UNITED STATES NUCLEAR REGULATORY COMMISSION

NORTHERN STATES POWER COMPANY

MONTICELLO NUCLEAR GENERATING PLANT DOCKET NO. 50-263

REQUEST FOR AMENDMENT TO
OPERATING LICENSE DPR-22

LICENSE AMENDMENT REQUEST DATED March 1, 1988

Northern States Power Company, a Minnesota corporation, requests authorization for changes to Appendix A of the Monticello Operating License as shown on the attachments labeled Exhibits A, B, and C. Exhibit A describes the proposed changes, describes the reasons for the changes, and contains a significant hazards evaluation. Exhibits B and C are copies of the Monticello Technical Specifications incorporating the proposed changes.

This letter contains no restricted or other defense information.

NORTHERN STATES POWER COMPANY

By _____
David Musolf
Manager-Nuclear Support Services

On this 1 day of March 1988 before me a notary public in and for said County, personally appeared David Musolf, Manager-Nuclear Support Services, and being first duly sworn acknowledged that he is authorized to execute this document on behalf of Northern States Power Company, that he knows the contents thereof, and that to the best of his knowledge, information, and belief the statements made in it are true and that it is not interposed for delay.

Judy L. Klapperick

JUDY L. KLAPPERICK
NOTARY PUBLIC—MINNESOTA
ANOKA COUNTY
My Commission Expires Sept. 29, 1991

Exhibit A

Monticello Nuclear Generating Plant

License Amendment Request dated March 1, 1988

Proposed changes to the Technical Specifications
Appendix A of Operating License DPR-22

Pursuant to 10 CFR Part 50, Section 50.59 and 50.90, the holders of Operating License DPR-22 hereby propose the following changes to Appendix A Technical Specifications:

1. Standby Liquid Control System Requirements

Proposed Changes (Section 3.4 & 4.4)

Revise Sections 3.4 and 4.4 of the Technical Specifications as follows:

1) Reduce the pump minimum flow rate in Paragraph 4.4.A.1 from 26 gpm to 24 gpm.

2) Add the sentence in Paragraph 4.4.A.1 which reads, "Comparison of the measured pump flow rate against Equation 2 of Paragraph 4.4.C.1 shall be made to demonstrate operability of the system in accordance with the ATWS Design Basis.

3) Add the words "indicated" and "measured" in the variable definitions contained in Paragraph 3.4.C.1 as shown.

4) Delete the sentence in Paragraph 4.4.C.1 which reads, "In addition, boron enrichment shall be determined any time new chemicals are added to the liquid poison tank.".

5) Replace Figure 3.4-1 which allowed operation for B-10 enrichments greater than 39.6% with a new Figure 3.4-1 which allows operation for B-10 enrichments greater than 55.0%.

6) Revise the sentence in the bases which reads, "The described minimum system parameters (equivalent to 26 gpm, 13.7% concentration and 39.6 atom percent Boron-10 enrichment) will ensure an equivalent injection capability that meets the ATWS rule requirement." to read, "The described minimum system parameters (equivalent to 24 gpm, 10.7% concentration and 55.0 atom percent Boron-10 enrichment) will ensure an equivalent injection capability that meets the ATWS rule requirement.".

Reason for Change

The proposed changes are being requested because subsequent to the submittal of our License Amendment Request dated June 22, 1987 (Reference a), it was learned that the vendor could supply pre-mixed sodium pentaborate certified to 55 atom percent Boron-10 enrichment in lieu of enriched boric acid which would be mixed on-site with borax to form sodium pentaborate with a 39.6 atom percent Boron-10 enrichment. This approach offers a number of advantages. The additional enrichment allows us to return the required pump minimum flow rate to the original value of 24 gpm and still meet the ATWS Rule. It eliminates the possibility of error when mixing the boric acid and borax on-site and allows removal of the requirement for mid-cycle enrichment checks when adding chemicals. Finally, when performing surveillance tests less material is lost since the solution is at a lower concentration.

In addition, certain changes are being proposed to provide clarity to the operator. These changes are based on questions received during training of the operators on the technical specifications which incorporated the requirements of the ATWS Rule and the use of enriched boron.

Substantive changes that have been proposed to the technical specifications include, a) decreasing the required pump flow rate from 26 to 24 gpm, b) incorporating a new Figure 3.4-1 which is based on 55 atom % enriched boron, and c) delete the requirement for mid-cycle boron enrichment surveillance when new chemicals are added.

a. The 24 gpm minimum pump flow requirement is a return to the flow rate contained in technical specifications prior to implementation of the ATWS Rule. It had been raised to 26 gpm when it was planned to utilize a lower enriched sodium pentaborate solution (39.6 atom %) to allow for the lowest possible solution concentration (13.7 wt %) in meeting the ATWS Rule. With the use of a 55.0 atom % sodium pentaborate solution the solution concentration can be maintained as low as 10.7 wt % with the minimum pump flow rate returned to 24 gpm and still meet the ATWS Rule. This restores the original margin between the design value of the SLCS pump flow rate and the minimum pump flow rate contained in the technical specifications.

b. The curves in Figure 3.4.1 provide the boundaries which define an area of operation that ensures the original design basis and the ATWS rule are satisfied. The equation for the left hand curve or boundary is as provided in the discussion below entitled, "1. Comparison with the original design basis for the SLCS.". The lower boundary is provided a by straight line at 10.7 wt % below which the requirements of the ATWS rule are not met if a pump flow rate of 24 gpm and boron enrichment of 55.0 atom % or 2.78 times that naturally occurring are assumed.

c. Surveillance requirements have been deleted for verifying boron enrichment during mid-cycle addition of chemicals to the storage tank. These requirements are no longer necessary because rather

than buying enriched boric acid which then needed to be mixed on-site with borax to obtain sodium pentaborate we are procuring pre-mixed and certified sodium pentaborate directly from the vendor. The once per cycle requirement to verify enrichment is therefore adequate to ensure continued high system reliability.

Those changes which are being made to only provide clarification include, a) the addition of a sentence which states that when the monthly flow rate surveillance is performed that it should be compared to the equation which defines the ATWS Design Basis for the SLCS, and b) the addition of the words, "indicated" and "measured" in the definitions of the variables used in the calculations defined by the formulas.

The following two sections provide a comparison of the proposed changes to the original design basis of the Standby Liquid Control System and the ATWS Rule.

1. Comparison with the original design basis for the SLCS.

The original design objective of the Standby Liquid Control System (SLCS) was to provide the capability of bringing the reactor from full power to a cold, xenon-free shutdown assuming that none of the withdrawn control rods could be inserted. To meet this objective, the standby liquid control system was designed to inject a quantity of boron which produces a concentration of 660 ppm of boron in the reactor in less than 125 minutes. In addition, a 25 % boron concentration margin was added to account for possible imperfect mixing of the chemical solution in the reactor water and dilution from the water in the cooldown circuit. This resulted in the requirement to inject a quantity of boron which produces a concentration of 825 ppm of boron in the reactor in less than 125 minutes. With a sodium pentaborate solution with natural Boron-10 isotopic enrichment of 19.8 atom % a volume of 1400 gallons of solution having a 21.4 wt % sodium pentaborate concentration was required to meet the shutdown requirement. At a boron concentration of 10.8 wt %, a volume of solution equal to the maximum tank capacity of 2895 gallons was required. With a flow rate of 24 gpm the contents of the tank could be pumped into the reactor vessel in less that 121 minutes.

The proposed modified SLCS will utilize enriched boron and a flow rate value of 24 gpm. The decreased value for the flow rate returns to the value utilized in the technical specifications prior to the implementation of the ATWS Rule. The planned boron enrichment of the sodium pentaborate solution is a Boron-10 level of 55.0 atom % or greater as compared to 19.8 atom % (naturally occurring Boron-10). This is equivalent to an enrichment ratio of 2.78. With the enriched boron being utilized, the required boron concentration level (concentration of B-10 and B-11) can be reduced by the ratio of enrichment. The weight of sodium pentaborate necessary to meet the shutdown requirement can be calculated as follows:

$$SB = (W)(BC/10^6)(1.25)(1/MW)(19.8/E)$$ where;

W = Weight of the Water to be Borated = 715,000 lbs
including; a) Reactor Coolant Weight = 521,440 lbs (level 8 @ 70°F)
b) Reactor Recirculation Loops = 61,780 lbs
c) RHR Loops (in shutdown cooling mode) = 130,000 lbs

BC = Boron Concentration Level = 660 ppm

1.25 = 25% to account for imperfect mixing

MW = Molecular Weight Ratio of boron to sodium pentaborate ($Na_2B_{10}O_{16} \cdot 10H_2O$)

SB = Weight of Sodium Pentaborate (lbs)

E = Boron Enrichment (atom %)

$$(1/MW) = \frac{482.1 + 10(11.01 - E/100)}{10(11.01 - E/100)} = 1 + \frac{4821}{1101-E}$$

$$SB = (715{,}000)(660/10^6)(1.25)(1 + \frac{4821}{1101-E})(19.8/E)$$

This equation may be used to calculate the indicated tank volume which the operator reads in the control room. The minimum indicated tank volume (gal) necessary to meet the original design basis would be calculated as follows:

$$\text{Volume} = \frac{(SB)(VC)}{(WD)(SG^{SB})(C/100)} + 128 \text{ gal } *$$

where;

SB = Weight of Sodium Pentaborate (lbs)

VC = Volume Conversion = 7.481 gal/ft^3

WD = Density of Water = 62.00 lbs/ft^3 at 100 °F

SG^{SB} = Specific Gravity of Sodium Pentaborate = (0.0051xC) + 0.998

C = Concentration of Sodium Pentaborate (wt %)

* To account for instrument inaccuracies (100 gal on the wide range 28 gal on the narrow range) an additional 128 gallons is added.

Substituting in for "SB" using the equation from the previous page and multiplying the constants together:

$$\text{Volume} = \frac{(71.18)(1+\frac{4821}{1101-E})(19.8/E)(100/C)}{((0.0051 \times C) + 0.998)} + 128 \text{ gal}$$

This yields a minimum indicated value of 1404.2 gallons of solution required at 10.7 wt % is necessary to meet the original design basis with an enrichment of 55.0 atom %. With a minimum pump flow rate value of 24 gpm, the solution necessary to bring the reactor to shutdown will be pumped in under 59 minutes.

The operator will shut the SLCS pump off at an indicated volume of 0 gallons. An indicated volume of 0 gallons results in an actual volume remaining in the tank of 335 gallons. This 335 gallons represents 225 gallons for that unusable portion of the tank volume below the suction nozzle of the pump and 100 gallons for the wide range instrument inaccuracy which is necessary to prevent pump cavitation should the instrumentation be reading higher than the actual level.

2. Comparison with the ATWS Rule

To comply with the ATWS Rule, a higher rate of boron injection is required compared with that required under the original design basis. This rate must be equivalent to 86 gpm of sodium pentaborate at a 13 wt % concentration and natural Boron-10 enrichment for a 251-inch reactor vessel. Monticello has a 206-inch vessel. The method of normalizing the required boron injection for a 251-inch diameter vessel to the 206-inch diameter Monticello vessel in this section is consistent with the method approved by Reference (d) of this letter. In Generic Letter 85-03, "Clarification of Equivalent Control Capacity for Standby Liquid Control Systems", dated January 28, 1985, the Staff provided clarification of equivalent control capacity as follows:

1) The "equivalent in control capacity" wording was chosen to allow flexibility in the implementation of the requirement. For example, the equivalence can be obtained by increasing flow rate, boron concentration, or boron enrichment.

2) The 86 gallons per minute and 13-weight percent sodium pentaborate were values use in NEDE-24222, "Assessment of BWR Mitigation of ATWS, Volumes I and II", December 1979, for BWR/4, BWR/5 and BWR/6 plants with a 251-inch vessel inside diameter. The fact that different values would be equivalent for smaller plants was recognized in NEDE-24222.

   "The flow rates given here are normalized from a 251-inch diameter vessel plant to a 218-inch diameter vessel plant, i.e., the 66 gpm control liquid injection rate in a 218 is equivalent to 86 gpm in a 251. This is done to bound the analysis.....(pp. 2-15 [NEDE-24222])."

3) The important parameters to consider in establishing equivalence are vessel boron concentration required to achieve shutdown and the time required to achieve that vessel boron concentration. The minimally acceptable system should show an equivalence in the parameters to the 251-inch diameter vessel studied in NEDE-24222.

The equivalency requirement can be demonstrated if the following relationship is shown to be true:

$(Q/86\ gpm)(M_{251}/M)(C/13\ wt\ \%)(E/19.8\ atom\ \%) \geq 1$
where the plant-specific parameters are defined as:

Q = minimum SLCS flow rate (one or two pump operation as appropriate), gpm.

M = mass of water in the reactor vessel and recirculation system at the hot rated conditions, lbs.

C = minimum sodium pentaborate solution concentration, wt %.

E = minimum expected Boron-10 isotope enrichment (19.8 atom % for natural boron), atom %.

The value of M_{251} (the mass of the water in the reactor vessel and recirculation system at rated conditions in the reference plant) is 628,300 lbs for a BWR 3/4. This value was calculated based on rated temperature, rated void content, normal water level, control rods fully withdrawn, expected minimum vessel dimensions, and nominal vessel internals dimensions. The plant specific values chosen for Monticello which are reflected in the proposed technical specification changes, are a flow rate (Q) of 24 gpm, a boron concentration (C) of 10.7 wt % and a boron enrichment (E) of 55.0 atom %. The mass of water in the reactor vessel and recirculation system at the hot rated conditions (M) for Monticello is 400,000 lbs. Using the Monticello specific values yields:

$$(24/86)(\ 628{,}300/400{,}000)(10.7/\ 13)(55.0/19.8) = 1.0022$$

Safety Evaluation and Determination of Significant Hazards Considerations

The proposed changes to Appendix A of the Operating License have been evaluated to determine whether they constitute a significant hazards consideration as required by 10 CFR Part 50, Section 50.91 using the standards provided in Section 50.92. This evaluation is provided below:

1. The proposed amendment will not involve a significant increase in the probability or consequences of an accident previously evaluated.

   The proposed amendment would revise the Technical Specifications to reflect a sodium pentaborate solution which has a Boron-10 enrichment of 55.0 atom % supplied by the vendor in its final form certified to the specified Boron-10 enrichment. This change in no way detracts from the ability of the SLCS to meet its original design basis or its ability to meet the requirements of the ATWS rule. The proposed changes, with a decrease in the minimum pump flow rate and increase in the Boron-10 enrichment maintains the goal achieved when the ATWS Rule was implemented of reducing the time necessary to achieve cold shutdown by a factor of approximately 2. Therefore, this change has no significant effect on the probability or consequences of an accident previously evaluated or the ability of the SLCS to deal with that accident.

2. The proposed amendment will not create the possibility of a new or different kind of accident from any accident previously evaluated.

   The changes which are being made result in no mechanical modifications to the SLCS. Boron-10 is a stable isotope and no degradation of the enrichment level over time is expected. Other solution characteristics, such as concentration, are within the ranges where they have been operated in the past. The minimum pump flow rate specified by the proposed changes is a return to the value contained in the technical specifications prior to implementation of the ATWS Rule. The requirement for mid-cycle enrichment surveillance when new chemicals were added was instituted because the mixing of the individual components (enriched boric acid and borax) was being done on site. The sodium pentaborate is now being supplied pre-mixed and certified by the vendor to its specified Boron-10 enrichment. This eliminates the possibility of an accident due to mixing error and thereby, the need to perform the mid-cycle enrichment surveillance. Therefore, these changes result in no new or different kind of accident from any accident previously evaluated.

3. The proposed amendment will not involve a significant reduction in the margin of safety.

   The proposed technical specifications do not diminish the ability of the SLCS to meet its original design basis or the requirements of the ATWS Rule. The reduction in the minimum pump flow rate from 26 gpm to 24 gpm increases the margin between the pump design flow rate and the value contained in technical specifications to that which existed prior to implementation of the ATWS Rule. Since no mixing of the individual components of sodium pentaborate on-site is necessary the once per cycle surveillance of boron enrichment is sufficient to assure continued high system reliability of the SLCS. The proposed changes will, therefore, not involve a reduction in the margin of safety.

The Commission has provided guidance concerning the application of the Standards for determining whether a significant hazards consideration exists by providing certain examples of amendments that are considered not likely to involve significant hazards considerations. These examples were published in the Federal Register on March 6, 1986.

Changes proposed in this License Amendment Request are representative of example (vi). They are changes which may affect the probability or consequences of a previously-analyzed accident or may affect in some way a safety margin, but where the results of the change are clearly within all acceptable criteria with respect to the system or component specified in the Standard Review Plan, e.g., a change resulting from the application of a small refinement of a previously used calculational model or design method.

The proposed technical specification changes will have no effect on the physcical operation of the system. The sodium pentaborate solution being proposed has similar properties to the solution already in use and will pose no unknowns to plant operating personnel. The proposed changes result in the SLCS continuing to meet the criteria of the original design basis and the ATWS Rule as applicable to the Monticello Nuclear Generating Plant in a highly reliable manner.