DOCKET NO. 50-220

<u>Proposed Changes to Technical Specifications and Bases</u>

Replace the existing pages 45 and 48 with the attached revised pages 45 and 48. The pages have been retyped in their entirety with marginal markings to indicate changes.

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.

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

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 %)

d. The liquid poison solution temperature shall not be less than the temperature presented in Figure 3.1.2.b.

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.

Disassemble and inspect the squib-operated valves to verify that valve deterioration has not occurred.

(2) At least once per month -

Demineralized water shall be recycled to the test tank. Pump discharge pressure and minimum flow rate shall be verified.

b. Boron Solution Checks:

(1) At least once per month -

Boron concentration shall be determined.

(2) At least once per day -

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 Δk 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]

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

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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(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."

ATTACHMENT B

NIAGARA MOHAWK POWER CORPORATION

LICENSE NO. DPR-63

DOCKET NO. 50-220

Supporting Information and No Significant Hazards Consideration Analysis

INTRODUCTION

This Application for Amendment to the Nine Mile Point Unit 1 (NMP1) operating license proposes changes to the Limiting Condition for Operation (LCO) and the associated Bases for Technical Specifications (TS) Section 3.1.2, "Liquid Poison System." LCO 3.1.2c identifies the minimum required volume of boron bearing solution contained in the Liquid Poison System storage tank. The Bases identify the minimum required concentration of boron-10 in the reactor coolant that will bring the reactor from its full design rating to greater than 3 percent delta k subcritical.

The current LCO and Bases for the Liquid Poison System were included in an application for amendment, dated March 7, 1988 (NMP1L 0231), to satisfy the requirements of the Anticipated Transient Without Scram (ATWS) Rule, 10CFR50.62. Those proposed changes were approved as NMP1 TS Amendment No. 101.

The first revision concerns the current TS 3.1.2 Bases concentration of 120 ppm boron-10. The 120 ppm boron-10 was incorrectly calculated using atomic percent instead of weight percent. The correct concentration of boron-10 is 109.8 ppm.

The second revision occurs in TS Section 3.1.2c. The currently specified minimum volume of 1185 gallons was calculated based on atomic percent rather than weight percent boron-10 and an incorrect pump injection rate of 27 gpm. The correct minimum TS volume is based on weight percent of boron-10 and the correct pump injection rate of 30 gpm. Including a 25% margin to account for non-uniform mixing, the required minimum volume of boron bearing solution is 1103 gallons. The new TS minimum volume of 1325 gallons incorporates 197 gallons unusable volume and an additional 25 gallon margin for conservatism.

Upon discovery of the inadequate TS controls, Niagara Mohawk Power Corporation (NMPC) evaluated the operability of the Liquid Poison System based on historical normal liquid poison tank volume and solution concentration. NMPC concluded that at no time has the Liquid Poison System been inoperable. Administrative controls for required concentration, enrichment, and minimum volume were immediately established that assured the continued operability of the Liquid Poison System until issuance of this proposed amendment.

The Liquid Poison System consists of an ambient pressure storage tank with an immersion heater to maintain the design temperature of the 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. Actuation of the Liquid Poison System is performed manually from the control room.

The Liquid Poison System is designed to provide the capability to bring the reactor from a full design rating of 1850 thermal megawatts to greater than 3 percent delta k subcritical (0.97 k_{eff}) assuming none of the control rods can be inserted, and considering the combined effects of coolant voids, temperature change, fuel doppler, xenon and samarium. In addition, the Liquid Poison System is designed to satisfy the following requirement of 10CFR50.62, "Requirements for Reduction of Risk from Anticipated Transients Without Scram (ATWS) Events for Light-Water-Cooled Nuclear Power Plants:"

> "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."

Both of these design requirements are satisfied by pumping a predetermined amount of sodium pentaborate solution from the system storage tank at a specified rate into the reactor vessel. The NMP1 sodium pentaborate solution contains enriched boron-10. This isotope of boron shuts down the chain reaction due to its high thermal neutron absorption cross section. 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 vessel.

Furthermore, the quantity of the boron-10 isotope solution required to shutdown the NMP1 reactor (1103 gallons) includes an additional 25 percent margin. The 25 percent margin allows for any unexpected non-uniform mixing of the boron-10 in the reactor coolant. The total volume of the sodium pentaborate solution to be stored in the system storage tank (1325 gallons) also includes 197 gallons of solution (which is unavailable for injection into the reactor vessel) and an additional 25 gallon margin for conservatism. The 197 gallons is the volume of solution stored in the tank below the pump suction.

The ATWS Rule, which specifies a minimum injection rate of boron-10 into the reactor pressure vessel, is satisfied by meeting the equivalency equation which is provided in the LCO and Bases for the Liquid Poison System. The equivalency equation is a function of the pumping capacity (flow rate), solution concentration, and boron enrichment. Compliance with this equation satisfies the above stated requirements of the ATWS Rule.

EVALUATION

The ATWS Rule, 10CFR50.62, specifies an effective rate of boron-10 injection into the reactor vessel. NMP1 could have satisfied this requirement by increasing the pumping capacity (flow rate) of the Liquid Poison System pump or by increasing the amount of boron-10 in solution which is pumped into the reactor pressure vessel. NMPC decided to increase the amount of boron-10 in solution. This was done by replacing the naturally occurring boron used in the sodium pentaborate solution with boron enriched in the isotope boron-10. Therefore, in its application for amendment dated March 7, 1988, a change was proposed (to the Bases of the Liquid Poison System) to 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 percent delta k subcritical. The old concentration of 600 ppm boron was revised to 120 ppm boron-10. However, the 120 ppm concentration of boron-10 in the reactor coolant was incorrectly calculated in atomic percent rather than weight percent. The correct concentration is 109.8 ppm boron-10. This correct concentration of boron-10 in the reactor coolant provides a shutdown capability equivalent to 600 ppm of naturally occurring boron and satisfies the above design requirements of the Liquid Poison System. Accordingly, the Bases of the Liquid Poison System are being revised to reflect a required reactor coolant concentration for boron-10 of 109.8 ppm.

In the same application for amendment, the volume-concentration limits of Figure 3.1.2a were replaced with the required minimum volume of boron bearing solution contained in the Liquid Poison System storage tank. However, in that application the calculated volume of solution in the tank was also incorrectly based upon atomic percent, rather than the weight percent required concentration of boron-10, and a pump flow capacity of 27 gpm. The reduced pump capacity of 27 gpm was based upon a 10% degradation allowed by Section XI of the American Society of Mechanical Engineers Boiler and Pressure Vessel Code. The 27 gpm flow rate was incorrectly applied since the NMP1 TS 3.1.2c equivalency equation required a pump injection rate of 30 gpm. The TS value of 30 gpm is consistent with the use of nominal or design flow rates as stated in General Electric Company Licensing Topical Report NEDE-31096-P-A. The above identified errors resulted in a nonconservative amount of 1185 gallons minimum required volume of the boron bearing solution in the tank. The current 1185 gallons minimum required volume includes a 25% margin to account for non-uniform mixing and 197 gallons of unusable volume. Based on the correct weight percent of boron-10 and a pump injection rate of 30 gpm, including a 25% margin (to account for non-uniform mixing), the correct minimum volume of boron bearing solution is 1103 gallons. Incorporating 197 gallons unusable volume and a 25 gallon margin for conservatism, the proposed new TS minimum volume is 1325 gallons.

The minimum required volume of 1325 gallons of sodium pentaborate solution to be maintained in the storage tank, together with the requirements of the equivalency equation, ensure that a sufficient quantity of boron-10 will be injected into the reactor 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 10CFR50.62 is based on two pump operation for a generic reactor plant. The NMP1 liquid poison system control scheme is designed to prevent two pump operation, and the injection piping is sized to accommodate the output of only a single pump. The equivalency equation normalizes the NMP1 single pump flow rate of 30 gpm to the nominal or design flow rate of NEDE-31096-P-A so that the 10CFR50.62 requirements are met. Using one 30 gpm Liquid Poison System pump, 1103 gallons of sodium pentaborate solution would be injected into the reactor vessel in approximately 37 minutes. The injection time of approximately 37 minutes meets the requirement for an injection time greater than 17 minutes, as required by the Bases of the Technical Specifications for the Liquid Poison System. Therefore, adequate mixing is assured, and the required new TS minimum volume of 1325 gallons meets the design requirements of the Liquid Poison System.

CONCLUSION

The Liquid Poison System is designed to bring the reactor from a full design rating to a cold shutdown condition at any time in core life independent of the control rod system capabilities.

The proposed changes correct the LCO and the associated Bases for Technical Specification Section 3.1.2, "Liquid Poison System," that had been incorporated into the TS by NMP1 TS Amendment No. 101. In the LCO, the required minimum volume of the sodium pentaborate solution contained in the Liquid Poison System storage tank is being increased from 1185 gallons to 1325 gallons. In addition, in the Bases, the concentration of boron-10 in the reactor coolant required to bring the reactor to a shutdown condition is corrected from 120 ppm to 109.8 ppm.

These changes are required to maintain compliance with the requirements of 10CFR50.62, "Requirements for Reduction of Risk from Anticipated Transients without Scram (ATWS) Events for Light-Water-Cooled Nuclear Power Plants." In addition, these changes will maintain the capability of the Liquid Poison System to bring the reactor from a full design rating of 1850 thermal megawatts to greater than 3 percent delta k subcritical (0.97 k_{eff}) assuming none of the control rods can be inserted, and considering the combined effects of coolant voids, temperature change, fuel doppler, xenon and samarium.

Based on these considerations, the health and safety of the public will not be endangered by operation in the proposed manner, and the issuance of the proposed amendment is consistent with the common defense and security.

Eligibility for Categorical Exclusion from Performing an Environmental Assessment

This amendment involves a change in the installation or use of a facility component located within the restricted area as defined in 10CFR20 and changes in surveillance requirements. Niagara Mohawk has determined that this amendment involves no significant hazards consideration, no increase in types or amounts of offsite effluents, and no increase in individual or cumulative exposure. Accordingly, this amendment meets the eligibility criteria for categorical exclusion set forth in 10CFR51.22(c)(9). Pursuant to 10CFR51.22(b), Niagara Mohawk has determined that no environmental impact statement or environmental assessment need be prepared in connection with the issuance of this amendment.

NO SIGNIFICANT HAZARDS CONSIDERATION ANALYSIS

10CFR50.91 requires that at the time a licensee requests an amendment, it must provide to the Commission its analysis using the standards in 10CFR50.92 concerning the issue of no significant hazards consideration. Therefore, in accordance with 10CFR50.91, the following analysis has been performed.

The operation of Nine Mile Point Unit 1, in accordance with the proposed amendment, will not involve a significant increase in the probability or consequences of an accident previously evaluated.

The Liquid Poison System is designed to provide the capability to bring the reactor from a full design rating to a shutdown condition assuming none of the control rods can be inserted. The system is manually initiated in response to a failure of the Control Rod Drive System to shutdown the reactor. The proposed changes revise the required liquid poison solution volume and concentration. The proposed changes to the Technical Specifications and the Bases require no changes to the physical facility which could adversely affect any accident precursors. Therefore, the proposed changes cannot significantly increase the probability of an accident.

The proposed changes will assure that the Liquid Poison System continues to provide the capability to shutdown the reactor during an ATWS event. In addition, the system will continue to be capable of bringing the reactor to cold shutdown, 3 percent delta k subcritical (0.97 k_{eff}), from a full design rating of 1850 megawatts thermal assuming none of the control rods can be inserted, and considering the combined effects of coolant voids, temperature change, fuel doppler, and xenon and samarium. Therefore, the change to the Technical Specifications does not significantly increase the consequences of a previously evaluated accident.

The operation of Nine Mile Point Unit 1, in accordance with the proposed amendment, will not create the possibility of a new or different kind of accident from any accident previously evaluated.

Injection of the sodium pentaborate solution into the reactor vessel has been considered in the plant design. The proposed changes revise the required liquid poison solution volume and concentration. The proposed changes make no physical modification to the plant which could create the possibility of a new or different kind of accident. The proposed changes will maintain the capability of the Liquid Poison System to shutdown the reactor from its full design rating assuming none of the control rods are inserted, and considering the combined effects of coolant voids, temperature change, fuel doppler, and xenon and samarium. Consequently, these changes do not create the possibility of a new or different kind of accident from any accident previously evaluated.

The operation of Nine Mile Point Unit 1, in accordance with the proposed amendment, will not involve a significant reduction in a margin of safety.

The proposed changes revise the required liquid poison solution volume and concentration. The proposed changes make no physical modification to the plant which could reduce the margin of safety. These changes will assure compliance with the requirements of 10CFR50.62, "Requirements for Reduction of Risk from Anticipated Transients without Scram (ATWS) Events for Light-Water-Cooled Nuclear Power Plants." In addition, these changes will maintain the capability of the Liquid Poison System to bring the reactor from a full design rating of 1850 megawatts thermal to greater than 3 percent delta k subcritical (0.97 k_{eff}) assuming none of the control rods can be inserted, and considering the combined effects of coolant voids, temperature change, fuel doppler, xenon and samarium.

The required volume of boron-10 solution in the Liquid Poison System storage tank includes an additional 25 percent margin beyond the amount needed to shutdown the reactor to allow for any unexpected non-uniform mixing. Also, the total storage tank volume of sodium pentaborate solution incorporates 197 gallons of solution which is unavailable for injection into the reactor vessel and a 25 gallon margin for conservatism. Additionally, using one 30 gpm Liquid Poison System pump, the injection time is greater than 17 minutes thereby assuring adequate mixing. The proposed changes to the liquid poison concentration and volume ensure the NMP1 Liquid Poison System is able to meet its safety function requirements. Therefore, this change will not involve a significant reduction in the margin of safety.

Accordingly, as determined by the analysis above, this proposed amendment involves no significant hazards consideration.

ATTACHMENT C

NIAGARA MOHAWK POWER CORPORATION

LICENSE NO. DPR-63

DOCKET NO. 50-220

Marked Copy of Proposed Changes to Current Technical Specifications and Bases

The current versions of pages 45 and 48 of the NMP1 Technical Specifications have been hand marked to reflect the proposed change.

LIMITING CONDITION FOR OPERATION	SURVEILLANCE REQUIREMENT

c. The liquid poison tank shall contain a minimum of 1325 ~~1185~~ 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.

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

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 %)

d. The liquid poison solution temperature shall not be less than the temperature presented in Figure 3.1.2.b.

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.

Disassemble and inspect the squib-operated valves to verify that valve deterioration has not occurred.

(2) At least once per month -

Demineralized water shall be recycled to the test tank. Pump discharge pressure and minimum flow rate shall be verified.

b. Boron Solution Checks:

(1) At least once per month -

Boron concentration shall be determined.

(2) At least once per day -

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.

BASES FOR 3.1.2 AND 4.1.2 LIQUID POISON SYSTEM

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 ~~120~~ 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 Δk 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]

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