January 23, 2001

Mr. Joel Sorensen
Site General Manager
Prairie Island Nuclear Generating Plant
Nuclear Management Company, LLC
1717 Wakonade Drive East
Welch, MN 55089

SUBJECT: PRAIRIE ISLAND NUCLEAR GENERATING PLANT, UNIT 1 - PROPOSED IRRADIATION OF LEAD TEST FUEL ASSEMBLY BEYOND CURRENT FUEL ROD BURNUP LIMIT (TAC NO. MB0835)

Dear Mr. Sorensen:

By a letter dated December 21, 2000, as supplemented by a letter dated January 15, 2001, Nuclear Management Company, LLC informed the Nuclear Regulatory Commission (NRC) of its plans to irradiate a Westinghouse VANTAGE+ fuel assembly in the reactor core of the Prairie Island Nuclear Generating Plant, Unit 1, during the upcoming operating cycle (February 2001 to August 2002), as part of the industry's lead test assembly program. Irradiation of this test assembly will provide data on fuel and materials performance that will support industry goals of extending the current fuel burnup limits and will provide data to address NRC questions related to fuel performance behavior at high burnups. The data will also help confirm the applicability of nuclear design and fuel performance models at high burnups.

This test assembly has already been irradiated for two operating cycles in Prairie Island Nuclear Generating Plant, Unit 2, and currently has accumulated rod average burnups ranging from approximately 37,000 to 56,000 megaWatt-days per metric ton of Uranium (MWD/MTU). It is expected that this test assembly will attain end of life rod average burnups ranging from about 52,000 to 75,000 MWD/MTU.

The proposed irradiation of this test assembly does not require any changes to the plant operating license, including the technical specifications. However, since some of the fuel rods in this test assembly are expected to exceed the current rod burnup limit of 62,000 MWD/MTU, NRC approval was requested prior to initiating Cycle 21 operation in Unit 1. Based on our review of the information provided, the NRC has no objection to the proposed irradiation of this test assembly for another operating cycle. The detail of the NRC staff's review is enclosed.

Sincerely,

/RA/

Tae Kim, Senior Project Manager, Section 1
Project Directorate III
Division of Licensing Project Management
Office of Nuclear Reactor Regulation

Docket No. 50-282

Enclosure: As Stated

cc w/encl: See next page

The proposed irradiation of this test assembly does not require any changes to the plant operating license, including the technical specifications. However, since some of the fuel rods in this test assembly are expected to exceed the current rod burnup limit of 62,000 MWD/MTU, NRC approval was requested prior to initiating Cycle 21 operation in Unit 1. Based on our review of the information provided, the NRC has no objection to the proposed irradiation of this test assembly for another operating cycle. The detail of the NRC staff's review is enclosed.

Sincerely,

/RA/

Tae Kim, Senior Project Manager, Section 1
Project Directorate III
Division of Licensing Project Management
Office of Nuclear Reactor Regulation

Docket No. 50-282

Enclosure: As Stated

cc w/encl: See next page

DISTRIBUTION

PUBLIC	MChatterton	TKim	RCaruso
PDIII-1 Reading	OGC	RBouling	JWermiel
RLanksbury, RIII	CCraig	ACRS	

OFFICE	PDIII-1/PM	PDIII-1/LA	SRXB/SC	PDIII-1/SC
NAME	TKim	THarris for RBouling	RLandry for RCaruso	CCraig
DATE	1/ 22/01	1/ 22 /01	1/19/01	1/ 22/01

Accession No. ML010230223

OFFICIAL RECORD COPY

Prairie Island Nuclear Generating Plant,
Units 1 and 2

cc:

J. E. Silberg, Esquire
Shaw, Pittman, Potts and Trowbridge
2300 N Street, N. W.
Washington, DC 20037

Plant Manager
Prairie Island Nuclear Generating Plant
Nuclear Mana
gement Company, LLC
1717 Wakonade Drive East
Welch, MN 55089

Adonis A. Neblett
Assistant Attorney General
Office of the Attorney General
455 Minnesota Street
Suite 900
St. Paul, MN 55101-2127

U.S. Nuclear Regulatory Commission
Resident Inspector's Office
1719 Wakonade Drive East
Welch, MN 55089-9642

Regional Administrator, Region III
U.S. Nuclear Regulatory Commission
801 Warrenville Road
Lisle, IL 60532-4351

Mr. Stephen Bloom, Administrator
Goodhue County Courthouse
Box 408
Red Wing, MN 55066-0408

Commissioner
Minnesota Department of Commerce
121 Seventh Place East
Suite 200
St. Paul, MN 55101-2145

Site Licensing
Prairie Island Nuclear Generating Plant
Nuclear Management Company, LLC
1717 Wakonade Drive East
Welch, MN 55089

Tribal Council
Prairie Island Indian Community
ATTN: Environmental Department
5636 Sturgeon Lake Road
Welch, MN 55089

Site General Manager
Prairie Island Nuclear Generating Plant
Nuclear Management Company, LLC
1717 Wakonade Drive East
Welch, MN 55089

PRAIRIE ISLAND NUCLEAR GENERATING PLANT, UNIT 1

PROPOSED IRRADIATION OF LEAD TEST FUEL ASSEMBLY BEYOND

CURRENT LEAD FUEL ROD BURNUP LIMIT

1.0 INTRODUCTION

By a letter dated December 21, 2000, Nuclear Management Company, LLC informed the Nuclear Regulatory Commission (NRC) of its plans to irradiate a Westinghouse VANTAGE+ fuel assembly in the reactor core of the Prairie Island Nuclear Generating Plant, Unit 1, during the upcoming operating cycle (February 2001 to August 2002), as part of the industry's lead test assembly program. Irradiation of this test assembly, designated T81, will provide data on fuel and materials performance that will support industry goals of extending the current fuel burnup limits and will provide data to address NRC questions related to fuel performance behavior at high burnups. The data will also help confirm the applicability of nuclear design and fuel performance models at high burnups.

The lead test assembly T81 is a twice-burned VANTAGE+ assembly. The assembly has ZIRLO fuel rod cladding, guide thimbles and Zircalloy-4 mid grids. This assembly, like most of the VANTAGE+ assemblies used in Prairie Island includes 4.95 w/o U235 enrichments, gadolinia burnable absorbers, enriched annular axial blankets, a removable top nozzle, and a debris resistant bottom nozzle. VANTAGE+ fuel at Prairie Island does not include intermediate flow mixing mid-grids. The assembly contains twelve gadolinia rods enriched to 2.97 w/o U235 and containing 6 w/o gadolinia.

This test assembly has already been irradiated for two operating cycles in Prairie island Nuclear Generating Plant, Unit 2, and currently has accumulated rod average burnups ranging from approximately 37,000 to 56,000 megaWatt-days per metric ton of Uranium (MWD/MTU). It is expected that this test assembly will attain end of life rod average burnups ranging from about 52,000 to 75,000 MWD/MTU. The assembly will be irradiated for one additional cycle in Prairie Island Unit 1.

The proposed irradiation of this test assembly does not require any changes to the plant operating license, including the technical specifications. However, since some of the fuel rods in this test assembly are expected to exceed the current rod burnup limit of 62,000 MWD/MTU, NRC approval was requested prior to initiating Cycle 21 operation in Unit 1.

Since the original submittal dated December 21, 2000, was prepared before the reload design process was completed, it indicated that the fuel assembly would be fully evaluated and that it was expected that all design criteria would be met. During the conference call on January 3, 2001, NMC confirmed that the reload design process was complete and that all design criteria were met. The licensee also stated this in the January 15, 2001, submittal.

2.0 EVALUATION

The NRC has recently been working with the industry to develop guidelines for lead test assemblies (LTAs) including fuel assemblies such as the one under review. The intention is to develop a set of guidelines which provides a structured process for LTAs while maintaining safety. These guidelines will be consistent with the NRC performance goals which are: maintain safety, maintain public confidence, improve efficiency and effectiveness of regulation and reduce unnecessary burden. Many different aspects will be addressed in the LTA guidelines, including: (1) characterization of the fuel assembly, both pre- and post- irradiation; (2) description of the of the poolside examinations to be performed; (3) the number of LTAs allowed in any given core; (4) the location or placement of LTAs within the core; (5) the content of the safety analysis; and (6) reporting requirements. The evaluation of the request to irradiate Fuel Assembly T81 for an additional operating cycle has been done with these developing guidelines in mind.

Pre- and Post- Irradiation Characterization of the Fuel Assembly

The characterization of Fuel Assembly T81 was performed by the licensee as part of a fuel inspection in July 1997. The inspection consisted of a visual inspection, control rod drag testing, assembly growth and oxide thickness measurements. All measurement results were typical for a ZIRLO assembly with the given burnup.

Six peripheral rods with exposures of approximately 52 GWD/MTU were examined. The appearance of the fuel was normal for twice-burned fuel. Eddy current measurements of the oxide thickness for these rods showed less than 30 microns.

Control rod drag testing was performed on Fuel Assembly T81. The results were typical of ZIRLO assemblies and predictions for Fuel Assembly T81 indicate that it should not be susceptible to incomplete control rod insertion (IRI) at the end of operating Cycle 21. The assembly growth was only 0.06 percent which is in the typical range of ZIRLO assembly growth data.

These results confirmed that the assembly performance was as predicted and that irradiation for an additional cycle should not result in any unusual behavior.

Post irradiation testing of LTAs is essential to the value of the program. The licensee has proposed to do an inspection program similar to the pre-irradiation one. This program will include assembly length measurements, visual inspections for crud and the rod/nozzle gaps, and measurements of the oxide thickness on the peripheral rods and guide tubes. The NRC staff considers these tests to be appropriate and expects NMC to advise the NRC of the details of the post irradiation program when they become available and send the results of the tests to the NRC after completion of the program.

Design Evaluation

The fuel vendor performed the mechanical design assessment of Fuel Assembly T81. The history of the assembly and planned operating conditions for operating Cycle 21 were considered. Since Fuel Assembly T81 is susceptible to top nozzle spring screw failure, the

licensee stated that the top nozzle is being replaced with an improved design top nozzle prior to use in Cycle 21. Using NRC-approved models and methods, fuel rod design criteria for all rods in Fuel Assembly T81 were shown to be met. Calculations were performed as part of the normal reload design analysis to demonstrate that all fuel rod design criteria that are normally evaluated for reload fuel have been satisfied for the projected lead rod burnup levels. For the high burnup fuel rods in Fuel Assembly T81, the most limiting criterion is rod internal pressure, and this design criterion was satisfied. Using a conservative corrosion model for ZIRLO, the 10 CFR Part 50.46 total local oxidation limit of 17 percent was satisfied.

The measurements of Fuel Assembly T81 after two cycles of burnup to 52 GWD/MTU showed no unusual results, thus, no unusual conditions exist that would affect the ability of the assembly to meet all mechanical design requirements, including areas such as: compatibility with all in-core fuel handling, and storage interfaces; grid impact strength; grid cell force and fretting wear resistance requirements; and fuel assembly growth allowances.

Fuel assembly and core component pressure drops are not affected by the fuel burnup of Fuel Assembly T81. The thermal hydraulic performance evaluation of Fuel Assembly T81 was performed in accordance with the normal reload design methodology using NRC-approved codes and methods. The fuel assembly met the same design criteria as other fuel assemblies in the core.

The nuclear design evaluation performed for Prairie Island Unit 1's Cycle 21 demonstrated that all applicable design criteria were met. Fuel Assembly T81 will be located in the center of the core, and will operate at an assembly average power near 75 percent of the core average power throughout the cycle. The high burnup fuel rods will not be in the highest fuel rod power density locations.

The safety analysis for Prairie Island Cycle 21 showed that all design criteria have been met. The analyses of the Condition III and IV transients show that the predicted temperatures remain below the fuel melting temperature. It was confirmed that for the locked rotor and the rod ejection accident, where fuel is allowed to fail, that the less than 20 percent fuel failure criteria was met even assuming that all the pins in Fuel Assembly T81 fail. The high burnup rods will not be limiting with respect to any safety analysis limit.

3.0 CONCLUSION

Based on the above evaluation, the staff agrees that it is acceptable for Prairie Island Nuclear Generating Plant, Unit 1, Cycle 21 to include irradiation of Fuel Assembly T81, that will attain end of life rod average burnups ranging from about 52,000 to 75,000 MWD/MTU. The data obtained from irradiation of Fuel Assembly T81 will be useful to the industry and NRC as well. Irradiation of this assembly is in agreement with the developing lead test assembly guidelines.

Principal Contributor: M. Chatterton

Date: January 23, 2001