Xcel Energy®

Prairie Island Nuclear Generating Plant (PINGP)

Pre-Application Meeting

Request for NRC Approval of

PRA Model for Flowserve N-Seal Abeyance Seal and Dynamic Testing for the Prairie Island Nuclear Generating Plant

July 22, 2019

Meeting Agenda

- Describe future submittal requesting NRC approval
- Discuss scope of the new PRA model
- Background information
- Abeyance seal design and operation
- Basis of the N-Seal PRA model
- Proposed schedule
- Questions

Proposed Submittal

NRC approval of Flowserve Report:

> *PRA Model for Flowserve N-Seal Abeyance Seal and Dynamic Testing for the Prairie Island Nuclear Generating Plant*

Proposed Submittal (continued)

Reasons for submittal:

- Reflect the risk benefit of the N-9000 seal package abeyance seal in the PRA models
- Allows closure of the open Fact & Observation (F&O) Finding SY-A17-01 from the PRA Peer Review
- Supports risk-informed NFPA 805 licensing basis and 10 CFR 50.69 application

Scope of RCP Seal PRA Modeling

- Static (RCP off) modeling of Abeyance seal
- Dynamic (RCP running) modeling of N-Seal (Time to trip RCPs)
- Update on operating history data of N-Seal

- Not an overall RCP seal model
  - Abeyance seal is modeled per the Flowserve Report
  - 3-stage face-type seal is modeled per NRC-approved WCAP 16175-P-A, “Model for Failure of RCP Seals Given Loss of Seal Cooling in CE NSSS Plants”

Background

- Xcel Energy installed Flowserve N-9000 RCP seal packages
  - PINGP Unit 2: Dec 2013
  - PINGP Unit 1: Nov 2014
- PINGP PRA updated accordingly
  - 3-stages of face-type seals modeled per WCAP 16175-P-A consistent with NRC SE conditions/limitations for use by non-CE plants
  - Abeyance seal modeled per Flowserve PRA model
  - 2014 Focused-scope Peer Review of Flowserve N-Seal Abeyance Seal PRA Model conducted
    - F&O Finding SY-A17-01 addressed model assumptions for loss of power to RCPs when safeguards power is lost.
  - 2017 Closure Review Team determined the closure was acceptable, but determined SY-A17-01 could not be closed due to lack of NRC-approved abeyance seal PRA model

Background (continued)

- RCP seal model (in particular, allowing credit for the abeyance seal) is discussed in PINGP risk-informed applications:
  - NFPA 805
  - TSTF-425
  - 10 CFR 50.69
- Enercon developed Flowserve N-Seal Abeyance Seal PRA Model
  - Updates for abeyance seal, hot dynamic tests, and 20+ years of operating experience at several plants

Background (continued)

NRC SE for NFPA 805:

- Licensee used the best available applicable information, (i.e., the Flowserve RCP seal PRA model), to estimate the associated change-in-risk
- Licensee will take action if replacing the current model with a final, NRC-approved PRA model increases risk beyond risk acceptance guidelines
- Implementation Item 66: PINGP PRA to be reviewed and updated when NRC approves a seal model.
  - Compensatory measures remain in place until the seal model is approved or the PRA model removes credit for the abeyance seal

Background (continued)

NRC SE for TSTF-425:

- Licensee performed a sensitivity study that removed credit for abeyance seals.
- Staff concluded the Flowserve N-9000 RCP seal model did not have a significant impact on the Surveillance Frequency Control Program (SFCP)

Background (continued)

10 CFR 50.69 (under NRC review):

- NRC staff noted there is no NRC accepted methodology to model the abeyance seal in PRAs.
- Xcel Energy proposed Implementation Item #1, PRA model used for categorization will only credit the abeyance RCP seal after NRC approval

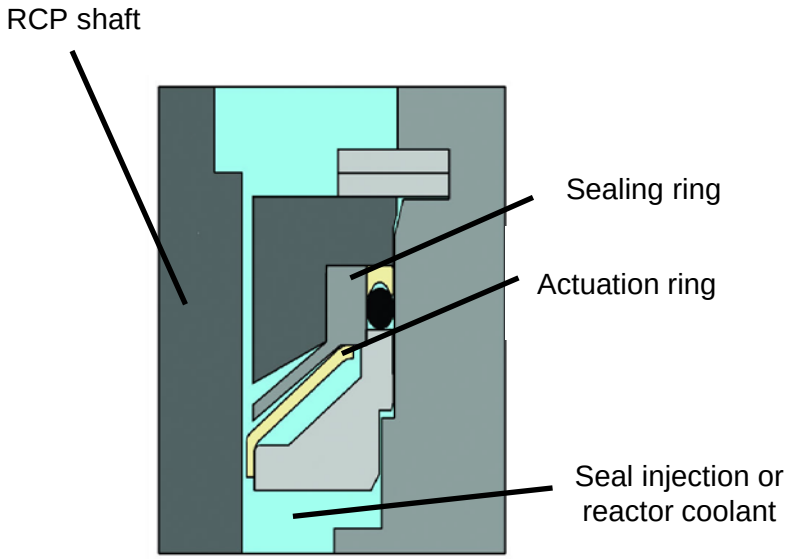
Abeyance Seal Design and Operation

Simplicity of design provides reliable actuation

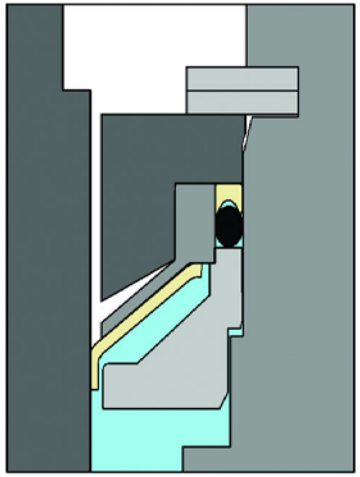
- Abeyance seal is a diverse sealing mechanism located above top stage
- Inert until significant leak from all three primary seal stages occurs
- Passive, self-actuated device with no reliance on sub-assemblies - actuated by pressure of leakage flow across seal package
- Does not rely on elastomers
  - Metallic sealing ring is main sealing device
  - Supplemented by PEEK actuation ring (initial sealing until pressure loading collapses metal sealing ring onto shaft sleeve)
- Near zero leakage provided RCP has tripped
- Non-contacting during normal operation – no wear
- Testing demonstrated no credible mechanism for inadvertent actuation

Abeyance Seal Design and Operation

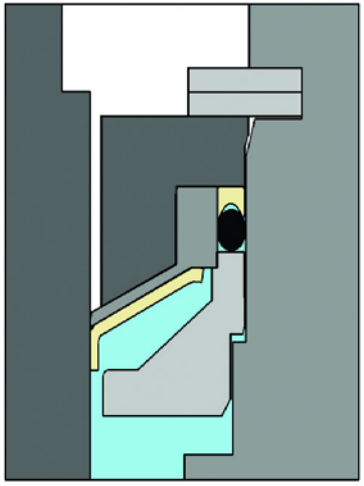
Abeyance Seal Actuation Sequence



Normal Operation



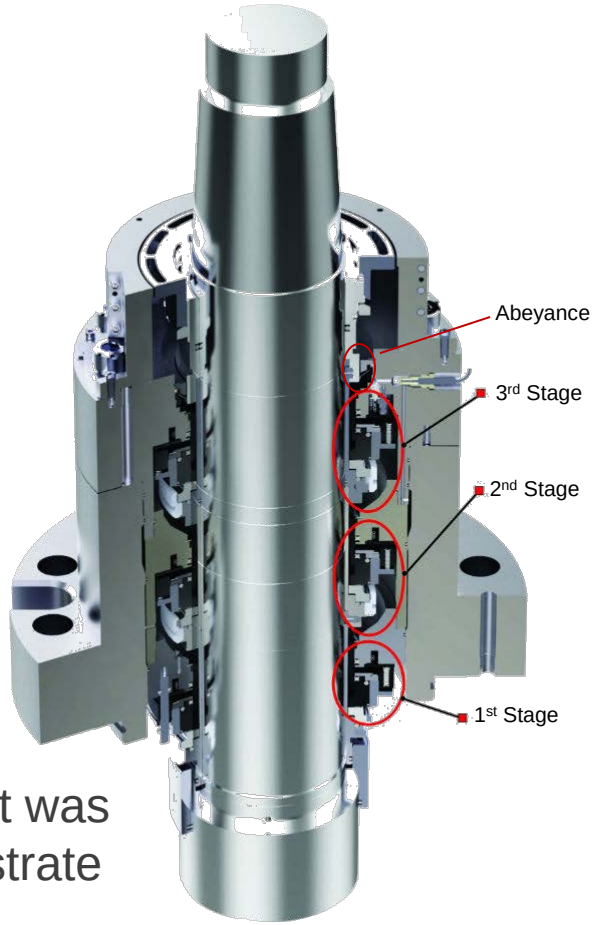
Initialization



Full Deployment

Basis of N-Seal PRA Model

- Abeyance seal modeling
  - Failure modes considered
    - Fail to actuate (per demand)
    - Fail to hold once sealed (per hour)
    - Failure due to installation error
  - Failure data from development testing
    - Modes precluded by design excluded
    - Conservative values used
- N-Seal dynamic operation without cooling
  - Additional testing was completed (beyond what was used to develop WCAP-16175-P-A) to demonstrate extended operation at full RCS conditions
  - N-Seal design-specific data supports significantly greater time than generically-approved 20 minutes for operators to trip RCPs



Schedule

- Projected submission in August 2019 with a requested issuance of September 2020
- Implement in time to coincide with implementation of final NFPA 805 modifications consistent with Transition License Condition 3 and Implementation Item 66
  - Not required for NFPA 805 implementation, but highly desired

Questions

- Questions or comments?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