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Northern States Power Company
Prairie Island Nuclear Generating Plant
1717 Wakonade Dr. East
Welch, Minnesota 55089

October 23, 1996

Generic Letter 96-04

U S Nuclear Regulatory Commission
Attn: Document Control Desk
Washington, DC 20555

PRAIRIE ISLAND NUCLEAR GENERATING PLANT
Docket Nos.50-282 License Nos. DPR-42
50-306 DPR-60

Response to Generic Letter 96-04,
Boraflex Degradation in Spent Fuel Pool Storage Racks

This letter is in response to Generic Letter 96-04: Boraflex Degradation in Spent Fuel Pool Storage Racks. The Generic Letter requests a written response to the information requested within 120 days from the date of the Generic Letter. Our response to the information requested by Generic Letter 96-04 is attached to this letter.

In this letter we have made new Nuclear Regulatory Commission commitments, indicated as the statements in italics.

Please contact Gene Eckholt (612-388-1121) if you have any questions related to our response to Generic Letter 96-04.

Michael D Wadley

Michael D Wadley
Plant Manager
Prairie Island Nuclear Generating Plant

c: Regional Administrator - Region III, NRC
Senior Resident Inspector, NRC
NRR Project Manager, NRC
J E Silberg

A068

Attachments: 1. Affidavit
2. Response to Generic Letter 96-04

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UNITED STATES NUCLEAR REGULATORY COMMISSION

NORTHERN STATES POWER COMPANY

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

GENERIC LETTER 96-04, Boraflex Degradation in Spent Fuel Pool Storage Racks

Northern States Power Company, a Minnesota corporation, with this letter is submitting information requested by NRC Generic Letter 96-04.

This letter contains no restricted or other defense information.

NORTHERN STATES POWER COMPANY

BY Michael D Wadley
Michael D Wadley
Plant Manager
Prairie Island Nuclear Generating Plant

On this 23rd day of October 1996 before me a notary public in and for said County, personally appeared Michael D Wadley, Plant Manager, Prairie Island Nuclear Generating Plant; 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.

Marcia K LaCore

MARCIA K. LaCORE
NOTARY PUBLIC-MINNESOTA
HENNEPIN COUNTY
My Commission Expires Jan. 31, 2000

RESPONSE TO GENERIC LETTER 96-04

Requested Action:

Provide an assessment of the physical condition of the Boraflex, including any deterioration, on the basis of current accumulated gamma exposure and possible water ingress to the Boraflex and state whether a subcritical margin of 5 percent can be maintained for the racks in unborated water.

Response to the Requested Action:

The Prairie Island Boraflex spent fuel storage racks were put into use in late 1981 and were filled to near capacity by 1995. As a result, most of the individual spent fuel cells have a high accumulated gamma dose. A Boraflex coupon surveillance program was established when the racks were installed to monitor long term performance of the Boraflex material. At five year intervals, an irradiated Boraflex test coupon is removed from its location in the spent fuel pool and sent for analysis of physical dimensions, hardness and B10 areal density. The last coupon was analyzed in 1994 and was found to not be significantly degraded, with the B10 areal density exceeding original specification.

Due to Prairie Island's high spent fuel pool silica levels relative to the rest of the industry, EPRI and the EPRI Boraflex Working Group shifted its focus from gap formation in Boraflex to the potential for Boraflex dissolution under long term exposure to spent fuel pool conditions. EPRI sponsored studies have shown that the combination of gamma exposure and water ingress into the Boraflex panel cavity significantly degrades the silica polymer matrix. The Prairie Island rack design allowed for a large amount of water ingress to alleviate the potential for cell wall bulging as a result of the Boraflex material offgassing. The Prairie Island sample coupons were not designed to allow for significant water ingress and are therefore not believed to be accurate indicators of rack Boraflex degradation.

The EPRI sponsored calculational model RACKLIFE is being used to estimate the condition of the Boraflex panels. The RACKLIFE model utilizes spent fuel pool chemistry parameters (including silica levels) and cell-by-cell exposure histories to estimate each Boraflex panel's potential for degradation. Additional developmental work is being performed on the model, specifically for Prairie Island, to accurately simulate the rapid increase in the Prairie Island spent fuel pool silica levels. *Once this work is complete, the information will be used to determine if 5% subcriticality margin is being maintained. The evaluation of the rack subcriticality margin is expected to be completed by November 30, 1996 and a supplemental response to Generic Letter 96-04, including the results of the subcriticality evaluation, will be submitted to the NRC at that time.*

Requested Action:

Submit a description of any proposed actions to monitor or confirm that this 5% subcriticality margin can be maintained for the lifetime of the storage racks and describe what corrective actions could be taken in the event it cannot be maintained.

Response to the Requested Action:

Beyond the surveillance coupon program, which is believed to be unrepresentative in Prairie Island's case, there are no practical ways to directly monitor or confirm that the 5% subcriticality margin is being maintained (see blackness testing discussion below). The design of the racks at Prairie Island make direct inspection of the Boraflex impossible without destroying the rack itself. A management strategy based on the EPRI sponsored RACKLIFE program is being developed to ensure that cells that are modeled to have been subjected to the highest degradation receive and store only low reactivity fuel assemblies.

In addition to the management strategy, Prairie Island is the lead plant for the proposed Westinghouse methodology by which credit could be taken for soluble boron in the spent fuel pool. If approved, the spent fuel pool would contain a minimum boron concentration in combination with other neutron poisons and checkerboarding schemes to ensure 5% subcriticality margin under normal circumstances and to ensure that the racks would remain subcritical in the event of complete dilution to zero ppm boron. The Prairie Island specific criticality analysis submitted as part of the lead plant submittal for soluble boron credit in the spent fuel pool takes no credit for Boraflex.

Prairie Island is currently maintaining an administrative limit of 2000 ppm soluble boron in the spent fuel pool as a conservative measure to ensure 5% subcriticality margin. The 2000 ppm limit was developed in-house and verified to be conservative by subsequent Westinghouse analysis. *This administrative limit will be maintained in place until the license amendment allowing credit for soluble boron in the spent fuel pool is approved by the NRC.*

Requested Action:

Describe the results from any previous post operational blackness tests and state whether blackness testing, or other in-situ tests or measurements, will be periodically performed.

Response to the Requested Action:

There have been no post operational blackness testing on the Prairie Island Boraflex racks and none is planned. Due to the small number of empty cells in the

Prairie Island spent fuel pool, a large number of fuel moves would need to be made into temporary racks in order to clear sufficient space to make any blackness testing data meaningful (i.e., eliminate gamma background). Typically, blackness testing is a go/no-go technology that indicates the presence of neutron absorber without the ability to accurately quantify the results. The BADGER System (Boron Areal Density Gage for Evaluating Racks) developed by EPRI is capable of quantifying the B10 density in certain rack designs but has not been tested with a flux-trap design like Prairie Island's and is assumed to have prohibitively high measurement errors for flux-trap applications. Given these facts, it is believed that currently available in-situ testing would not provide useful information for Prairie Island's situation.

Requested Action:

Provide chronological trends of pool reactive silica levels, along with timing of significant events such as refuelings, pool silica cleanups, etc.

Response to the Requested Action:

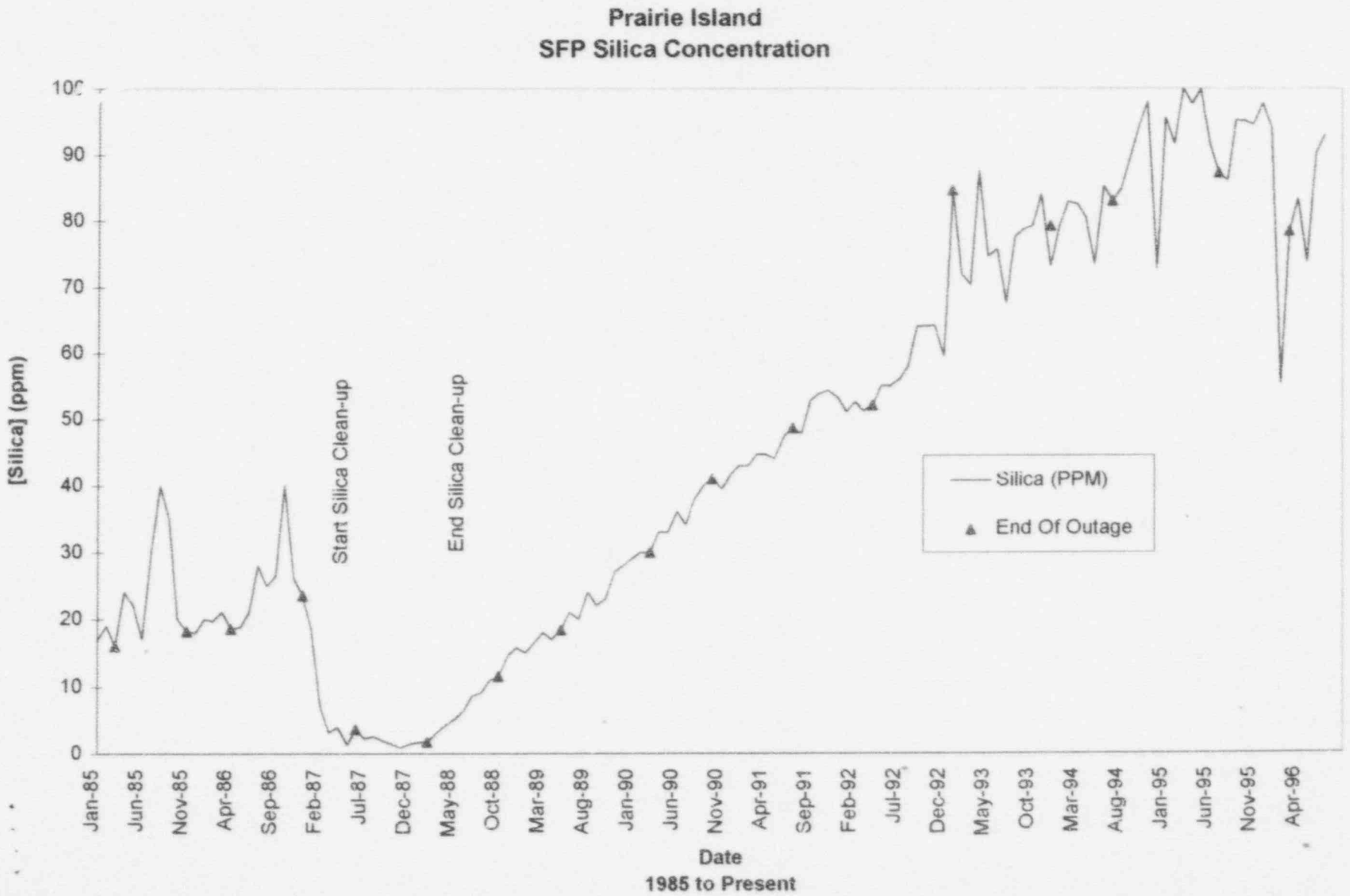
Attachment 1 gives a chronological trend of spent fuel pool reactive silica from the time silica was first measured at Prairie Island. As can be seen, an aggressive effort was undertaken in 1987 to reduce the spent fuel pool silica levels using reverse osmosis. At that time it was not yet known that Boraflex was the source of the silica. The silica concentration was reduced from approximately 40 ppm to <1 ppm. Since that time, the silica concentration has increased rapidly to a peak of 107 ppm in 1995. There are no plans to reduce silica levels further until the Boraflex issue is resolved.

Requested Action:

Describe the implications of how pool silica levels relate to Boraflex performance.

Response to the Requested Action:

EPRI studies indicate that the concentration of silica in borated spent fuel pools directly relates to the level of degradation of Boraflex in the spent fuel pool racks. As indicated above, the EPRI sponsored calculational model RACKLIFE can be used to estimate the condition of the Boraflex panels. The RACKLIFE model utilizes spent fuel pool chemistry parameters (including silica levels) and cell-by-cell exposure histories to estimate each Boraflex panel's potential for degradation.


Prairie Island
SFP Silica Concentration
[Silica] (ppm)
100
90
80
70
60
50
40
30
20
10
0
Start Silica Clean-up
End Silica Clean-up
Silica (PPM)
End Of Outage
Jan-85
Jun-85
Nov-85
Apr-86
Sep-86
Feb-87
Jul-87
Dec-87
May-88
Oct-88
Mar-89
Aug-89
Jan-90
Jun-90
Nov-90
Apr-91
Sep-91
Feb-92
Jul-92
Dec-92
May-93
Oct-93
Mar-94
Aug-94
Jan-95
Jun-95
Nov-95
Apr-96
Date
1985 to Present