

#### NORTHERN STATES POWER COMPANY

INNEAPOLIS. MINNESOTA 55401

September 12, 1980

Director of Nuclear Reactor Regulation 75 Nuclear Regulatory Commission Washington, DC 20555

> PRAIRIE ISLAND NUCLEAR GENERATING PLANT Docket No. 50-282 License No. DPR-42 50-306 DPR-60

## Fuel Surveillance

The NRC issued Amendment Nos. 35 and 29 to facility operating license Nos. DPR-42 and DPR-60 on April 20, 1979 which incorporated changes to the Appendix A Technical Specifications to support operation in Cycle 5 with reload fuel by Exxon Nuclear Company. The Safety Evaluation accompanying that Amendment stated the following on page 5:

"However, because of the relatively limited experience with gadolinium containing fuel rods and because this fuel is used for the first time in Prairie Island, we note that ENC (will) perform a visual inspection of a sufficient number of irradiated fuel bundles to verify that the performance of the ENC fuel and especially the fuel containing gadolinium oxide is acceptable. The amount of surveillance should depend on the coolant activity during plant operation and will be decided by the licensee with our approval 90 days before the scheduled plant shutdown for the next cycle refueling."

In response to the NRC Safety Evaluation, NSP submitted information to the NRC Staff on April 30, 1980 on reactor coolant activity and the proposed fuel surveillance program for the refueling outage scheduled to begin early in August, 1980. On August 5, 1980, NSP received three inquiries from the NRC staff on the proposed fuel surveillance program. Responses to the NRC questions were discussed with the Prairie Island NRC Porject Manager on August 6, 1980 during a visit to the Prairie Island Plant. Further information on the NRC questions was provided during a telephone conference with a representative from the NRC Core Performance Branch on September 4, 1980. At that time NSP was requested to provide a written response to the NRC questions. Listed below are the NRC questions and NSP responses:

#### Question No. 1

In a previous experience with burnable poisons, hydriding failures occurred in some rods that were not processed through the usual dryout and moisture-checking procedures used for standard production-line

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fuel rods. Please verify, therefore, that the fabrication methods used for the gadolinia-bearing rods were typical of production-type fuel rods, particularly with respect to moisture control and testing. In particular, confirm that the moisture specification is consistent with the following statement in the Standard Review Plan, Rev 1:

Hydriding: Hydriding as a cause of failure (i.e., primary hydriding) is prevented by keeping the level of moisture and other hydrogenous impurities very low during fabrication. Acceptable moisture levels for Zircaloy-clad uranium oxide fuel should be no greater than 20 ppm. Current ASTM specifications (Ref. 5) for UO<sub>2</sub> fuel pellets state an equivalent limit of 2 ppm of hydrogen from all sources. For other materials clad in Zircaloy tubing, an equivalent quantity of moisture or hydrogen can be tolerated. A moisture level of 2 mg H<sub>2</sub>O per cm<sup>2</sup> of hot void volume within the Zircaloy cladding has been shown (Ref. 6) to be insufficient for primary hydride formation.

## Response

The fabrication methods used for the gadolinia-bearing rods were typical of production-type fuel, particularly with respect to moisture control and testing. In addition, NSP Quality Assurance personnel made a number of visits to the Exxon facility during fabrication of the Prairie Island fuel. The Exxon acceptance level for total hydrogen content, including moisture, is  $\leq 1.5$  ppm by weight per pellet before closure welding.

#### Question No. 2

Because these rods are a new product, we believe that some of the gadolinia rods should receive inspection after each cycle of operation, at least until there is sufficient operating experience to assure that further inspections are not warranted. However, the limited fuel surveillance program that is proposed in the April 30, 1980 letter from L O Mayer involves only a video-scan of three of the gadolinia-bearing assemblies. Because the gadolinia-bearing rods are not on the outer rows of the fuel bundles, we doubt that the video-scan will reveal anything about the condition of those rods. Therefore, please propose some other way to examine the poison rods; e.g., can you use a periscope or a boroscope?

#### Response

Based upon reactor coolant system activity as reported in the NSP April 30, 1980 letter and experience up to the Unit No. 1 shutdown, there was no significant increase in reactor coolant activity levels

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during cycle 5. On this basis, we concluded that the Exxon fuel has performed satisfactorily and there is no basis for a fuel inspection program beyond the videotape scan of four sides of the three highest burnup Exxon fuel assemblies containing gadolinia. The video scanning equipment has adequate resolution to observe significant abnormalities in fuel rods of any type. If the fuel assembly is described as being made up of rows and columns, the four gadolinia bearing rods in each assembly are located in the second row and are the fourth rod in the column. Particular attention will be paid to lighting for the video-scan and about 1/4 of the diameter of the rod should be visible. With appropriate lighting, we would expect to see any evidence of ridging, bowing, excessive corrosion or nodular corrosion. Use of a periscope or a boroscope would not provide any more information.

In order to expand the area of inspection of the gadolinia bearing rods, it would be necessary to disassemble the fuel assembly and remove the gadolinia-bearing rod. Once removed, the video-scan would be the preferred choice of examination. Disassembly of a fuel rod requires significant advance planning, preparation and procedures; procurement of the necessary jigs and disassembly tools; and presents the possibility of fuel assembly damage. Since Prairie Island Unit No. 1 was taken off line on August 31, 1980 for the Cycle 5-6 refueling, and with the fuel shuffle expected to be completed on September 16 and the reactor vessel head replaced shortly thereafter, any attempt to schedule disassembly of a fuel bundle would have a high probability of impacting on the outage critical path. Based on reactor coolant activities, it does not appear warranted to perform fuel bundle disassembly.

# Question No. 3

It is not clear from the April 30, 1980 letter whether the proposed video-scan (or other examinations) would be performed at each refueling or whether a different surveillance scheme would be proposed before each cycle. Please clarify this matter.

#### Response

If there are no significant increases in reactor coolant activity during Cycle 6, it is our intent to schedule a limited fuel surveillance program similar to that proposed in the April 30, 1980 NSP letter for end of Cycle 5. Should there be indications during Cycle 6 of increases in reactor coolant activity attributable to possible fuel degradation, the normal methods of identification and isolation of degraded fuel assemblies will be pursued. Further inspection requirements and disposition of degraded fuel will have to be determined on a case-by-case basis.

ayes L O Mayer, PE

Manager of Nuclear Support Services

cc: G Charnoff J G Keppler NRC kesident Inspector