January 3, 1996

Mr. Roger O. Anderson, Director
Licensing and Management Issues
Northern States Power Company
414 Nicollet Mall
Minneapolis, Minnesota 55401

SUBJECT: REQUEST FOR ADDITIONAL INFORMATION ON THE PRAIRIE ISLAND NUCLEAR GENERATING PLANT, UNITS 1 & 2, TECHNICAL SPECIFICATION AMENDMENT TO INCLUDE L* STEAM GENERATOR TUBE ACCEPTANCE CRITERIA (TAC NOS. M91122 AND M91123)

Dear Mr. Anderson:

By letter dated January 9, 1995, Northern States Power Company (NSP) submitted a request to amend the Technical Specifications (TS) for the Prairie Island Nuclear Generating Plant, Units 1 and 2 to include alternative repair criteria, F* and L*, for steam generator tubes. On May 15, 1995, the staff issued amendments to the TS which allowed use of the F* criterion only. The staff planned to review the L* portion and issue a separate safety evaluation and amendments dealing with L* at a later date. Additional information is required in order for the staff to complete its review. Our request for additional information (RAI) is enclosed.

The staff requests that you submit your responses to the enclosed RAI within 60 days to meet the staff's review schedule. If you have any questions regarding the content of the RAI, please contact me at (301) 415-1355.

This requirement affects nine or fewer respondents and, therefore, is not subject to the Office of Management and Budget review under P.L. 96-511.

Sincerely,

Original Signed By:

Beth A. Wetzel, Project Manager
Project Directorate III-1
Division of Reactor Projects - III/IV
Office of Nuclear Reactor Regulation

Docket Nos. 50-282, 50-306

Enclosure: Request for Additional Information

cc w/encl: See next page

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REQUEST FOR ADDITIONAL INFORMATION
PRAIRIE ISLAND NUCLEAR GENERATING PLANT, UNITS 1 & 2,
L* STEAM GENERATOR REPAIR CRITERIA

1. Details were not provided in WCAP-14225 regarding the tube loads assumed during the pullout tests. Provide specific details on all the loads considered in the testing to demonstrate that L* tubes have sufficient structural capability. Specifically address the calculation to quantify the reduction in strength of the tube-to-tubesheet joint due to tubesheet bowing effects and how these effects were accounted for by a modification of rolling torque in the testing.

2. In Appendix A of the Westinghouse report, the section entitled "Test Major Steps" indicates that tubes were rolled into the test collar to a specified midrange torque. What is the range of torque considered in determining the midrange value? What is the basis for using a midrange value for the testing rather than a bounding torque?

3. Figure 3-7 in WCAP-14225 shows the ¾-inch tube pull test data as well as the derived design curve. Are the smooth continuous curves in this figure generated from the failure model or are they from a fit of these data? Were the test data points obtained from collared, decollared, or "never-collared" tube specimens?

4. The design curve model used a fully-plastic fracture mechanics approach to predict failure of L* tubes. In order to have the J-integral characterize the behavior at a crack tip, the conditions associated with J-controlled crack growth must also exist. Explain how J-controlled growth exists for the steam generator tube flaws in the hardrolled region. Include a discussion on the residual stresses in the hardroll, the loading direction with respect to the crack orientation, and the size scales involved with steam generator tube flaws.

5. WCAP-14225 describes the general approach used to develop the failure model; however, the staff requests that the licensee submit full details on the steps involved with the derivation of this model.

6. There is a higher potential for tube-to-tubesheet crevice leakage with L* tubes than for other repair criteria. The bypass leakage between the tube and tubesheet could potentially affect the strength of the joint. Define the basis for separating the leakage and strength testing in the analysis.

7. The NRC staff is concerned that the crevice conditions were not adequately simulated in qualification testing to determine the leakage from rerolled tubes. The Westinghouse report, as well as other studies, have concluded that the tube bypass leakage is directly related to the condition of the contact surfaces between the tube and tubesheet bore (i.e., roughness, deposits, etc.). Magnetite forms on the outer surfaces of inservice steam generator tubes when ferrous hydroxide ($Fe(OH)_2$) reacts at the hot tube surfaces. The strong adherence of the magnetite formed inservice would prevent these deposits from being forced out of the crevice during the rerolling process. In addition to magnetite, other deposits may form on the tube surface as well as the

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tubesheet bore surface. A conclusion of the qualification testing was that poor surface conditions generally lead to high leakage around the tube-to-tubesheet joint. Explain how the surface generated magnetite and tube and tubesheet deposits on inservice tubes were simulated or accounted for in the qualification testing.

8. Identified defects below the L* region may grow during operation up into the previously undegraded hardroll. This would result in a higher potential for leakage as well as an overall decrease in the strength of the tube-to-tubesheet joint. Section C.3.f of NRC Regulatory Guide 1.121 states that there should be a basis for the growth of indications left in service. What is the basis for neglecting the growth of indications below the L* distance?

9. The eddy current inspection uncertainty in measuring distances relevant to L* was not quantified in the submittals related to this amendment application. Provide the eddy current uncertainty for L* measurements and a technical basis for this value. In addition, the definition of the L* distance in the Prairie Island Technical Specifications should include the eddy current uncertainty.

10. Describe the inspection method to be used to inspect the hardroll of L* tubes (i.e., probes, frequencies, etc.). Explain how this method was qualified for L* inspections. Was a performance demonstration completed? If so, how were these tests conducted and what were the results of the demonstration?

11. Due to the limitations with eddy current inspection technology, there is the possibility that part through-wall flaws in the degraded roll expansion (DRE) below the threshold of detection may extend into the L* region. How does the [illegible] account for the reduction in strength from undetected extensions of cracks in the DRE up into the L* distance?

12. Inspections of L* tubes will rely on an accurate distinction between circumferential and axial indications in the hardroll. What steps are included in the L* inspection procedure to ensure that the number of flaws and their associated angles are accurately measured on L* tubes? How will the inspection method allow for an accurate distinction between bands of short axial cracks around the tube circumference and circumferential flaws with depths approximately at the threshold of detection of the inspection coil(s)?