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Washington, DC 20555-0001

Prairie Island Nuclear Generating Plant Units 1 and 2
Dockets 50-282 and 50-306
Renewed License Nos. DPR-42 and DPR-60

LER 50-282-2016-001-00, Unanalyzed Condition Due to Non-Compliant Fire Protection Manual Operator Actions

Northern States Power Company, a Minnesota corporation, doing business as Xcel Energy (hereafter "NSPM"), encloses Licensee Event Report (LER) 50-282/2016-001-00, Unanalyzed Condition Due to Non-Compliant Fire Protection Manual Operator Actions.

Summary of Commitments

This letter contains no new commitment and no change to an existing commitment.

Kevin Davison
Site Vice President, Prairie Island Nuclear Generating Plant
Northern States Power Company - Minnesota

Enclosure

cc: Administrator, Region III, USNRC
Project Manager, Prairie Island Nuclear Generating Plant (PINGP), USNRC
Resident Inspector, PINGP, USNRC
Department of Commerce, State of Minnesota

ENCLOSURE

LICENSEE EVENT REPORT 50-282/2016-001-00

8 Pages Follow

NRC FORM 366 (11-2015) U.S. NUCLEAR REGULATORY COMMISSION

LICENSEE EVENT REPORT (LER)

APPROVED BY OMB: NO. 3150-0104 EXPIRES: 10/31/2018

Estimated burden per response to comply with this mandatory collection request: 80 hours. Reported lessons learned are incorporated into the licensing process and fed back to industry. Send comments regarding burden estimate to the FOIA, Privacy and Information Collections Branch (T-5 F53), U.S. Nuclear Regulatory Commission, Washington, DC 20555-0001, or by internet e-mail to Infocollects.Resource@nrc.gov, and to the Desk Officer, Office of Information and Regulatory Affairs, NEOB-10202, (3150-0104), Office of Management and Budget, Washington, DC 20503. If a means used to impose an information collection does not display a currently valid OMB control number, the NRC may not conduct or sponsor, and a person is not required to respond to, the information collection.

1. FACILITY NAME	2. DOCKET NUMBER	3. PAGE
Prairie Island Nuclear Generating Plant	05000282	1 OF 8

4. TITLE

Unanalyzed Condition Due to Non-Compliant Fire Protection Manual Operator Actions

5. EVENT DATE			6. LER NUMBER			7. REPORT DATE			8. OTHER FACILITIES INVOLVED	
MONTH	DAY	YEAR	YEAR	SEQUENTIAL NUMBER	REV NO.	MONTH	DAY	YEAR	FACILITY NAME	DOCKET NUMBER
									Prairie Island - Unit 2	05000306
12	21	2015	2016	- 001	- 00	02	18	2016	FACILITY NAME	DOCKET NUMBER 05000

9. OPERATING MODE	11. THIS REPORT IS SUBMITTED PURSUANT TO THE REQUIREMENTS OF 10 CFR §: *(Check all that apply)*			
1	☐ 20.2201(b)	☐ 20.2203(a)(3)(i)	☐ 50.73(a)(2)(ii)(A)	☐ 50.73(a)(2)(viii)(A)
	☐ 20.2201(d)	☐ 20.2203(a)(3)(ii)	X 50.73(a)(2)(ii)(B)	☐ 50.73(a)(2)(viii)(B)
	☐ 20.2203(a)(1)	☐ 20.2203(a)(4)	☐ 50.73(a)(2)(iii)	☐ 50.73(a)(2)(ix)(A)
	☐ 20.2203(a)(2)(i)	☐ 50.36(c)(1)(i)(A)	☐ 50.73(a)(2)(iv)(A)	☐ 50.73(a)(2)(x)
10. POWER LEVEL	☐ 20.2203(a)(2)(ii)	☐ 50.36(c)(1)(ii)(A)	☐ 50.73(a)(2)(v)(A)	☐ 73.71(a)(4)
	☐ 20.2203(a)(2)(iii)	☐ 50.36(c)(2)	☐ 50.73(a)(2)(v)(B)	☐ 73.71(a)(5)
100	☐ 20.2203(a)(2)(iv)	☐ 50.46(a)(3)(ii)	☐ 50.73(a)(2)(v)(C)	☐ 73.77(a)(1)
	☐ 20.2203(a)(2)(v)	☐ 50.73(a)(2)(i)(A)	☐ 50.73(a)(2)(v)(D)	☐ 73.77(a)(2)(i)
	☐ 20.2203(a)(2)(vi)	☐ 50.73(a)(2)(i)(B)	☐ 50.73(a)(2)(vii)	☐ 73.77(a)(2)(ii)
		☐ 50.73(a)(2)(i)(C)	☐ OTHER Specify in Abstract below or in NRC Form 366A	

12. LICENSEE CONTACT FOR THIS LER

LICENSEE CONTACT	TELEPHONE NUMER *(Include Area Code)*
Penny S. Oleson	651-267-1750

13. COMPLETE ONE LINE FOR EACH COMPONENT FAILURE DESCRIBED IN THIS REPORT

CAUSE	SYSTEM	COMPONENT	MANU-FACTURER	REPORTABLE TO EPIX	CAUSE	SYSTEM	COMPONENT	MANU-FACTURER	REPORTABLE TO EPIX

14. SUPPLEMENTAL REPORT EXPECTED	15. EXPECTED SUBMISSION DATE	MONTH	DAY	YEAR
☐ YES *(If yes, complete 15. EXPECTED SUBMISSION DATE)* X NO				

ABSTRACT *(Limit to 1400 spaces, i.e., approximately 15 single-spaced typewritten lines)*

On 12/21/2015 with Unit 1 (U1) in Mode 1 at 100% power and Unit 2 (U2) in Mode 3, a technical review of a new weak link calculation as part of the transition to National Fire Protection Association's Performance Based Standard for Fire Protection for Light Water Reactor Electronic Generating Plants (NFPA 805) identified a non-emergency unanalyzed condition reportable under 10 CFR 50.72(b)(3)(ii)(B). Specifically, several motor operated valves (MOVs) credited to be manually operated from outside the control room in the event of a fire in the control room or relay room could be damaged in a postulated fire if hot shorts were to bypass the torque and limit switches. Also, MOVs associated with the Gland Steam system of both U1 and U2 had been added to F5 Appendix B but never analyzed in the event of a hot short. These conditions could impact the ability of plant operators to implement procedure F5 Appendix B, Control Room Evacuation (Fire). The identified MOVs are located in Fire Area (FA) 13 (Control Room) and FA 18 (Relay and Cable Spreading Room). New hourly fire watch impairments were created in these areas as compensatory measures. The fire detection systems in the control room and relay room remain in service. The site submitted Event Notification (EN) 51616.

Reviews of the list of MOVs susceptible to hot shorts bypassing the torque and limit switches continued and additional valves were noted to be affected by this failure mechanism. As a compensatory measure, new hourly fire watch impairments were created for FA 31 ("A" Train Hot Shutdown Panel & Air Compressor/Auxiliary 695 Feedwater Room), FA 32 ("B" Train Hot Shutdown Panel & Air Compressor/Auxiliary 695 Feedwater Room), FA 58 (Auxiliary Building Ground Floor U1) and FA 73 (Auxiliary Building Ground Floor U2). EN 51616 was updated on 01/14/2016. The public health and safety was not impacted.

Event Description

During technical review for a new calculation as part of the transition to NFPA-805, the station reviewed MOVs identified in the Appendix R program to ensure they had been analyzed correctly. In this review it was determined several MOVs had been added to the program but had not been analyzed for a weak link. Further, several MOVs would not survive a hot short condition, although they were credited in the Appendix R program to meet programmatic requirements for survivability from a hot short condition. Also, MOVs associated with the Gland Steam system of both U1 and U2 had been added to F5 Appendix B but never analyzed in the event of a hot short. These MOVs could be affected by a fire in FA 13 (Control Room) and FA 18 (Relay and Cable Spreading Room). This unanalyzed condition could impact the ability of plant operators to implement procedure F5 Appendix B. Therefore, the station reported this unanalyzed condition under 10 CFR 50.72(b)(3)(ii)(B) on 12/21/2015 as EN 51616. New hourly fire watch impairments were created in these fire areas as compensatory measures.

After submittal of EN 51616, the review was further expanded for all credited MOVs which resulted in identifying additional MOVs that would not survive a hot short condition if a fire were to occur in the following fire areas: FA 31 ("A" Train Hot Shutdown Panel & Air Compressor/Auxillary Feedwater Room, 695), FA 32 ("B" Train Hot Shutdown Panel & Air Compressor/ Auxillary Feedwater Room, 695), FA 58 (Auxiliary Building Ground Floor U1), and FA 73 (Auxiliary Building Ground Floor U2). EN 51616 was updated on 01/14/2016 listing the additional fire areas and the compensatory actions of new hourly fire watch impairments.

Event Analysis

On February 28, 1992 the NRC released Information Notice 92-18 (IN 92-18), Potential for Loss of Remote Shutdown Capability During a Control Room Fire, addressing the potential for a control room fire causing electrical short circuits ("hot shorts") between normally energized conductors and conductors associated with the control circuitry of motor-operated valves (MOVs) required for achieving and maintaining post-fire safe shutdown conditions. This could result in a loss of capability to achieve or maintain safe shutdown conditions

In 2014 as part of the NFPA 805 project, the mechanical MOV analysis to support IN 92-18 was reviewed. During this review the MOV program engineer determined there were new weak link data that were not incorporated into ENG-ME-353. An Engineering Change (EC) was initiated to update ENG-ME-353 and determine if any manually operated motor valves, credited by NFPA 805, are susceptible to over-torque conditions described in IN 92-18. It is this update that prompted the 12/15/2015 event notification, and the updated notification on 01/14/2016, for an unanalyzed condition due to non-compliant fire protection manual operator actions reportable under 10 CFR 50.72(b)(3)(ii)(B). Compensatory measures were initiated in affected fire areas. EN 51616 was submitted to the NRC.

During the causal evaluation for the LER, PINGP reviewed its response to a 1997 Unresolved Issue (URI) regarding the review of MOVs in accordance with IN 92-18 (Accession Number 9710200112). The response stated PINGP would use IN 92-18 as guidance to perform additional reviews of the hot short problem following the completion of the Appendix R safe shutdown analysis and create an accurate list of MOVs susceptible to hot shorts (ADAMS Accession Number 9711200012). On August 7, 1998, calculation ENG-ME-353, Mechanical MOV Analysis to support IN 92-18 determined the valve and operator thrust and torque values that may occur during a hot short that bypasses the limit switches and torque switches. The calculation addressed 46 Appendix R related valves and found 32 could potentially be damaged during a fire induced hot short requiring modifications and revision to the Appendix R safe shutdown analysis.

During a fire, a hot short could cause the MOV to operate without its torque/limit switch protection, damaging the valve and preventing manual operation of the valve. All credited MOVs for safe shut-down were reviewed for this condition and seventeen MOVs were found susceptible.

Susceptible MOVs

Eleven (11) MOVs require modification to re-wire the torque and limit switches to prevent damage to the actuator:

1) MV-32006, 1 TURB GLND STM SL SPLY UPSTRM SO MV
2) MV-32010, 1 TURB GLND STM SL SPLY B-P MV
3) MV-32016, 11 SG MS SPLY TO 11 TD AFW PMP MV
4) MV-32017, 12 SG MS SPLY TO 12 TD AFW PMP MV
5) MV-32019, 21 SG MS SPLY TO22 TD AFW PMP MV
6) MV-32020, 22 SG MS SPLY TO 22 TD AFW PMP MV
7) MV-32021, 2 TURB GLND STM SL SPLY UPSTRM SO MV
8) MV-32022, 2 TURB GLND STM SL SPLY B-P MV
9) MV-32238, 11 AFW TO 11 SG MV
10) MV-32246, 22 AFW TO 21 SG MV
11) MV-32333, 11 TD AFW PMP SUCT FROM CST MV

Six (6) MOVs require PINGP to revise the Appendix R safe shutdown analysis to credit actions to isolate other valves or to credit check valves.

1) MV-32115, 122 SFP HX INLT HDR MV B
2) MV-32117, 121 SFP HX INLT HDR MV A
3) MV-32166, 1 REAC EXCS LTDN LINE ISOL MV A
4) MV-32194, 2 REAC EXCS LTDN LINE ISOL MV A
5) MV-32335, 12 MD AFW PMP SUCT FROM CST MV
6) MV-32336, 21 MD AFW PMP SUCT FROM CST MV

The causal evaluation for this event determined the cause was the failure to include ENG-ME-353 as an input to the Appendix R safe shutdown analysis. Because of this exclusion, the site did not update ENG-ME-353 to include new weak link data to support the Appendix R safe shutdown analysis.

Additionally, the causal evaluation identified inadequate supervisory oversight during the transition to NFPA 805 that contributed to the event. When one engineer was assigned to both the Appendix R program and the transition to NFPA 805 resulting in untimely responses, in a

manner commensurate with their safety significance, to previously identified deficiencies for compliance with IN 92-18.

Safety Significance

The NFPA 805 License Amendment identified the need to revise ENG-ME-353 to incorporate updated vendor information (ADAMS Accession Number ML12278405). During the revision of ENG-ME-353, this issue was identified. There were no structures, components or systems that were inoperable at the start of the event that contributed to the event.

There was no nuclear, environmental, radiological or industrial safety consequences related to this event. PINGP has procedures and controls in places to minimize the likelihood and severity of fires occurring, and a significant fire impacting the ability to safely shutdown did not occur.

This postulated fire scenario requires that a significant fire of sufficient size and intensity to damage MOV control cables and bypass torque and limit switches to cause spurious operation and damage to MOVs. The frequency of fires large enough to damage control cables is much lower than the generic fire ignition frequency that includes fires of all intensities. To damage the MOV, the fire must cause damage to cable insulation to the point that an energized conductor shorts around the torque and limit switches to the MOV control circuit for sufficient time for the MOV to stroke to the opposite position without open circuit or short to ground.

Causes

- PINGP failed to include ENG-ME-353 as an input to the Appendix R safe shutdown analysis which led to failure to update ENG-ME-353 to include new weak link data.
- During the original analysis for IN 92-18, only a specified list of MOVs was reviewed to be credited; however, additional MOVs were added without the required analysis to support survivability.

Corrective Actions

- The Appendix R safe shutdown analysis for the fire protection program will be updated to include ENG-ME-353 in the methodology section.
- Document actions necessary to address the 17 MOVs.
  - Eleven (11) MOVs require modification to re-wire the torque and limit switches to prevent damage to the actuator:
    - MV-32006, 1 TURB GLND STM SL SPLY UPSTRM SO MV
    - MV-32010, 1 TURB GLND STM SL SPLY B-P MV
    - MV-32016, 11 SG MS SPLY TO 11 TD AFW PMP MV
    - MV-32017, 12 SG MS SPLY TO 12 TD AFW PMP MV
    - MV-32019, 21 SG MS SPLY TO 22 TD AFW PMP MV
    - MV-32020, 22 SG MS SPLY TO 22 TD AFW PMP MV
    - MV-32021, 2 TURB GLND STM SL SPLY UPSTRM SO MV
    - MV-32022, 2 TURB GLND STM SL SPLY B-P MV
    - MV-32238, 11 AFW TO 11 SG MV
    - MV-32246, 22 AFW TO 21 SG MV
    - MV-32333, 11 TD AFW PMP SUCT FROM CST MV

- Six (6) MOVs require PINGP to revise the Appendix R safe shutdown analysis to credit actions to isolate other valves or to credit check valves.
- :

  - MV-32115, 122 SFP HX INLT HDR MV B
  - MV-32117, 121 SFP HX INLT HDR MV A
  - MV-32166, 1 REAC EXCS LTDN LINE ISOL MV A
  - MV-32194, 2 REAC EXCS LTDN LINE ISOL MV A
  - MV-32335, 12 MD AFW PMP SUCT FROM CST MV
  - MV-32336, 21 MD AFW PMP SUCT FROM CST MV

Previous Similar Events

LER 1-98-10, "Discovery That 32 Appendix R Related MOV's Are Susceptible to Physical Damage by Fire Induced Hot Shorts" was submitted on September 7, 1998 (ADAMS Accession Number 9809150244).

Corrective Actions

- Compensatory fire watches in each affected area until the affected MOVs had been evaluated or modified as described below:
  a. Re-evaluate MOVs to identify alternate shutdown systems, components, or flow paths that are not susceptible to damage and revise the Safe Shutdown Analysis accordingly, or
  b. Modify MOV's mechanically to prevent mechanical damage (e.g. smaller motor), or
  c. Modify MOV's electrically to prevent hot short susceptibility (e.g. hold the MOV circuit breaker open or rewire the MOV control circuit).
- Submit a schedule of corrective actions after the engineering review is completed.

LER 1-98-15, "Containment to RHR MOV's Appendix R Safe Shutdown Analysis Issues", was submitted on October 26, 1998 (ADAMS Accession Number 9810300149).

Corrective Actions

- Include MOV's MV-32075, MV-32076, MV-32077, MV-32078, MV-32178, MV-32179, MV-32180, and MV-32181 in the Appendix R safe shutdown equipment list. Complete the circuit analysis packages for the valves with recommendations to provide assurance of maintaining the flow diversion path closed.
- Evaluate the valves for IN 92-18 damage concerns. If the valves could be mechanically damaged during spurious operation, circuit modifications will be performed as required under the IN 92-18 program. Results of this evaluation will be provided in a Supplement to LER 1-98-10.

- Review the Appendix R safe shutdown list against the appropriate flow diagrams to ensure that all other flow paths vulnerable to diversion were included in the SSA.
- Implement modifications and/or administrative controls to resolve this issue (and any other flow diversion issues identified above).

LER 1-98-10, Supplement 1. "Discovery That 32 Appendix R Related MOV's Are Susceptible to Physical Damage by Fire Induced Hot Shorts" was submitted on April 8, 1999 to supply the NRC with a schedule of the corrective actions as committed to in the original submittal (ADAMS Accession Number 9904150006).