



UNITED STATES
NUCLEAR REGULATORY COMMISSION
WASHINGTON, D.C. 20555-0001

February 10, 2020

Mr. Scott Sharp
Site Vice President
Prairie Island Nuclear Generating Plant
Northern States Power Company - Minnesota
1717 Wakonade Drive East
Welch, MN 55089

SUBJECT: PRAIRIE ISLAND NUCLEAR GENERATING PLANT, UNITS 1 AND 2 –
NONACCEPTANCE OF REQUESTED LICENSING ACTION RE: REQUEST TO
APPROVE SITE-SPECIFIC PROBABILISTIC RISK ASSESSMENT MODEL
FOR FLOWSERVE N-SEAL ABEYANCE SEAL (EPID L-2019-TOP-0035)

Dear Mr. Sharp:

By letter dated August 27, 2019 (Agencywide Documents Access and Management System (ADAMS) Accession No. ML19239A420), Northern States Power Company (NSPM) submitted a request to approve a site-specific probabilistic risk assessment (PRA) model for Flowserve N-Seal abeyance seal for Prairie Island Nuclear Generating Plant (PINGP), Units 1 and 2. The purpose of this letter is to inform you that because the request is for greater operating authority than provided for under the operating licenses, then an application for an amendment must be made under Section 50.90 of Title 10 of the *Code of Federal Regulations* (10 CFR) for the reasons explained below.

License conditions 2.C.(9), "Adoption of 10 CFR 50.69, ["]Risk-informed categorization and treatment of structures, systems, and components for nuclear power plants["]" for PINGP, Unit 1 and PINGP, Unit 2 each state, in part:

NSPM will complete the implementation items listed in Attachment 1 of NSPM's letter to the NRC dated August 5, 2019, prior to implementation of 10 CFR 50.69.

Attachment 1 of NSPM's letter dated August 5, 2019 states:

The NSPM PRA model used for categorization will only credit the abeyance RCP seal after the NRC has approved the modeling approach for the abeyance seal. Prior to modeling approach approval, the PRA model used for categorization will not credit the abeyance seal.

Because crediting the abeyance seals without prior NRC approval is prohibited by implementation item 1 referenced in license conditions 2.C.(9), the approval of crediting would grant greater operating authority, and accordingly require a license amendment. The need for an amendment pursuant to 10 CFR 50.90 was conveyed to Ms. Sara Scott during a phone call on December 17, 2019.

The focus of the NRC staff's review of any amendment request will be on the technical adequacy of the methodology and analyses relied upon in the application. Based on its review of your letter dated August 27, 2019, the Nuclear Regulatory Commission (NRC) staff preliminarily concluded that the letter did not provide sufficient details to demonstrate that the proposed action would meet the Commission's regulations. This informational need is summarized below:

The topical report, WCAP-16175-P-A, "Model for Failure of RCP [Reactor Coolant Pump] Seals Given Loss of Seal Cooling in CE [Combustion Engineering, Inc.] NSSS [Nuclear Steam Supply System] Plants," was approved by the NRC staff on February 12, 2007 (ADAMS Accession No. ML070240429). The topical report provides a PRA model of the failure of the 3-stage N-9000 seal cartridge (N-9000), but did not include credit for the abeyance seal. The approved N-9000 seal cartridge PRA model credits successful operation of the 3-stage N-Seal package only if an RCP is tripped within 20 minutes after loss of RCP seal cooling.

The purpose of the Flowserve Corporation report, "PRA Model for Flowserve N-Seal Abeyance Seal and Dynamic Testing for the Prairie Island Nuclear Generating Plant," is to develop PRA models to estimate the probability of failure for the Flowserve N-Seal package including the abeyance seal given failure of the N-Seal package. One analysis in the report evaluates data from dynamic testing of the N-Seal package first, second, and third stages without seal cooling and provides a basis for the time that the N-Seal can operate without seal cooling. The second analysis in the report is used to develop a model to estimate the probability of failure for the Flowserve N-Seal package abeyance seal given failure of the other three sealing stages. This model is intended to be used in PRA models to quantify the risk of an RCP seal loss-of-coolant accident given a loss of seal cooling event.

The following information is required for the NRC staff to complete its review of the Flowserve Corporation report:

- The report summarizes test methods and results for the N-9000 seal and the abeyance seal, and refers to References 4 and 5, which contain the details of the test methods and results. Reference 4 is Test Report RDR-0010, "Loss of Seal Cooling Water Test N-9000 Advanced Reactor Coolant Pump Mechanical Seal Cartridge," Flowserve Corporation, Byron Jackson Project No. DG-871.015.80, April 1988. Reference 5 is Internal Project: 1342-963, 1342-985 & 1343-017, "N-Seal Appendix R Spurious Operation and Abeyance Seal Development Project," Revision C, Flowserve Corporation, December 2014. References 4 and 5 would be required for the NRC staff to complete its review.
- Footnote 3 under Section 3.0, "Seal Failure Mechanisms," of Enclosure 1 states that "The testing that underlies the analysis in the report was conducted on sealing stages with slotted carbon faces. One RCP in each PINGP unit has a seal package outfitted with Mayer groove faces. As such, the testing does not match the as-installed pumps, so the increase in time to trip RCPs that is supported by the Flowserve report is not credited in the current PINGP PRA models."
 - Clarify whether and how the increased time to trip will be credited in future PINGP's PRAs if the testing does match the as-built plant. Alternatively,

provide testing results and information to support the increased time to trip for RCP seals with Mayer groove face configuration.

- Section 3.1, “Mechanical Seal Failure Symptoms,” of Enclosure 1 discusses indications of incipient or actual failure of the 3-stage mechanical N-9000 seal. Are these any different than the WCAP-16175-P-A indications given that the report differs from WCAP-16175-P-A only in the period that the mechanical seals are expected to survive and actuate following failure to trip the RCP and loss of seal cooling? Discuss how indications of incipient or actual failure are used in the PRA.
- Section 2.1.2, “Abeyance Seal,” of Enclosure 1 states that during normal RCP operation, the abeyance seal is non-contacting and suffers no wear or degradation. Section 7.0, “RCP Seal Failure Model for the Abeyance Seal of the N-Seal Package,” of Enclosure 1 states that three failure modes are included; failure caused by installation, failure to actuate, and failure to hold once actuated. Stand-by failure of the abeyance seal (e.g., caused by spurious action or simply degradation) during normal operation such that the unavailability of the seal would increase over time is not included.
 - If the abeyance seal were to actuate (i.e., the metal sealing ring plastically collapses onto the shaft sleeve) during normal operation, what would happen to the seal itself and what would be the consequences on normal operation of the RCPs?
 - Are any inspections to be performed on the abeyance seal when they are in-service, during normal maintenance, or during replacement which could detect standby failures?
- The conclusion on page 18 of Enclosure 2 of the submittal states that slotted carbon N-9000 seals can operate for a duration that does not appear to be consistent with the results of the dynamic seal test shown in the report. Clarify the apparent inconsistency of the length of seal operating times identified between the conclusion statement and the testing results.

If you elect to submit a license amendment request, we ask that you consider addressing the items above. Note, however, that during review of any subsequent amendment request, the NRC staff might identify additional information needs.

NRC staff activities on the review have ceased and the associated Enterprise Project Identifier (EPID) number has been closed.

S. Sharp

- 4 -

If you have any questions, please contact me at (301) 415-3733.

Sincerely,

/RA/

Robert F. Kuntz, Senior Project Manager
Plant Licensing Branch III
Division of Operating Reactor Licensing
Office of Nuclear Reactor Regulation

Docket Nos. 50-282 and 50-306

cc: Listserv

SUBJECT: PRAIRIE ISLAND NUCLEAR GENERATING PLANT, UNITS 1 AND 2 –
 NONACCEPTANCE OF REQUESTED LICENSING ACTION RE: REQUEST TO
 APPROVE SITE-SPECIFIC PROBABILISTIC RISK ASSESSMENT MODEL
 FOR FLOWSERVE N-SEAL ABEYANCE SEAL (EPID L-2019-TOP-0035)
 DATED FEBRUARY 10, 2020

DISTRIBUTION:

PUBLIC

PM File Copy

RidsACRS_MailCTR Resource

RidsNrrDra Resource

RidsNrrDex Resource

RidsNrrDraApla Resource

RidsNrrDexEmib Resource

RidsNrrDorl Resource

RidsNrrDorlLpl3 Resource

RidsNrrLASRohrer Resource

RidsNrrLAJBurkhardt Resource

RidsNrrPMPrairieIsland Resource

RidsRgn3MailCenter Resource

ADAMS Accession No. ML19347B010

* via e-mail

OFFICE	NRR/DORL/LPL3/PM	NRR/DORL/LPL3/LA	NRR/DRA/APLA/BC*
NAME	RKuntz	SRohrer (JBurkhardt for)	RPascarelli JCircle for
DATE	12/18/2019	12/18/2019	12/30/2019
OFFIC	NRR/DEX/EMIB/BC*	NRR/DSS/SNSB/BC (A)*	NRR/DORL/LPL3/BC
NAME	SBailey	JBorreomeo	NSalgado
DATE	1/29/2020	12/19/2019	2/6/2020
OFFICE	OGC (NLO)*	NRR/DORL/DD	NRR/DORL/LPL3/PM
NAME	RAugustus	GSuber	RKuntz
DATE	2/5/2020	2/7/2020	2/10/2020

OFFICIAL RECORD COPY