SERP Worksheet for SDP-Related Findings

IMC 0609
Exhibit 4 of Att 1

SERP Date: January 23, 2003

Cornerstone Affected and Proposed Preliminary Results:

This finding affects the Mitigating Systems Cornerstone, because it affects the objective to ensure the availability, reliability, and capability of systems that respond to an external event (fire) to prevent undesirable consequences. Specifically, the licensee's ability to achieve and maintain hot shutdown conditions in the event of a fire in Fire Areas 98J and 99M is affected by the lack of separation of redundant trains of safe shutdown systems in accordance with 10 CFR Part 50, Appendix R, Section III.G.2.

Licensee:	Entergy Operations, Inc.
Facility/Location:	Arkansas Nuclear One
Docket No(s):	50-313 and 50-368
License No(s):	DPR-51, NPF-6
Inspection Report No:	2001-06
Date of Exit Meeting:	August 21, 2001- final exit meeting pending
Issue Sponsor:	Dwight Chamberlain
Meeting Members:	
Issue Sponsor:	Dwight Chamberlain
Technical Spokesperson:	NRR Probabilistic Safety Assessment Office Branch
Program Spokesperson:	NRR Inspection Program Branch
OE Representative:	Jennifer Dixon-Herrity

A. Brief Description of Issue

ANO Unit 1 fire zones for the diesel generator corridor (Fire Zone 98J) and the north electrical switchgear (Fire Zone 99M) room did not meet separation requirements for electrical cables associated with redundant trains of safe shutdown equipment. In addition, the licensee did not have adequate procedures for the manual actions necessary to achieve safe shutdown (Section 1R05.3 of Reference 1).

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B. Statement of the Performance Deficiency

As a method for complying with 10 CFR Part 50, Appendix R, Section III.G.2, the licensee credited the use of manual actions to locally operate equipment necessary for achieving and maintaining hot shutdown, in lieu of ensuring cables associated with that equipment were free of fire damage as required by 10 CFR Part 50, Appendix R, Section III.G.2. The licensee credited a symptom-based approach which relied on the operator's ability to detect each failure or mal-operation as it occurred and perform manual actions as necessary to mitigate the effects of the failure or mal-operation. Due to the number of components that may be affected as a result of fire and uncertainty regarding the timing and synergistic impact that potential failures may have on the operator's ability to accomplish required shutdown functions, the inspection team determined that the strategy for implementing manual actions to mitigate a postulated fire were inadequate (Reference 1).

C. Significance Determination Basis

1. Reactor Inspection for IE, MS, B cornerstones

a. Phase 1 screening logic, results and assumptions

[redacted]

b. Phase 2 Risk Evaluation

[redacted]

List dominant affected accident sequences by initiator, in order of contribution, and each sequence's numerical contribution.

[redacted]

[redacted]

5

List any pertinent assumptions under each initiator group (A risk analyst should review and verify that Phase 2 process was followed correctly and that the results are reasonable.)

5

[redacted]

Attach applicable Phase 2 Worksheets

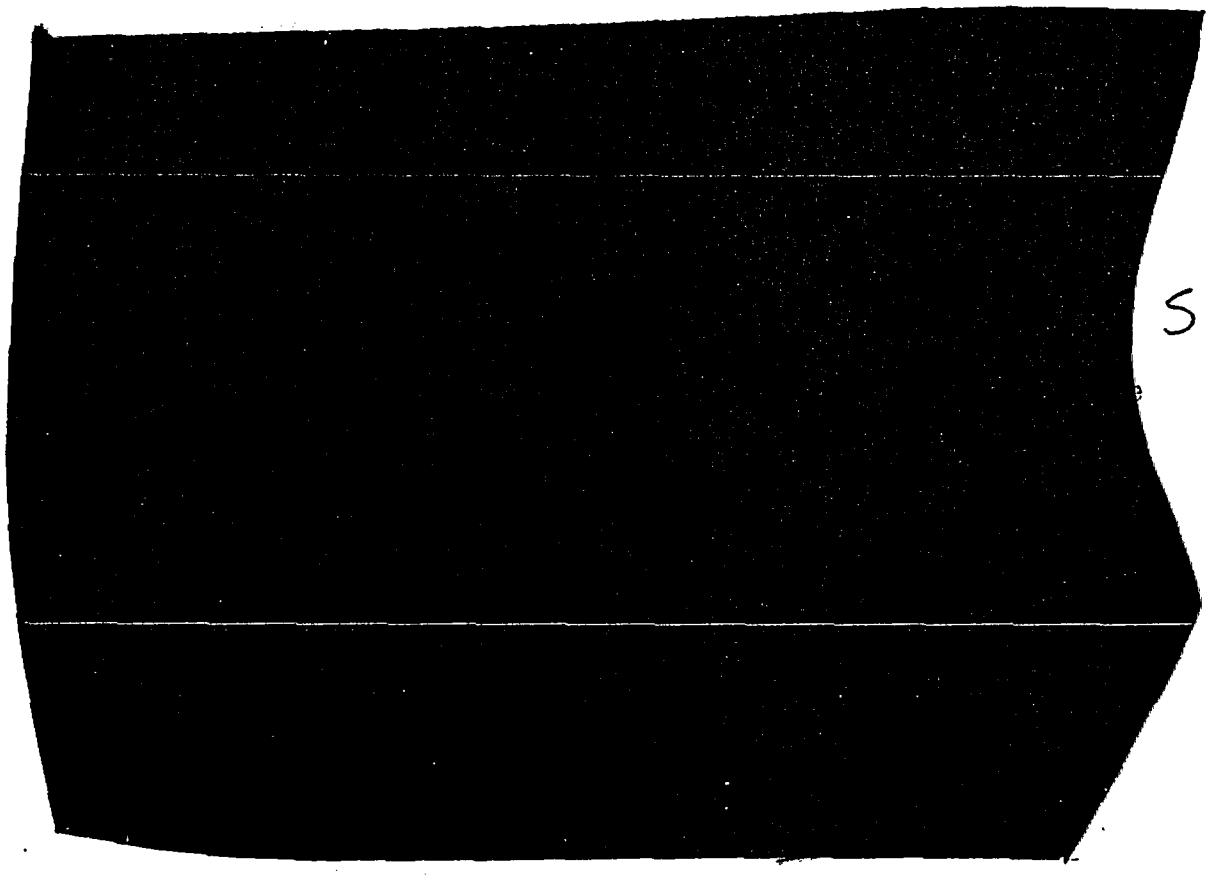
See Reference 2.

List any confirmatory checks made using licensee risk information, SPAR model results, or other source of risk insights.

[redacted]

5

Note any differences and an evaluation of their effect on this determination.



c. **Phase 3 Analysis (if necessary)**

Concisely address each of the analysis aspects that follow.

PRA tools used:

Affected sequences:

[redacted]

Influential assumptions:

[redacted]

Sensitivity of results to each influential assumption:

[redacted]

Contributions of greatest uncertainty factors and impact on assumptions:

[redacted]

Previous similar analyses: N/A

Proposed preliminary or final color[redacted]

[redacted]

[redacted]

2. **All Other Inspection Findings (not IE, MS, B cornerstones):** NONE

D. Proposed Enforcement.

a. Regulatory requirement not met.

10 CFR 50.48, Section (b) and 10 CFR Part 50, Appendix R, Sections III.G.2, III.G.3, and III.L.

b. Proposed citation.

During an NRC triennial fire protection inspection conducted on June 11 - 15, 2001, at Arkansas Nuclear One, Unit 1, the following violation of NRC requirements was identified. Note that ANO-1 was licensed prior to January 1, 1979; therefore, was required to meet 10 CFR Part 50, Appendix R, Section III.G.

10 CFR 50.48, "Fire protection," Section (b) states,

"Appendix R to this part establishes fire protection features required to satisfy Criterion 3 of Appendix A to this part with respect to certain generic issues for nuclear power plants licensed to operate before January 1, 1979. ... With respect to all other fire protection features covered by Appendix R, all nuclear power plants licensed to operate before January 1, 1979, must satisfy the applicable requirements of Appendix R to this part, including specifically the requirements of Sections III.G, III.J, and III.O."

10 CFR Part 50, Appendix R, Paragraph III.G, "Fire protection of safe shutdown capability," states,

1. *"Fire protection features shall be provided for structures, systems, and components important to safe shutdown. These features shall be capable of limiting fire damage so that:*

   a. *One train of systems necessary to achieve and maintain hot shutdown conditions from either the control room or emergency control station(s) is free of fire damage; and*

   b. *Systems necessary to achieve and maintain cold shutdown from either the control room or emergency control station(s) can be repaired within 72 hours.*

2. *Except as provided for in paragraph G.3 of this section, where cables or*

equipment, including associated non-safety circuits that could prevent operation or cause maloperation due to hot shorts, open circuits, or shorts to ground, of redundant trains of systems necessary to achieve and maintain hot shutdown conditions are located within the same fire area outside of primary containment, one of the following means of ensuring that one of the redundant trains is free of fire damage shall be provided:

a. Separation of cables and equipment and associated non-safety circuits of redundant trains by a fire barrier having a 3-hour rating. Structural steel forming a part of or supporting such fire barriers shall be protected to provide fire resistance equivalent to that required of the barrier;

b. Separation of cables and equipment and associated non-safety circuits of redundant trains by a horizontal distance of more than 20 feet with no intervening combustible or fire hazards. In addition, fire detectors and an automatic fire suppression system shall be installed in the fire area; or

c. Enclosure of cable and equipment and associated non-safety circuits of one redundant train in a fire barrier having a 1-hour rating. In addition, fire detectors and an automatic fire suppression system shall be installed in the fire area; ...

3. Alternative or dedicated shutdown capability and its associated circuits, independent of cables, systems or components in the area, room or zone under consideration, shall be provided:

a. Where the protection of systems whose function is required for hot shutdown does not satisfy the requirement of paragraph G.2 of this section; or ..."

Contrary to the above, in Fire Zones 98J and 99M in Unit 1, the licensee failed to ensure that cables of redundant trains of systems necessary to achieve and maintain hot shutdown conditions were free of fire damage by one of the means specified in 10 CFR Part 50, Appendix R, Paragraph III.G.2, or by alternative means specified in III.G.3.

Specifically, in Unit 1, Fire Zone 98J, the licensee did not ensure that cables associated with redundant trains of the following equipment necessary to achieve and maintain hot shutdown were free of fire damage, and did not provide alternative shutdown capability:

- control cables for emergency diesel generators;
- control cables for emergency diesel generator lock-out relays and output breakers;
- control cables for emergency feedwater system pumps;

- control cables for service water system valves to emergency diesel generator jacket water cooling;
- control cables for service water system pumps and valves;
- make-up system pumps and valves;
- control cables for steam generator atmospheric dump and block valves; and
- control cables for pressurizer emergency relief and block valves.

In addition, in Unit 1, Fire Zone 99M, the licensee failed to ensure that cables associated with redundant trains of the following equipment necessary to achieve and maintain hot shutdown were free of fire damage, and did not provide alternative shutdown capability:

- power and control cables for service water system pumps;
- emergency diesel generator output breaker 4KA;
- control cables for emergency diesel generator output breaker 4KB;
- control and instrument cables for emergency feedwater system pumps;
- control cables for emergency feedwater system valves;
- power and control power cables for make-up system pumps.

c. **Historical precedent.** None

E. Determination of Follow-up Review

For White findings propose whether HQs (NRR and/or OE) should review final determination letter before issuance. (For greater than White findings review and concurrence by NRR and OE is required as discussed in Section 4b.)

HQ should review the final determination letter before issuance.

F. References

1. NRC Inspection Report 50-313; 368/01-06 dated August 20, 2001 (ML012330501)
2. Task Interface Agreement - Request for Risk Determination of Fire Protection Findings at Arkansas Nuclear One, Unit 1 (01TIA11), dated September 10, 2001 (ML012530361)
3. ANO Calculation 95-E-0066-01, Revision 2, "ANO-2 IPEEE P2 Values"
4. ANO Calculation 95-E-0066-02, Revision 2, ANO-1 IPEEE P2 Values"
5. ANO Unit 1 and Unit 2 IPEEE
6. ANO FIRE Hazards Analysis
7. ANO White Paper regarding Ignition Source Frequencies

8. ANO Calculation 02-E-0004-01, "Zone 99-M PSA Analysis for Operator Action SDP"

9. ANO Calculation 02-E-0004-02, Zone 98-J PSA Analysis for Operator Action SDP"

10. NRC Memorandum from E. W. Weiss to M. Reinhart, "Fire Hazard Analysis for Fire Zone 98-J, Emergency Diesel Generator Corridor and Fire Zone 99-M, North Electrical Switchgear Room, Arkansas Nuclear One, Unit 1 (TAC No. MB2872)," dated May 28, 2002 (ML012330501)

11. NRC Memorandum from E. W. Weiss to M. Reinhart, "Supplemental Fire Modeling for Fire Zone 98-J, Emergency Diesel Generator Corridor and Fire Zone 99-M, North Electrical Switchgear Room, Arkansas Nuclear One, Unit 1 (TAC No. MB2872)," dated July 18, 2002 (ML021990405)

12. ANO Unit 1 and Unit 2 Updated Safety Analysis Reports

13. NRC analyst human reliability screening analysis (RIV S:\DRS\PRA_ANO\99M FIRE ANALYSIS\FIRE HRA.WPD)

14. NRC analyst qualitative assessment of remaining fire zones in Unit 1 and Unit 2 (RIV S:\DRS\PRA_ANO\99M FIRE ANALYSIS\ANO MATRIX.WPD)

15. NRC analyst sensitivity analysis for Fire Zone 99-M (RIV S:\DRS\PRA_ANO\99M FIRE ANALYSIS\SENSITIVITY ANALYSIS.WPD and RIV S:\DRS\PRA_ANO\99M FIRE ANALYSIS\ANO SDP CALC DATA.XLS)