UNITED STATES NUCLEAR REGULATORY COMMISSION

NORTHERN STATES POWER COMPANY

PRAIRIE ISLAND NUCLEAR GENERATING PLANT DOCKET NO. 50-282
50-306

License Amendment Request Dated October 23, 1998
Inoperable Rod Position Indicator Channels

Northern States Power Company, a Minnesota corporation, with this letter is submitting information to support a requested license amendment.

This letter contains no restricted or other defense information.

NORTHERN STATES POWER COMPANY

BY Roger O. Anderson

Roger O. Anderson
Director
Nuclear Energy Engineering

On this 23rd day of October 1998 before me a notary public in and for said County, personally appeared Roger O. Anderson, Director, Nuclear Energy Engineering; 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.

Cynthia V. Jakobson

CYNTHIA V. JAKOBSON
Notary Public-Minnesota
Hennepin County
My Commission Expires Jan 31, 2000

EXHIBIT A

PRAIRIE ISLAND NUCLEAR GENERATING STATION

License Amendment Request dated October 23, 1998

Evaluation of Proposed Changes to the
Technical Specification Appendix A of
Operation License DPR-42 and DPR-60

Pursuant to 10 CFR Part 50, Sections 50.59 and 50.90, the holders of Operating Licenses DPR-42 and DPR-60 hereby propose the following changes to the Technical Specifications contained in Appendix A of the Facility Operating Licenses:

BACKGRCUND

At times during rod movement the difference in rod position between the Individual Rod Position Indication (IRPI) system outputs and the control rod group demand counters has exceeded the rod misalignment limitations in the Prairie Island Technical Specification 3.10.E.2.b. In each instance the performance of plant procedures to verify actual rod positions has never identified that any control rod has been misaligned from its group. Since the control rods were not misaligned, the operability of IRPI was next examined, but current Technical Specification 3.10.F does not clearly define IRPI operability. To address this situation NCR 19970613 was initiated to investigate and identify a resolution.

The instrument accuracy of the Individual Rod Position Indication (IRPI) system at Prairie Island is affected by the following characteristics which are generic to all Westinghouse supplied analog IRPI systems:

1) Steady state non-linearity in the relationship between actual rod position and analog indication. This non-linearity is fixed, measurable and reproducible. The IRPI output produces an S-shaped curve that can be calibrated to intersect group demand counter output at two points. These points are chosen to provide a "best fit", but some offset between the two indications will exist over portions of the range of control rod motion.

2) Transient thermal drift, which is due to the change in detector characteristics caused by temperature changes after rod motion. This transient effect is measurable and predictable. After completion of rod motion the detector output returns to essentially the steady state value within about one hour.

The NCR examined the USAR and the Technical Specification bases to identify the required functions of the IRPI system:

1) Provide relative individual rod position indication in order to allow verification of rod motion upon demand.

2) Provide actual rod position indication to control board indicator and input signals to the ERCS Rod Deviation Monitor for detection of a misaligned rod and annunciation of the control rod deviation.

3) Provide indication of each control rod at the bottom of the core following a reactor trip or plant shutdown.

The NCR then concluded that there were two capabilities that must be maintained to provide for operability of the IRPI system and that this definition of operability was independent of system accuracy:

1) The IRPI channel(s) must trend with the control rod group demand position indication and provide the operator with the ability to manually detect rod misalignment.

2) The IRPI channel(s) must provide indication of the control rods at the bottom of the core.

The NCR concluded that an IRPI channel continues to be operable when the control rods are not misaligned but the difference between demand indication and IRPI indication is greater than 12 steps but less than 24 steps. With a difference greater than 24 steps the IRPI channel should be logged OOS.

On October 14, 1998 Northern States Power was informed that the NRC Staff had completed a review of the definition of IRPI operability utilized at Prairie Island and had concluded that the definition was not adequate. The NRC Staff clarified during a call with the Prairie Island Staff on October 15, 1998 that they consider an IRPI channel inoperable anytime the IRPI indicated position differs from the group demand position by greater than the rod misalignment limitations in Technical Specifications.

As discussed above, changes in rod position, as required during power changes, normally results in some amount of additional bias in the IRPI indicated rod positions which can result in an increase in the difference between the IRPI indicated position and the group demand position. It is typical during significant power changes to see several IRPI channels affected by this phenomenon, some of which may exceed the rod misalignment limitations in Technical Specifications between IRPI indicated position and group demand position.

If operability of the IRPI channels is based on not exceeding a difference between IRPI indicated position and demand position by greater than the rod misalignment limitations in Technical Specifications, then any significant power change can result in multiple IRPI

channels being declared inoperable. Per the requirements of current Prairie Island Technical Specification 3.10.F.2, should more than one IRPI channel per group or more than two IPRI channels per bank be found to be inoperable, the plant must be brought to the Hot Shutdown condition.

This presents problems for any plant evolution requiring a significant power change such as turbine valve testing or condenser cleaning, where power is reduced, but the unit is not taken to the Hot Shutdown condition. Based on past performance of the IRPI channels and this new definition of IRPI operability, the current Prairie Island Technical Specifications do not provide adequate flexibility to perform such required plant maintenance and testing at power. The reduction in power required to perform the testing could result in a plant shutdown.

In addition, because the IRPI drift phenomenon is also experienced during power increases the application of the ± 12 step operability criteria in combination with the requirements of current Technical Specification 3.10.F.2 may prevent the plant from returning to power following shutdowns or outages.

To resolve the problems presented by the revised IRPI operability definition, this License Amendment Request proposes changes to the Prairie Island Technical Specifications which would allow additional flexibility with respect to plant operation with inoperable IRPI channels. This License Amendment Request proposes changes based on changes previously approved for the Callaway and Wolf Creek plants and the guidance in the Improved Standard Technical Specifications (NUREG-1431).

PROPOSED CHANGES AND JUSTIFICATION OF CHANGES

A brief description of the proposed changes are provided below along with a discussion of the justification for each change. The specific wording changes to the Technical Specifications are provided in Exhibits B and C.

TS 3.10.F Inoperable Rod Position Indicator Channel

The heading for section 3.10.F is being revised to "Rod Position Indication System" to better reflect the content of the section following incorporation of the changes proposed by this License Amendment Request.

TS 3.10.F.1 Inoperable Rod Position Indicator Channel

Proposed new Specification 3.10.F.1 incorporates a Limiting Condition for Operation (LCO) statement for the IRPI System along with criteria to be used for determining operability of the IRPI channels.

The proposed LCO states that the IRPI channels shall be operable in MODE 1. This is consistent with the requirements of the current Technical Specifications.

A reference to the action statements (3.10.F.2 and 3.10.F.3) associated with Specification 3.10.F.1 is provided in a format consistent with the current Prairie Island Technical Specifications.

Proposed Specifications 3.10.F.1.a and b provide criteria for determining the operability of the IRPI channels. The criteria provided are based on the vertical position of the control rods in the core. A criteria of ± 12 steps is specified for the center region of the core between 30 and 215 steps. A criteria of ± 24 steps is specified for the outer core regions below 30 steps and above 215 steps. These criteria are based on the rod misalignment limits currently specified in Technical Specification 3.10.E.2. They are being added to Section 3.10.F to provide definitive criteria for use in determining IRPI channel operability.

TS 3.10.F.2 Inoperable Rod Position Indicator Channel

The requirements of current Specification 3.10.F.1 have been incorporated into the proposed new Specification 3.10.F.2 with a number of changes.

Current Specification 3.10.F.1 specifies actions to be taken if a rod position indicator channel is taken out of service. The proposed specification provides better guidance on the applicability of the actions by specifying that the actions are applicable to the inoperability of one rod position indicator channel per group for one or more groups. This applicability is consistent with the guidance in the Improved Standard Technical Specifications.

The requirements of current Specification 3.10.F.1.a have been relocated to proposed Specification 3.10.F.2.a and have been revised to be consistent with the guidance provided in the Improved Standard Technical Specifications. The statement that the action is applicable between 50% and 100% power has been deleted, it is unnecessary. The ability to use excore detectors and thermocouples for determining rod position has been deleted. The requirement to check rod position "directly" by core instrumentation has been changed to "indirectly" since the moveable incore detectors cannot directly check rod position in the core. The frequency for verifying rod position has been changed to "at least once per 8 hours" from "every shift" to provide a more specific frequency and to be consistent with Improved Technical Specifications.

The requirement in current Specification 3.10.F.1.a to verify rod position subsequent to rod motion has been deleted. The remaining actions in proposed Specifications 3.10.F.2.a and b are adequate for the allowed condition of only one inoperable IRPI per group. Based on experience, normal power operation does not require excessive movement of control rod groups. Verification of RCCA position every eight hours is adequate for allowing continued full power operation, since the probability of simultaneously having a rod significantly out of position and an event sensitive to that rod position is small. Prairie Island is used as a base load plant so during normal power operation most control rod movement would involve changes in the position of D bank which only has one group. Hence during normal full power operation under either the old or the new specification only one control rod with an inoperable position indicator would be moved. Verification of the position of this single control rod either subsequent to rod motion exceeding 24 steps or within 4 hours of rod motion exceeding 24 steps would further increase the use of the flux mapping system.

Frequent use of the flux mapping system may lead to more maintenance work required on the system and an "As Low As Reasonably Achievable" worker radiation exposure concern, since it is located in a radiation area. This proposed change is also consistent with the guidance in the Improved Standard Technical Specifications.

The requirements of current Specification 3.10.F.1.b have been relocated to proposed Specification 3.10.F.2.b and have been revised to require that power be reduced to less than 50% within eight hours. This action is provided as an alternative to the actions specified in proposed specification 3.10.F.2.a. The actions of either proposed Specification 3.10.F.2.a or b may be performed. The eight hour limitation is intended to limit operation above 50% if rod position isn't verified every eight hours per Specification 3.10.F.2.a. This proposed change is consistent with the guidance in the Improved Standard Technical Specifications.

TS 3.10.F.3 Inoperable Rod Position Indicator Channel
TS 3.10.F.4 Inoperable Rod Position Indicator Channel

The requirements of current specification 3.10.F.2 have been deleted. They have been replaced with the new actions specified in proposed Specifications 3.10.F.3 and 4. These proposed specifications provide additional flexibility in the actions to be taken in the event that more than one rod position indicator per group is inoperable for one or more groups. The changes in proposed Specifications 3.10.F.3 and 4 have been adapted from and are consistent with changes previously approved by the NRC for the Callaway (Amendment 61) and Wolf Creek (Amendment 46) plants.

Proposed Specification 3.10.F.3 imposes five new actions to be taken when more than one rod position indicator channel per group is inoperable for one or more groups:

1. Proposed Specification 3.10.F.3.a requires that rod position be verified indirectly at least once per 8 hours using the moveable incore detectors. This will ensure that any rod misalignments are identified while IRPI channels are inoperable. The eight hour frequency for completion of the rod position verification is adequate because:

    a. Any misalignment occurring as the result of significant rod motion will be identified by action 3.10.F.3.b.
    b. Action 3.10.F.3.c will help ensure that no inadvertent rod motion occurs
    c. Action 3.10.F.3.d will help ensure that any rod misalignment that may occur during steady-state conditions will be identified.

2. Proposed Specification 3.10.F.3.b requires that rod position be verified indirectly using the moveable incore detectors within 4 hours after rods with inoperable position indicators have been moved in excess of 24 steps in one direction since the last determination of their position. This will ensure that any rod misalignments are identified following significant rod motion while IRPI channels are inoperable. The 4 hour allowance for completion of this action allows adequate time for personnel to be called in and for them to complete the rod position verification using the moveable incore detectors.

3. Proposed Specification 3.10.F.3.c requires that the position of the control rods be monitored hourly. This will help ensure that no inadvertent rod motion occurs that could lead to a rod misalignment.

4. Proposed Specification 3.10.F.3.d requires that reactor coolant system average temperature be monitored and recorded once per hour. This will help identify any unplanned rod motion and potential misalignment during steady-state operating conditions.

5. Proposed Specification 3.10.F.3.e requires that inoperable position indicators be restored to OPERABLE status within 24 hours such that a maximum of one rod position indicator per group is inoperable. This limits the amount of time that the plant is allowed to operate with more than one IRPI channel inoperable per group. The 24 hour allowed out of service time provides sufficient time to troubleshoot and restore the IRPI system to operation following a component failure in the system, while avoiding the challenges associated with a plant shutdown.

While these proposed actions provide additional flexibility over requirements of the current Technical Specifications, they maintain adequate controls to limit rod misalignment, to ensure that any rod misalignment would be identified and to limit the amount of time the plant is allowed to operate with more than one rod position indicator per group inoperable.

Proposed Specification 3.10.F.4 requires that the plant be taken to the Hot Shutdown condition within six hours if the requirements of Specification 3.10.F.3 are not met. This is an appropriate action to be taken if more than one IRPI channel per group is inoperable and the requirements specified in Specification 3.10.F.3 are not fully implemented.

TS 3.10.F.5 Inoperable Rod Position Indicator Channel

The requirements of current Specification 3.10.F.3 have been relocated to proposed Specification 3.10.F.5 with wording changes intended to clarify what actions are to be taken if a misaligned rod is identified during the verification of control rod position required by Specifications 3.10.F.2.a, 3.10.F.3.a or 3.10.F.3.b. This specification ensures that appropriate actions are taken per the requirements of the Rod Misalignment specification, 3.10.E should a misaligned rod be discovered using the moveable incore detectors.

TS 3.10.E Rod Misalignment Limitations

With the implementation of the changes proposed for Section 3.10.F, the actions specified in current Specifications 3.10.E.2.a and b are unnecessary. The criteria for the differential between indicated rod position and the group demand have been relocated to Specification 3.10.F.1. The current wording of Specifications 3.10.E.2.a and b requires that a rod be declared to be misaligned just because the IRPI indication exceeds the limits for the differential between group demand position and IRPI indication. It does not provide for the verification of actual rod position prior to declaring a rod misaligned nor does it provide any

guidance if rods are verified to be in proper alignment. The proposed changes to 3.10.F incorporate the specific limits for IPRI operability, require the verification of rod position if the IRPI are outside those limits, and specify that if a rod with an inoperable IRPI is found to be misaligned the requirements of 3.10.E are to be implemented.

Current Specification 3.10.E.3 is re-numbered to 3.10.E.2 because of the deletion of current Specification 3.10.E.2.

Basis 3.10.E Rod Misalignment Limitations
Basis 3.10.F Rod Position Indication Channels

The bases for Specifications 3.10.F and 3.10.E are revised in accordance with the changes made in the specification as stated above. The changes to the bases are shown in Exhibit B.

SAFETY EVALUATION

The proposed changes clarify the conditions that constitute operable Individual Rod Position Indication (IRPI) system channels, provide for an allowed out of service time for inoperable IRPI indicator channels and provide compensatory measures to be taken when any channel is determined to be inoperable. Continued plant operation with IRPI channel(s) inoperable will not directly result in challenges to the plant safety limits, but may have the potential to contribute to an operator error. Examples of relevant operator errors would be the mispositioning of a control rod group or the failure to detect a control rod that is misaligned from it's group. Without the simultaneous failure of other plant equipment, these two potential operator errors will not result in conditions which contribute to an increased challenge to plant safety limits

For most of the Prairie Island analyzed transients there is no aggravating control rod motion and the events are assumed to begin from an initial steady state power level with core peaking factors at their Technical Specification limits and control rods at their Technical Specification insertion limits. These proposed changes to the Technical Specifications will not impact the ability of the plant staff to maintain operation within the Technical Specification core thermal limits.

There are 5 plant transients and 1 plant condition related to control rod position or control rod motion:

1) Shutdown Margin:
This calculation is performed at various exposures and consists of determining the highest worth stuck rod and shutdown reactivity. Consideration is given to the range of initial power, xenon distributions and control rod initial positions consistent with the power dependent rod insertion limits. The shutdown margin is conservatively adjusted using model reliability factors and biases applied to the inserted rod worth, the

moderator temperature defect and the Doppler defect. Neither rod mispositioning nor rod misalignment would affect the method of analysis or outcome of this event.

2) RCCA Withdrawal at Power:[1]
This analysis assumes the control rods are at the Tech Spec Insertion Limit and uses an iterative process to determine a limiting reactivity insertion rate for the event. A conservative rod pattern is used to generate the peaking factors (F_Q and $F_{\Delta H}$ nuclear values). Then reliability factor, bias and tilt factors were added to the limiting peaking factors. A hot channel model initialized with these limiting peaking factors is driven with the limiting reactivity insertion rate. This provides very conservative results since the physical core conditions that produce the limiting reactivity insertion rate are not the same conditions that produce the limiting core thermal peaking factors. Neither rod mispositioning nor rod misalignment would affect the method of analysis or outcome of this event.

3) RCCA Withdrawal from Subcritical:
This analysis determines a conservative reactivity insertion rate equal to the maximum worth of two rod banks moving simultaneously at maximum speed through the region of highest differential worth which is then compared to the worth used in a previously performed bounding analysis. Neither rod mispositioning nor rod misalignment would change the method of analysis or the outcome of this event.

4) RCCA Misalignment:
This analysis assumes that the D-bank is at the full power insertion limit, with one rod fully withdrawn. The DNBR remains above the safety limit. Neither rod mispositioning nor rod misalignment would change the method of analysis or the outcome of this event.

5) Dropped Rod:
In this analysis the control rod system is assumed to be in automatic, a single RCCA is assumed to fall into a fully inserted position in the core, and the neutron flux negative rate trip is inoperable. The RCCA with a conservative rod worth is selected such that were the neutron flux negative rate to be operable this RCCA has more than sufficient worth to trigger the negative rate trip setpoint. The DNBR remains above the safety limit. Neither rod mispositioning nor rod misalignment would change the analyzed outcome of this event.

6) Ejected Rod:
In this analysis, the maximum ejected rod worth is determined with all control banks at their maximum permissible insertion for the power level of interest. Peaking factors used in this analysis are determined conservatively and appropriate reliability factors and biases are applied. Neither rod mispositioning nor rod misalignment would change the analyzed outcome of this event.

These analyses do not assume any dependence on the operator to monitor and properly position control rods, other than the requirement that control rods are maintained within the

[1] Applicable from 10% power up to 100% power.

Technical Specification Insertion Limits. Assurance that the control rods do not exceed their insertion limits is provided by the Rod Insertion Limit Monitor in ERCS which receives input directly from a pulse-to-analog converter fed from Rod Control system. Proper function of the Rod Insertion Limit Monitor is not dependent upon the operability of IRPI, except for the condition where power is lost to the IRPI cabinet. This situation is addressed in TS 3.10.I.

Essentially any impact on the plant safety analysis design basis would involve a reactivity transient induced by operator error associated with the loss of rod position indication. As described above the relevant safety analyses are not dependent on operator action. The assumed reactivity insertion rates are based on conservative, worst case scenarios that are independent of the specific characteristics associated with actual equipment malfunctions or human errors. Furthermore, the reactor protection system detection features and the engineered safety feature mitigation features are unaffected by these proposed changes.

The addition of a 24 hour allowed out of service time provides sufficient time to troubleshoot and restore inoperable IRPI channels, while avoiding the challenges associated with a plant shutdown. Overall plant safety would be enhanced by having a reasonable opportunity to maintain steady state operation rather than being immediately forced, without control rod position indication, to perform the large number of control rod movements required during plant shutdown.

Continued plant operation with IRPI inoperable due to either a temperature induced increase in the output signal nonlinear bias or some other mechanism will not increase the probability that operators will either misposition the control rods or fail to observe a control rod misalignment. There is no reason to expect that a control rod with out-of-spec IRPI indicator channel but with no other indication of misalignment is indeed misaligned. To date Prairie Island has not had a verified rod misalignment due to any reason. Random rod misalignment failures together with an associated IRPI failure is a very low probability event.

In the unlikely event that an actual control rod misalignment did occur while IRPI was inoperable and went undetected, a further chain of low probability events would have to take place to lead to a significant fission product release to the environment. True rod misalignment is potentially a contributor to localized fuel failure, not gross fuel failure. Process radiation monitors are available that are constantly monitoring for any fuel failure, so that it is highly unlikely that a localized fuel failure due to rod misalignment could escape detection and result in any, even insignificant, fission product release to the environment. Other, non-IRPI based initiating events and failures leading to a loss of core cooling would be required to result in gross fuel failure and subsequent release of fission products.

DETERMINATION OF SIGNIFICANT HAZARDS CONSIDERATIONS

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

   The proposed changes do not affect any system that is a contributor to initiating events for previously evaluated design basis accidents. Neither do the changes significantly affect any system that is used to mitigate any previously evaluated design basis accidents. Therefore, the proposed changes do not involve a significant increase in the probability or consequence of an accident previously evaluated.

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

   The proposed changes do not alter the design, function, or operation of any plant component and do not install any new or different equipment, therefore the possibility of a new or different kind of accident from those previously analyzed has not been created.

   While continued operation of the plant for 24 hours with a number of IRPI channels inoperable does slightly increase the possibility that a misaligned control rod or mispositioned control group might go undetected by the operators for some time period, this possibility is not new and has been addressed in previously performed safety analyses, where bounding conservative assumptions on rod position were used.

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

   The proposed changes do not alter the initial conditions assumed in deterministic analyses associated with either the RCS boundary or fuel cladding, therefore these changes do not involve a significant reduction in the margins of safety.

Considering the above evaluation and pursuant to 10CFR50.91, Northern States Power Company has determined that operation of the Prairie Island Nuclear Generating Plant in accordance with the proposed license amendment request does not involve a significant hazards consideration as defined by Nuclear Regulatory Commission regulations in 10CFR50.92.

ENVIRONMENTAL ASSESSMENT

Northern States Power Company has evaluated the proposed change and determined that:

1. The changes do not involve a significant hazards consideration,
2. The changes do not involve a significant change in the types or significant increase in the amounts of any effluents that may be released offsite, and
3. The cnanges do not involve a significant increase in individual or cumulative occupational radiation exposure.

Accordingly, the proposed change meets the eligibility criterion for categorical exclusion set forth in 10CFR51.22(c)(9). Therefore, pursuant to 10CFR51.22(b), an environmental assessment of the proposed changes is not required.