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ESTIMATED BURDEN PER RESPONSE TO COMPLY WITH THIS MANDATORY INFORMATION COLLECTION REQUEST: 50.0 HRS. REPORTED LESSONS LEARNED ARE INCORPORATED INTO THE LICENSING PROCESS AND FED BACK TO INDUSTRY. FORWARD COMMENTS REGARDING BURDEN ESTIMATE TO THE INFORMATION AND RECORDS MANAGEMENT BRANCH (T-6 F33), U.S. NUCLEAR REGULATORY COMMISSION, WASHINGTON, DC 20555-0001, AND TO THE PAPERWORK REDUCTION PROJECT (3150-0104), OFFICE OF MANAGEMENT AND BUDGET, WASHINGTON, DC 20503.

LICENSEE EVENT REPORT (LER)

(See reverse for required number of digits/characters for each block)

FACILITY NAME (1)	DOCKET NUMBER (2)	PAGE (3)
Prairie Island Nuclear Generating Plant Unit 1	05000 282	1 OF 6

TITLE (4)
Fire Area 32 Appendix R Safe Shutdown Analysis Issues

EVENT DATE (5)			LER NUMBER (6)			REPORT DATE (7)			OTHER FACILITIES INVOLVED (8)	
MONTH	DAY	YEAR	YEAR	SEQUENTIAL NUMBER	REVISION NUMBER	MONTH	DAY	YEAR	FACILITY NAME	DOCKET NUMBER
08	27	98	98	-- 14 --	01	10	26	98	Prairie Island Unit 2	05000 306
									FACILITY NAME	DOCKET NUMBER 05000

OPERATING	1
POWER	100

THIS REPORT IS SUBMITTED PURSUANT TO THE REQUIREMENTS OF 10 CFR §: (Check one or more) (11)

20.2201(b)	20.2203(a)(2)(v)	50.73(a)(2)(i)	50.73(a)(2)(viii)
20.2203(a)(1)	20.2203(a)(3)(i)	√ 50.73(a)(2)(ii)	50.73(a)(2)(x)
20.2203(a)(2)(i)	20.2203(a)(3)(ii)	50.73(a)(2)(iii)	73.71
20.2203(a)(2)(ii)	20.2203(a)(4)	50.73(a)(2)(iv)	OTHER
20.2203(a)(2)(iii)	50.36(c)(1)	√ 50.73(a)(2)(v)	Specify in Abstract below or in NRC Form 366A
20.2203(a)(2)(iv)	50.36(c)(2)	50.73(a)(2)(vii)	

LICENSEE CONTACT FOR THIS LER (12)

NAME	TELEPHONE NUMBER (Include Area Code)
Jeff Kivi	651-388-1121

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

CAUSE	SYSTEM	COMPONENT	MANUFACTURER	REPORTABLE TO NPRDS		CAUSE	SYSTEM	COMPONENT	MANUFACTURER	REPORTABLE TO NPRDS

SUPPLEMENTAL REPORT EXPECTED (14)

				EXPECTED	MONTH	DAY	YEAR
	YES (If yes, complete EXPECTED SUBMISSION DATE).	√	NO				

ABSTRACT (Limit to 1400 spaces, i.e., approximately 15 single-spaced typewritten lines) (16)

On August 27, with both Units at 100% power, it was determined the control cable for motor operated valve MV-32335 (Condensate Storage Tank to No. 12 Motor Driven Auxiliary Feedwater Pump) in Fire Area 32 in the turbine building was not protected (as required by an exemption to 10CFR50 Appendix R).

Appropriate compensatory measures will be maintained in the Fire Area 32 until the fire barrier for the control cable is replaced.

EVENT DESCRIPTION

On August 27, 1998, Prairie Island Nuclear Generating Plant (PINGP) it was determined some cables[1] in Fire Area 32 (and possibly in Fire Area 31) in the turbine building (695' elevation) were not protected (as required by an exemption to 10CFR50 Appendix R for these areas). This issue was assessed by NCR 19982049. In particular, the assessment of NCR 19982049 determined that (in Fire Area 32) a control cable for motor-operated valve[2] (MOV) MV-32335, Condensate Storage Tank[3] to No. 12 Motor Driven Auxiliary Feedwater Pump[4], should have a one-hour fire barrier installed in Fire Area 32, but that the barrier had been removed.

As part of the 1987 safe shutdown analysis (SSA), power and control cables for MV-32335 were protected with a one-hour barrier within Fire Area 32 in accordance with the approved exemption for the area. MV-32335 is normally open and is required to remain open for safe shutdown. The current SSA (1997 revision) credited this valve as being open and credited manual action to de-energize the source motor control center[5] (MCC) and reopen the valve locally in the event of spurious closure of the MOV. Guidance for these manual actions was provided in PINGP Safety Procedure F5, Appendix D. Based on this analysis the one-hour barrier was removed from these cables in April of 1998.

During this event both units were operating at 100% power.

CAUSE OF THE EVENT

The PINGP Appendix R SSA was completely reconstituted (finished in 1997) due to:

- Addition of two new safety-related diesel generators for Station Blackout (SBO).
- Installation of and relocation of new 480 volt electrical switchgear and new Unit 2 4kV electrical switchgear as part of the Electrical System Upgrade (ESU) modification.
- Resolution of issues associated with Thermo-Lag under GL 92-08.

As part of this reconstitution effort, each fire area was re-evaluated and several changes were made to the original compliance strategy of the previous SSA. These changes were based on the new plant electrical configuration, the revised cable routing philosophy implemented in the SBO/ESU modifications and additional review of new regulatory guidance documents.

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[1] (EIIS Component Identifier: CBL)
[2] (EIIS Component Identifier: V)
[3] (EIIS Component Identifier: TK)
[4] (EIIS Component Identifier: P)
[5] (EIIS Component Identifier: MCC)

The cause of the non-compliance with the exemption to 10CFR50, Appendix R was crediting local manual action in lieu of remote (control room) operation for compliance. Crediting is allowed under the guidance of Generic Letter 86-10 in some cases, but the exemptions for the areas claimed credit for remote operation. In addition, there is an open door[6] between the two fire areas (with a fusible link to shut the door in case of fire). A fire in Fire Area 32 could have hampered local manual operation of MV-32335 (in Fire Area 31) because the door between the fire areas probably would remain open for some time while smoke infiltrated Fire Area 31 from Fire Area 32.

ANALYSIS OF THE EVENT

The current SSA analysis of Fire Area 32 noted that the power cable for MV-32335 did not need to be protected because the cable was run entirely in rigid conduit[7], thus, a three phase hot short could not occur to cause a spurious operation. The current SSA therefore concluded that wrapping this cable would neither offer any protection for the operation of MV-32335 nor reduce the combustible loading within Fire Area 32. In addition, because manual action to correct the lineup was credited, the current SSA concluded that the control cable for valve MV-32335 did not need to be wrapped.

The current SSA further concluded that securing power to the MCC would mitigate spurious MOV closure concerns and negate the need to re-enter the area to open the breaker[8] if manual operation of the valve were required. If MV-32335 were to spuriously close prior to power being secured, it could be manually opened because it is in another Fire Area (separated from Fire Area 32 by a 3-hour barrier). The current SSA assumed (but did not specifically state) in the analysis of Fire Area 32 that, if the suction valve did spuriously close, 12 Motor Driven Auxiliary Feed Pump would subsequently trip on low suction pressure (the ensuing implicit assumption is that the operator would recognize the low suction pressure trip and take appropriate corrective action.) The one-hour barrier installed on conduits for MV-32335 power and control cables was removed in April of 1998 as part of Modification 94L483.

As part of the Fire Protection Functional Inspection (FPFI), a review of Fire Area 32 noted that the existing exemption for Fire Area 32 requires all Division B safe shutdown conduits to be protected by a one-hour barrier in that Fire Area. This resulted in the issuance of PINGP NCR 19982049. The assessment of NCR 19982049 concluded that the removal of wrap from the power cable was insignificant because fire induced damage to the power cable could not cause a spurious operation of the MOV. However, NCR 19982049 concluded that the removal of the wrap from the control cable is

[6] (EIIS Component Identifier: DR)
[7] (EIIS Component Identifier: CND)
[8] (EIIS Component Identifier: BRK)

improper because MV-32335 was not adequately protected from spurious closure due to fire induced damage to the control cable.

Spurious closure of MV-32335 would cause the 12 Motor Driven Auxiliary Feedwater Pump to trip on low suction pressure, thus, the pump would not be free from fire damage as required. Further, operator actions in Fire Area 31 could be hampered by a fire in Fire Area 32 because the sliding door connecting the two fire areas has normally been open (with a fusible link that is expected to close the door in case of fire). The fusible link would no expected to close the door before smoke from a fire in Fire Area 32 infiltrated Fire Area 31.

A. Deterministic Evaluation of the Safety Significance of the Non-compliance

An evaluation of the sequence that could have occurred if a fire in Fire Area 32 had affected these cables concluded:

> "The safety significance during the time that the 12 MDAFW Pump condensate supply valve cables lacked fire barrier protection for is considered low based on the following:
>
> 1. Approximately 30 minutes would be available to operators prior to steam generator WR level reaching 7%. If AFW could not be restored, approximately 2 hours would be available to line up for primary feed and bleed to avoid core damage.
>
> 2. Procedures and guidance were available to operators to recognize and mitigate the potential loss of feedwater due to a postulated fire in FA 32.
>
> 3. Equipment and procedures were available to provide primary feed and bleed for core cooling in the event that auxiliary feedwater cannot be restored.
>
> 4. Sufficient time was available to operators to take action such that fuel damage will not occur."

B. Risk Significance Evaluation

The IPEEE Fire PRA, Rev. 2, considered the impact of a fire in Fire Area 32 causing spurious closure of MV-32335 prior to failure of MCC 1A2, such that the valve could not be repositioned from the control room. The Fire IPEEE conservatively did not credit the potential for operators to locally open a suction valve (either from the CST or from the cooling water system) and restart the pump to restore AFW flow from the 12 AF pump. In the final quantification of this area, only the conditional probability of spurious actuation given exposure of the control cable itself to fire was

considered (no credit for operator response was given). The results of this conservative treatment demonstrate that the spurious actuation of the valve itself is not a significant contributor to plant risk.

Only large instrument air compressor fires with failure of suppression were found to lead to damage of the MV-32335 cabling. The total frequency of these fires with suppression failure and spurious actuation of the valve (and all other valves susceptible to spurious actuation in this fire area) is 3.2E-7/rx-yr. With credit for local operator action in response to MV-32335 closure, the core damage frequency from this specific sequence drops to less than 1E-8/rx-yr. In addition, a fire watch was established in this area throughout the period of potential non-compliance that provides further assurance that the risk due to fires in this fire area is very low.

C. Compensatory Measures Established

As part of the resolution program for Thermo-Lag issues, Special Order SO-236, was put in effect in 1992 and has continued to be in effect during implementation of Modification 94L483, Part A. Modification 94L483 implemented the changes to the fire barrier wrapping and implemented the cable re-routes and/or component re-locations in response to the development of the current SSA. Special Order SO-236 maintains the roving hourly fire watches and will remain in effect until resolution of all the fire protection issues for which it has been posted. Therefore, the one-hour fire barrier protection that was removed in April 1998 was compensated for by the presence of the roving hourly fire watch. In addition, NCR 19981794 (IN 92-18 MOV Hot Shorts -- submitted to NRC as LER 1-98-10) also has compensatory measures in place for this area (and specifically for this valve) which consists of the roving fire watch under SO-236. The adequacy of the hourly fire watch was evaluated and justified as part of the assessment of NCR 19981794.

A control cable for MV-32335 that should be protected by a one-hour fire barrier per an existing exemption to 10CFR50, Appendix R, for Fire Area 32 is not protected. That barrier was removed based on a SSA that credited local manual actions to mitigate spurious closure of MV-32335. This crediting of local manual actions is inconsistent with the approved exemption for this area. In addition, since local manual action could have been hampered, the ability to shut down the reactor and maintain the reactor in a safe shutdown condition could conceivably have been affected. Therefore this condition is reportable per 10CFR50.73(a)(2)(v) as affecting the safe shutdown capability and per 10CFR50.73(a)(2)(ii)(B) as being outside of the PINGP design basis for 10CFR50, Appendix R.

CORRECTIVE ACTION

1. Compensatory actions that have been established in Fire Area 32 shall remain in effect until all corrective actions have been implemented or the issue has been otherwise resolved. The following specific corrective actions for this event are as follows:

2. Install a one-hour fire rated barrier to protect the Train B control cable to MV-32335 (including Terminal Box1263) to return to compliance with the approved exemption in Fire Area 32.

3. Review compliance with exemptions to 10CFR50 Appendix R for all Fire Areas. See LER 1-98-12 for additional information.

FAILED COMPONENT IDENTIFICATION

None.

PREVIOUS SIMILAR EVENTS

Cases of missing Appendix R Fire Barriers have been identified previously. Refer to Unit 2 Licensee Event Report (LER) 98-03 and Unit 1 LER's 98-12 and 98-15. Unit 1 LER 98-10 addresses the related issue of MOV hot shorts and spurious operation.

Attachment 2

Deterministic Evaluation of
Safety Significance of Loss of 12 MDAFW Pump Due to Fire Induced Spurious Closure of the
Condensate Supply Motor Operated Valve

This assessment evaluates the safety significance of the loss of 12 Motor Driven Auxiliary Feedwater Pump while the fire barrier protective wrap for the condensate supply valve, MV-32335, for the 12 Motor Driven Auxiliary Feedwater Pump was removed.

A scenario could be postulated in which a fire in the Train A Auxiliary Feedwater Pump Room, Fire Area (FA) 32 could lead to loss of instrument air, which would cause loss of the condensate system and loss of main feed. The reactor would trip on low-low steam generator level and both of the auxiliary feedwater pumps would automatically start. During this event, the 11 turbine driven auxiliary feedwater pump (TDAFWP) is assumed not to be available due to being located in the area of the fire. Due to the lack of fire barrier protection, the fire could also cause spurious closure of the condensate supply valve to 12 motor driven auxiliary feedwater pump (MDAFW) Pump, MV-32335. The 12 MDAFW Pump is relied on for safe shutdown and would trip on low suction pressure. The condensate suction valve, MV-32335, and the cooling water supply valves (direct source of river water to the 12 MDAFWP) are located in the adjacent fire area (FA 31) and are powered by MCC 1A2 in FA 32.

Effects of the Fire on Systems of Interest

Off-site Power

A fire in this fire area would not cause loss of off-site power; thus, both trains of safeguards power would be available at all times.

RCS Inventory Control

The 12 SI Pump and attendant equipment are not affected by a fire in this area and remain available. The Pressurizer PORVs are not affected and would remain available, since accumulators provide a source of air in the event that the Instrument Air System would be lost. The Train A head vent system would remain functional throughout the event. The Train B head vent system would be functional subject to the availability of power. Letdown would secure on loss of instrument air.

While not analyzed, it is not likely that all three of the charging pumps would be rendered inoperable by the fire, since they are located in a separate fire area.

Component Cooling would remain available; thus, cooling to the RCP thermal barrier heat exchangers would not be affected and RCP seal failure would not be required to be assumed.

Decay Heat Removal

As stated above, 12 MDAFW Pump is relied on for a fire in this area. Fire induced spurious closure of the condensate supply valve would have caused the AFW pump to trip on low suction pressure.

For the postulated scenario, main feedwater is assumed not to be available following the AFW pump trip due to either loss of instrument air or damage to main feed pump (MFP) cables.

Plant Response Calculations

IPE Calculations, Loss of Feedwater

To support the IPE project, calculations were performed (References 2 and 3) to investigate plant response to a loss of main and auxiliary feedwater events. These calculation files include detailed documentation of the assumptions and results. The Reference 2 and 3 calculations assumptions closely resemble the Appendix R scenario. Since the Appendix R and IPE scenarios are similar, the assumptions and results of the IPE calculations can be compared to the Appendix R scenario to provide a qualitative assessment of the time sequence and potential for core damage.

Both References 2 and 3 assume a loss of feedwater and subsequent reactor trip on low-low steam generator level. The auxiliary feedwater system is also assumed to have initially failed. Reference 3 predicts that steam generator WR level reaches 7% at 30 minutes, dryout occurs at 44 minutes. If an AFW pump is restored within 15 minutes of dryout, Pressurizer level goes off scale low at approximately 1.5 hours and is recovered prior to 2 hours. Steam generator WR level is recovered to 7% in 1.5 hours. A void never forms in the vessel and there is no fuel damage.

Reference 2 is similar to Reference 3, except that AFW is not assumed to be restored. In this case, steam generator WR level reaches 7% at 30 minutes, dryout occurs at 43 minutes. The pressurizer goes solid at one hour and empties at 1.9 hours. A void develops in the vessel at 1.3 hours and core damage occurs at 2 hours.

Comparison of Appendix R and IPE Scenarios

Differences between the Appendix R scenario and IPE scenario are as follows:

Assumed RCS Inventory Loss and Make-up

The IPE cases never restore make-up capability. In the Appendix R scenario, SI flow and the pressurizer PORVs and head vent system (if required) would be available at all times.

Auxiliary Feed Water System Operation

Treatment of the AFW system is similar in both the Appendix R scenario and the IPE calculations. If AFW flow could be restored within 1 hour, no fuel damage will occur. If AFW could not be restored, approximately 2 hours would be available to line up for primary feed and bleed.

RCP Operation

The IPE calculations assume that the RCPs are tripped when primary pressure reaches 1550 psi. This occurs between 1.2 and 1.3 hours. PINGP Procedures require tripping the

RCPs when steam generator wide range level reaches 7%. Tripping the RCPs at 7% WR level would lengthen the time to fuel damage beyond the predicted 2 hours, due to eliminating the heat input from the RCPs.

Expected Operator Response

Once a reactor trip occurs, the Control Room response would be governed by the combined procedural guidance of the Alarm Response Procedures, the Abnormal Operating Procedures (AOPs) and the Emergency Operating Procedures (EOPs).

Upon entering EOP E-0, Reactor Trip or Safety Injection, the operators would carry out their immediate actions up to step four. Upon realizing that a safety injection had not occurred, nor was necessary, they would transition to ES-0.1, Reactor Trip Recovery.

Two methods are now available to detect the loss of AFW flow to the SGs assuming that 11 TDAFWP pump is not running due to the fire and 12 MDAFWP started but shortly tripped due to fire induced spurious closure of its suction valve.

1. Upon exiting E-0, Critical Safety Function Status Tree monitoring begins. When both SG levels falls below 50% Wide Range, a RED Status Tree for Heat Sink will occur. This will direct the operators to FR-H.1, Response to Loss of Secondary Heat Sink. In FR-H.1, the operators will make attempts to restore feedwater flow to the SGs.

2. If a RED path hasn't yet appeared, the operators, upon reaching Step 6 of ES-0.1, will determine that no feedwater flow exists and will begin attempts to restore flow.

Once aware that no feedwater flow exists, the operators will observe that 11 TDAFWP is not running and be aware that it is in the fire area. They will also note the 12 MDAFWP locked out annunciator is LIT and 12 AFWP is not running.

Responding to the 12 MDAFWP Locked Out annunciator, the operators will verify that it was not tripped by an electrical fault and then be directed by procedure to C28.1 AOP4, Restarting an AFWP After Low Suction/Discharge Pressure Trip. This will require verification of suction alignment.

F5 Appendix D, Impact of Fire Outside Control/Relay Room, for Fire Area 32 specifically addresses the possibility of spurious closure of the 12 MDAFWP suction valve and the contingency actions necessary to allow manual repositioning of the condensate supply or cooling water supply. The operators will open the condensate supply locally to reestablish suction for 12 MDAFWP. They will then restart 12 MDAFWP.

If restarting of the MDAFWP is delayed till the SGs are "dried out", (criteria defined in FR-H.1), the operators will be directed to establish "feed and bleed" of the RCS to maintain core cooling while continuing attempts to restore AFW flow. Feed and bleed would be established using 12 SI pump and the Pressurizer PORVs, which would be available as discussed above. While not a desirable condition to be in, the feed and bleed procedure assures core cooling is maintained.

Feed and bleed alignment can be achieved in a very short time. Experience with several scenarios on the simulator involving loss of all feedwater flow indicates the operators have time to make attempts to restore feedwater before initiating feed and bleed. In this case where SG dryout is assumed to occur in 1/2 hour, the operators would already be taking action to restore AFW flow. Feed and bleed is only initiated when the conditions of Step 2 in FR-H.1 indicate that no heat sink exists. Since these conditions are continuously monitored while attempts to restore feedwater are being made, immediate transfer to the feed and bleed methodology for heat removal is made at the appropriate time. This sequencing is in accordance with the Generic Westinghouse Owner's Group Emergency Response Guidelines.

Conclusions

The safety significance during the time that the 12 MDAFW Pump condensate supply valve cables lacked fire barrier protection is considered low based on the following:

1. Approximately 30 minutes would be available to operators prior to steam generator WR level reaching 7%. If AFW could not be restored, approximately 2 hours would be available to line up for primary feed and bleed to avoid core damage.
2. Procedures and guidance were available to operators to recognize and mitigate the potential loss of feedwater due to a postulated fire in FA 32.
3. Equipment and procedures were available to provide primary feed and bleed for core cooling in the event that auxiliary feedwater cannot be restored.
4. Sufficient time was available to operators to take action such that fuel damage will not occur.

References

1. PINGP Procedure F5, Appendix D, "Impact of Fire Outside the Relay Room," Revision 2.
2. NAD File Number V.SPA.92.006, Prairie Island MAAP Case Number: MPP014/92, Dated May 10, 1993.
3. NAD File Number V.SPA.94.022, Prairie Island MAAP Case Number: MPP015/93, Dated May 19, 1994.
4. PINGP Procedure 1(2)E-0, "Reactor Trip of Safety Injection," Revision 17(16).
5. PINGP Procedure 1(2) FR-H.1, "Functional Response to Loss of Secondary Heat Sink," Revision 10(9).
6. PINGP Procedure C28.1 AOP2, "Loss of Condensate Supply to Auxiliary Feedwater Pump Suction," Revision 0.
7. PINGP Calculation GEN-PI-026, "Safe Shutdown Analysis for Compliance With 10CFR50 Appendix R, Section III.G," Addendum C32, Revision 2.