Omaha Public Power District

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August 25, 2003
LIC-03-0085

U. S. Nuclear Regulatory Commission
Attn: Document Control Desk
Mail Station P1-137
Washington, DC 20555

Reference:
1. Docket No. 50-285
2. Letter from NRC (W. C. Seidle) to OPPD (W. C. Jones) Dated July 1, 1983 (NRC-83-202)
3. Letter from OPPD (R. L. Andrews) to NRC (J. R. Miller) Dated January 9, 1985 (LIC-84-0338)
4. Letter from NRC (E. J. Butcher) to OPPD (R. L. Andrews) dated July 3, 1985 (NRC-85-0200)
5. Letter from NRC (D. E. Sells) to OPPD (R. L. Andrews) dated July 1, 1986 (NRC-86-0211)
6. Letter from NRC (D. A. Powers) to OPPD (S. K. Gambhir) dated May 9, 2000 (NRC-00-0054)
7. Letter from NRC (A. T. Howell) to OPPD (S. K. Gambhir) dated January 31, 2001 (NRC-01-0008)
8. Letter from OPPD (R. T. Ridenoure) to NRC (DCD) dated November 8 2002

SUBJECT: Changes to the Letter Originally Submitted November 8, 2002 Regarding an Exemption Request from the Requirements of 10 CFR 50, Appendix R, Section III.G.2 for Fire Area 32 at the Fort Calhoun Station

In Reference 8, Omaha Public Power District (OPPD) submitted a request regarding an exemption from the requirements of 10 CFR 50, Appendix R, Section III.G.2 for Fire Area 32 (FA-32) at the Fort Calhoun Station (FCS). Pursuant to discussions with Mr. A. B. Wang (NRC), OPPD submits this letter with a revised Attachment 3, "Summary of Fort Calhoun Station Fire Area 32 (Room 19) Fire Analysis Insights," for Reference 8.

Please consider the Reference 8 letter requesting exemption from the requirements of 10 CFR 50, Appendix R, Section III.G.2 for FA-32 at FCS as valid, with the exception of the original Attachment 3. Prior to final review of the exemption request, OPPD respectfully requests that the NRC please remove the original "Attachment 3" submitted in Reference 8 and include the revised "Attachment 3" enclosed with this letter. The revised Attachment 3 contains an excellent qualitative discussion of FA-32.

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There are no commitments made in this letter. However, should the NRC approve the Reference 8 request for exemption, OPPD understands that certain statements in the Reference 8 letter and corresponding attachments could become commitments.

If you have further questions, please contact Mr. Gary Cavanaugh, of my staff, at (402) 533-6913.

Sincerely,

R. L. Phelps 8-25-03

R. L. Phelps
Division Manager
Nuclear Engineering

RLP/GRC/grc

Enclosure

c: T. P. Gwynn, NRC (Acting)Regional Administrator, Region IV
A. B. Wang, NRC Project Manager
J. G. Kramer, NRC Senior Resident Inspector

Enclosure
Revised "Attachment 3" to OPPD Letter Dated November 8, 2003,
Concerning an Exemption Request from the Requirements of 10 CFR 50, Appendix R, Section III.G.2 for Fire Area 32 at the Fort Calhoun Station

Attachment 3
Summary of Fort Calhoun Station Fire Area 32 (Room 19) Fire Analysis Insights

Introduction

A detailed fire analysis was performed for Fire Area 32 (Room 19). The analysis considered a number of scenarios that could be characterized consistent with the requirements of 10 CFR 50.48 and Appendix R. It also considered scenarios beyond the requirements of Appendix R in that non-fire-induced random failures were considered. In particular, the consequences of a random failure of the automatic fire suppression system was investigated.

The analysis is best characterized as a bounding study that uses conditional core damage probability together with fire frequency values to calculate a figure of merit. This figure of merit is a fire core damage frequency, used for ranking and the development of risk insights. Because of necessarily conservative assumptions, it is not directly comparable with results from the plant PRA. However, it can effectively be used in a parametric fashion to provide qualitative insights, and to rank and prioritize the relative risk significance of the individual fire scenarios that were analyzed.

A review of the results of the analysis discovered that three scenarios collectively represented the dominant risk contribution for the area. These three scenarios all involve cases that go beyond the requirements of Appendix R. In part, this is because a non-fire-induced failure of the automatic fire suppression system is considered. Appendix R does not require imposing failures that are not the direct consequence of the fire itself. The remaining risk contributors that were evaluated are also discussed and collectively represented a minimal risk contribution.

A discussion of the three dominant risk contributors is provided in the next section. This is followed by a discussion of all other fire scenarios considered in the analysis for Fire Area 32 (Room 19).

Dominant Risk Contributors

As discussed in the section above, three fire scenarios collectively represented the dominant fire risk associated with this fire area. These three scenarios involve the three primary fixed fire ignition sources in the room. In each instance, the scenario assumes that a catastrophic oil-based fire occurs. This assumption is made even though there is a lack of industry data supporting the possibility of such fires. In the case of the two Auxiliary Feedwater Pumps, it is assumed that the entire contents of one oil retaining cavity is released, ignited, and burns under idealized conditions until the fuel supply is exhausted. This treatment is applied in spite of the fact that the

pumps are not normally operating. There is no credible failure mechanism for an idle pump to release oil in the fashion considered. In addition, with the pumps idle, there is no credible mechanism to heat and ignite the oil.

In the case of the air compressors, a credible scenario can be conceived wherein the air compressor can fail catastrophically. Millstone 3 has air compressors identical to those used at Fort Calhoun Station. The Millstone plant experienced a catastrophic failure of one of their air compressors. However, this failure did not result in a fire. As such, the treatment of the air compressor fires has a level of conservatism inherent in the scenario development similar to that discussed for the Auxiliary Feedwater pumps.

The treatment of the postulated oil spill fire was evaluated for response of the installed automatic fire suppression system. The analysis of this very conservative scenario determined that suppression system response would occur before critical target damage occurs. However, it was recognized that a random, non-fire-induced failure of the suppression could occur. Therefore, these scenarios were examined further assuming failure of the suppression system. Similarly, no credit has been given for the station's quick and effective manual suppression capabilities. This further examination essentially extends the analysis to address conditions beyond the requirements of Appendix R. The insights from the examination of each of these three scenarios are summarized in below.

1. FW-6 Severe Fire with Suppression System Failure

This scenario stems from a 3½-gallon oil fire from motor-driven AFW pump FW-6. In this scenario it is assumed that the area fire suppression system fails to actuate or operate and therefore, does not mitigate the fire. The oil fire is assumed to burn until the fuel is exhausted.

The analysis assumes that the fire results in the loss of both FW-10 and FW-6. They are lost because of the size of the fire and the proximity of the circuits in the overhead raceways. The fire barrier located between the two pumps provides a radiant energy shield for direct heat effects. However, it does not provide any protection for the overhead cables trays. Failures of cable trays 1S, 2S, 17S and 18S also occur because of the postulated failure of the fire suppression system. The important equipment failures resulting from damage to these cable trays include the loss of power to the PORVs. Because the location for the cabling for the secondary systems (BOP) is not delineated, it is assumed that a plant trip is caused by a loss of Main Feedwater.

Although significant loss of plant system features is predicted for this scenario, a safe shutdown success path remains available. This success path involves the use of diesel-driven AFW pump FW-54. The analysis of this scenario provides the means to explore the

additional challenges (additional non-fire-induced random failures) that must occur before core damage occurs. The insights from this analysis are consistent with those previously identified by the plant PRA. These insights include the importance of the operator action to maintain the Condensate Storage Tank (CST) water supply for long-term decay heat removal, and the importance of FW-54.

The configuration of the area does not increase the likelihood of fire occurring. Even with the very conservative treatment of the postulated oil spill fire, the fire suppression system was found to be effective. However, even if it were assumed to be unavailable, a safe shutdown success path remains available using equipment independent of this fire area. The safe shutdown success path includes sufficient equipment for secondary heat removal. The diesel-driven AFW pump FW-54 and its support system remains available with an intact RCS. The analysis of this scenario shows that an adequate balance of defense-in-depth is maintained even while imposing the random failure of the area fire suppression not required in Appendix R analyses.

2. FW-10 Severe Fire with Suppression System Failure

This scenario stems from a 5½-gallon oil fire from steam driven Auxiliary Feedwater Pump (AFW) pump FW-10 which has been previously discussed not to be credible. In this scenario it is assumed that the area fire suppression system fails to actuate or operate and therefore, does not mitigate the fire. The oil fire is assumed to burn until the fuel is exhausted.

The analysis assumes that the fire results in the loss of both FW-10 and FW-6. They are lost because of the size of the fire and the proximity of the circuits in the overhead raceways. Because of the close proximity of FW-10 to FW-6, the results of the analysis of this scenario are identical to that for FW-6. Therefore, the insights and conclusions presented for FW-6 are also applicable here.

The configuration of the area does not increase the likelihood of fire occurring. Even with the very conservative treatment of the postulated oil spill fire, the fire suppression system was found to be effective. However, even if it were assumed to be unavailable, a safe shutdown success path remains available using equipment independent of this fire area. The safe shutdown success path includes sufficient equipment for secondary heat removal with an intact RCS. The diesel-driven AFW pump FW-54 and its support system remains available. The analysis of this scenario shows that an adequate balance of defense-in-depth is maintained even while imposing the random failure of the area fire suppression not required in Appendix R analyses.

3. Air Compressor Severe Fire with Suppression System Failure

This scenario stems from a 7-gallon oil fire from any one of the three air compressors. In this scenario it is assumed that the area fire suppression system fails to actuate or operate and therefore, does not mitigate the fire. The oil fire is assumed to burn until the fuel is exhausted.

The analysis assumes the loss of all three air compressors. Failures of cable trays 1S, 16S, and 16S-1 also occur because of the postulated failure of the fire suppression system. The important equipment failures resulting from damage to these cable trays include the loss of the Raw Water system. Because the location for the cabling for the secondary systems (BOP) is not delineated, it is assumed that a plant trip is caused by a loss of Main Feedwater.

Although significant loss of plant system features is predicted for this scenario, a safe shutdown success path remains available. This success path is conditional on an operator action to trip the RCP's. The operator action to trip the RCP's upon loss of Raw Water is important in that it provides a barrier against an RCP seal LOCA event. Operators are trained and guided by station's abnormal and emergency procedures to recognize the loss of Raw Water and trip all RCP's.

The configuration of the area does not increase the likelihood of fire occurring. Even with the very conservative treatment of the postulated oil spill fire, the fire suppression system was found to be effective. However, even if it were assumed to be unavailable, a safe shutdown success path remains available. Adequate secondary cooling remains available and the RCS remains intact. This fire is assumed to cause a loss of RCP seal cooling with a resulting small likelihood of an RCP seal failure, leading to core damage. The analysis of this scenario shows that an adequate balance of defense-in-depth is maintained. An important insight from this analysis is the importance of the operator action to trip the RCPs upon loss of the Raw Water system.

Remaining Risk Contributors

The overall analysis for Fire Area 32 (Room 19) consisted of many fire scenarios. The three discussed in the prior section represented the dominant risk contribution for this Fire Area. The collective risk contribution of all of the remaining fire scenarios was minimal. For completeness, these remaining fire scenarios are discussed below.

In general, these scenarios represent the more likely fire scenarios. They also include the scenarios more typical of Appendix R treatments in that the response of the installed automatic fire suppression system is credited. Because of the configuration of the room and the response of the installed automatic fire suppression system, these scenarios did not constitute a significant

source of fire risk.

1. **FW-6 Severe Fire with Suppression System Success and FW-6 Non-Severe Fire**

   This scenario stems from a 3½-gallon oil fire from motor-driven AFW pump FW-6. The fire modeling analysis of this event shows that the fire suppression system would actuate prior to damage to critical targets. However, the fire ignition source itself, FW-6, is still disabled. The successful actuation of the fire suppression system results in a set of fire-induced failures that are the same as that predicted for a postulated non-severe FW-6 fire. Therefore, this case combines these two scenarios. Given that fire suppression is successful, the only damage is to FW-6 and no other unrelated cables are impacted. A reactor trip (plant shutdown) is assumed to occur.

   The analysis of this scenario shows that the fire does not result in any notable degradation in the echelons of defense-in-depth. There are no dominant scenarios that contribute to the risk of core damage. Many scenarios with the characteristic of multiple failures are required to sufficiently degrade the defense-in-depth. In general defense-in-depth is maintained by the continued availability of the 2 remaining AFW pumps as well as the option of RCS cooling via feed and bleed cooling. The configuration of the area does not increase the likelihood of a fire occurring. The ability to suppress the fire is maintained, and multiple safe shutdown success paths remain available using equipment not impacted by the fire.

2. **FW-10 Severe Fire with Suppression System Success and FW-10 Non-Severe Fire**

   This scenario stems from a 5½-gallon oil fire from steam driven AFW pump FW-10. The fire modeling analysis of this event shows that the fire suppression system would actuate prior to damage to critical targets. However, the fire ignition source itself, FW-10, is still disabled. The successful actuation of the fire suppression system results in a set of fire-induced failures that are the same as that predicted for a postulated non-severe FW-10 fire. Therefore, this case combines these two scenarios. Given that fire suppression is successful, the only damage is to FW-10 and no other unrelated cables are impacted. A reactor trip (plant shutdown) is assumed to occur.

   The analysis of this scenario shows that the fire does not result in any notable degradation in the echelons of defense-in-depth. There are no dominant scenarios that contribute to the risk of core damage. Many scenarios with the characteristic of multiple failures are required to sufficiently degrade the defense-in-depth. In general, defense-in-depth is maintained by the continued availability of the two remaining AFW pumps as well as the option of RCS cooling via feed and bleed cooling. The configuration of the area does not increase the likelihood of a fire occurring. The ability to suppress the fire is maintained, and multiple safe shutdown success paths remain available using equipment not impacted by the fire.

3. Air Compressor Severe Fire with Fire Suppression Success and Non-Severe Fires

This scenario stems from a 7-gallon oil fire from any one of the three air compressors. The fire modeling analysis of this event shows that the fire suppression system would actuate prior to damage to critical targets. However, the fire ignition source itself, the air compressor, is still disabled. To simply the overall analysis, this scenario assumed that the fire disables all three air compressors. Because of their relatively close proximity, this was deemed to be reasonable. This treatment eliminates the need to treat each air compressor individually. The successful actuation of the fire suppression system results in a set of fire-induced failures the same as that predicted for a postulated non-severe air compressor fire. Therefore, this case combines these two scenarios. Given that fire suppression is successful, the only damage is loss of the three air compressors and no other unrelated cables are impacted. A reactor trip (plant shutdown) is assumed to occur.

The successful actuation of the fire suppression system limits fire damage such that multiple safe shutdown paths remain available. The analysis of this scenario shows that the fire does not result in any notable degradation in the echelons of defense-in-depth. This scenario is dominated by the risk of the unlikely occurrence of a failure to trip the reactor (ATWS). During an ATWS it is assumed that 2 AFW pumps are required to provide sufficient cooling. In this scenario steam-driven AFW pump FW-10 is failed due to steam generator carryover from failed (loss of instrument air) flow control valves. Only in this unlikely scenario is the defense-in-depth compromised. In the absence of this unlikely event, the RCS remains intact and secondary cooling can be provided by the motor-driven AFW pump FW-6. The configuration of the area does not increase the likelihood of fire occurring. The ability to suppress the fire is maintained, and multiple safe shutdown success paths remain available using equipment not impacted by the fire.

4. Floor Based Transient Combustible Fire Between Column Lines C-1a and D-4a

The analysis of floor-based transient combustible fires determined that the configuration of the room and the presence of the automatic fire suppression system would preclude fire-induced target damage. The analysis was based on the 100 lb. limit for Class A combustibles established in Station Procedure SO-G-91.

A postulated random failure of the fire suppression system or a procedure non-compliance could result in target damage occurring. A simplified analysis was performed to provide a bounding characterization of the risk consequences. This analysis found that the resulting figure of merit was substantially lower than that obtained for the other scenarios. In addition, the prior analyses for the fixed fire ignition sources had discovered that with even substantial room damage, a success path was available using equipment independent of this fire area.

The analysis of this scenario assumed the worst set of equipment impacts from the fixed ignition source fire analyses above. The analysis of this scenario determined that the fire does not result in any notable degradation in the echelons of defense-in-depth. That is because the assumed equipment failures include the loss of both AFW pumps FW-6 and FW-10. The diesel-driven AFW pump FW-54 remains available and provides the secondary heat removal capability necessary for safe shutdown. The configuration of the area does not increase the likelihood of fire occurring. The ability to suppress the fire is maintained, and multiple safe shutdown success paths remain available using equipment not impacted by the fire.

5. Floor-Based Transient Combustible Fire Between Column Lines C-4a and C-6d

The analysis of floor-based transient combustible fires at this location resulted in the same conclusions and insights as those presented above. As such, they will not be repeated.

6. Floor-Based Transient Combustible Fire Between Column Lines C-7a and D-7a

The analysis of floor-based transient combustible fires at this location resulted in the same conclusions and insights as those presented above. As such, they will not be repeated.

7. Transient Combustible Based Fire on Roof of CCW Room Between Column Lines 4a and 5b

The analysis of transient combustible-based fires at this location found that the limited vertical spacing could result in critical target damage. However, this area can only be reached by a ladder. As such, it is unlikely that combustibles would accumulate. Because of the limited vertical spacing, a simplified treatment assumed that localized target damage would occur regardless of suppression system actuation. However, success suppression system actuation would limit damage to only those raceways. A postulated failure of the suppression system would result in consequences identical to those considered for the other transient combustible-based fires.

The analysis of this scenario assumed the worst set of equipment impacts from the fixed ignition source fire analyses above. The analysis of this scenario determined that the fire does not result in any notable degradation in the echelons of defense-in-depth. That is because the assumed equipment failures include the loss of both AFW pumps FW-6 and FW-10. The diesel-driven AFW pump FW-54 remains available and provides the secondary heat removal capability necessary for safe shutdown. The configuration of the area does not increase the likelihood of fire occurring. The ability to suppress the fire is maintained, and multiple safe shutdown success paths remain available using equipment not impacted by the fire.

Conclusions

The configuration of Fire Area 32 (Room 19) includes many cable trays containing redundant plant system cables. These trays are separated to the degree possible given the physical constraints of the room. An area-wide automatic water-based fire suppression system is installed in the room. The configuration and performance of this system is sufficient to provide protection for at least one train of plant shutdown circuits given a postulated fire event. If the suppression system is disabled or is otherwise unavailable given a fire event, the most risk-significant of the postulated damage scenario involves the loss of the 2 AFW pumps FW-6 and FW-10. In the event of their loss, the diesel-driven Auxiliary Feedwater Pump FW-54 and feed and bleed cooling provide a success path for plant shutdown. Auxiliary Feedwater Pump FW-54 and the equipment for feed and bleed cooling are located outside this room and are not dependent on any circuits or features located in Room 19.

The next most important fire scenario involves the loss of the air compressors. However, even if it were assumed that the area suppression system was unavailable, a safe shutdown success path remains available. Adequate secondary cooling remains available via the motor- and diesel-driven AFW pumps. This fire is assumed to cause a loss of RCP seal cooling with a resulting small likelihood of an RCP seal failure. Only with these additional conditions is core damage possible.

The remaining fire scenarios initiated by transient combustibles are assumed to be dominated by the loss of the AFW pumps FW-6 and FW-10. Even assuming these worst-case equipment losses, the contribution from the transient combustibles is insignificant to the fire risk.

The analysis of Fire Area 32 (Room 19) considered scenarios that went beyond the requirements of Appendix R and confirmed that defense-in-depth is maintained even with certain non-fire-induced failures considered.

All of the credit for fire suppression is from automatic systems located in FA-32. As an additional level of defense-in-depth, the station fire brigade is available to respond and suppress fires in FA-32 with manual fire stations and other fire fighting equipment.