FIRE PROTECTION BASELINE INSPECTION
NORTH ANNA

INPUT FOR INSPECTION REPORT NO.: 50-338,339/03-06

INSPECTOR: S. Walker
Electrical Lead

N. Staples, Intern

INSPECTION DATES:
- Week 1 of onsite inspection - May 5 - 9, 2003
- Week 2 of onsite inspection - May 19 - 23 , 2003

Type of Inspection: TRIENNIAL FIRE PROTECTION BASELINE INSPECTION: 711111.05 Fire Protection Features and Post-Fire Safe Shutdown Capability

A. INSPECTION REPORT INPUT (ELECTRICAL)

1. REACTOR SAFETY
Cornerstones: Initiating Events, Mitigating Systems

.01 Systems Required To Achieve and Maintain Post-Fire Safe Shutdown

a. Inspection Scope

The team reviewed the licensee's fire protection program documented in the Safety Evaluation Reports, the NAPS UFSAR, and the NAPS 10 CFR 50 Appendix R Report to determine the systems required to achieve post-fire SSD. The team selected the chemical and volume control (CVCS), auxiliary feedwater (AFW), and the Main Control Room (MCR) and Emergency Switchgear Room (ESGR) ventilation systems to review for their support in the fire protection program. The team also reviewed the safe shutdown equipment lists, system flow diagrams, and the fire area hazards analysis (in the Appendix R report) for each of the three selected fire areas to evaluate the completeness and adequacy of the FPP and the systems relied upon to mitigate fires in the selected fire areas. The team conducted interviews and reviewed procedures to evaluate both loss of offsite power and offsite power available scenarios and the systems required for each. The team examined license basis documents to verify local manual operator actions were consistent with Specific licensee documents and drawings reviewed during the inspection are listed in the Attachment.

b. Findings

No findings of significance were identified.

.02 Fire Protection of Safe Shutdown Capability

A-22

a. Inspection Scope

For the selected fire areas, the team evaluated the frequency of fires or the potential for fires, the separation of systems necessary to achieve safe shutdown, and the separation of electrical components and circuits located within the same fire area to ensure that at least one train of redundant safe shutdown systems is free of fire damage.

b. Findings

No findings of significance were identified.

.03 Post-Fire Safe Shutdown Circuit Analysis

a. Inspection Scope

The team reviewed how systems would be used to achieve inventory control, reactor coolant pump seal protection, core heat removal and reactor coolant system (RCS) pressure control during and following a postulated fire in the fire areas selected for review. In addition, the inspectors reviewed a sample of the HVAC system for the selected fire areas. Portions of the licensee's Appendix R Report which described the methodology and system flow diagrams were reviewed. Control circuit schematics were analyzed to identify and evaluate cables important to safe shutdown. The team traced the routing of cables through fire areas selected for review by using cable schedule, and conduit and tray drawings. The team walked down these fire areas to compare the actual plant configuration to the layout indicated on the drawings. The team evaluated the above information to determine if the requirements for protection of control and power cables were met. The following motor operated valves (MOVs) and other components were reviewed:

1. 2-CH-FCV-2212, Charging Pump Flow Control Valve
2. 2-SI-MOV-2867A, Safety Injection via BIT
3. 2-SI-MOV-2867C, Safety Injection via BIT
4. 2-CH-MOV-2370, RCP Seal Injection Valve
5. 2-CH-FCV-2186, RCP Seal Injection Valve
6. 2-CH-MOV-2381, RCP Seal Return Valve
7. 2-CH-MOV-2286A, Charging Pump Discharge Valve
8. 2-CH-MOV-2286C, Charging Pump Discharge Valve
9. 2-CH-MOV-2289A, Charging Line Stop Valve
10. 2-CH-MOV-2289B, Charging Line Stop Valve
11. 2-CH-MOV-2373, Charging Pump Recirc to Seal Water Heat Exchanger Valve
12. 2-RC-PCV-2455C, Pressurizer PORV
13. 2-RC-PCV-2456, Pressurizer PORV
14. 2-RC-MOV-2536, Pressurizer Block Valve
15. 2-RC-MOV-2535, Pressurizer Block Valve
16. 2-SI-MOV-2869B, Safety Injection to RCS Valve
17. 2-FW-MOV-200D, TDAFW MOV to SG 'A'
18. 2-MS-TV-211A, Steam Supply to TDAFW
19. 2-MS-TV-211B, Steam Supply to TDAFW

20. 2-FW-P-2, Turbine Driven Auxiliary Feedwater Pump
21. 2-EI-CB-06A & B , Auxiliary Shutdown Panels
22. 2-EI-CB-97A & 203 , Auxiliary Monitoring Panels
23. HV-160-1 & 2, Ventilation MOV
24. HV-161-1 & 2, Ventilation MOV

b. Findings

For a fire in the main control room, fans HVE - 41 & 42 and ventilation MOVs HV-60 & 61 (for both Unit 1 & Unit 2) could be lost, contributing to the generation of large amounts of heavy black smoke and toxic gases. The inspectors identified that the design of the common ventilation system shared between the Main Control Room and ESGRs could cause smoke migration issues and habitability concerns for operators attempting safe shutdown from the respective ASP . Consequently, details related to this finding are located in Section 1R05.10 below.

No other findings of significance were identified.

.04 Alternative Shutdown Capability

a. Inspection Scope

The team reviewed the licensee's ASD methodology to determine the adequacy of the identified components and systems to achieve and maintain SSD conditions for each fire area selected for review and to verify conformance with applicable requirements as listed in Section .01 above. The NAPS Appendix R Report identified twelve fire areas requiring use of an ASD strategy in order to achieve SSD. The team reviewed the licensee's ASD methodology for two of these fire areas. For a significant fire in ESGR No. 2 (Fire Area 6), ASD from the MCR would be used to place the unit in hot shutdown utilizing system cross-connect with Unit 1 as necessary. For a significant fire in the MCR (Fire Area 2), ASD from the Auxiliary Shutdown Panels (ASP) would be used to place the unit in hot shutdown. The team specifically reviewed the adequacy of the systems and components [both in the MCR and at the ASP] selected for reactivity control, reactor coolant makeup, reactor heat removal, process monitoring, and support system functions.

Electrical diagrams of power, control, and instrumentation cables required to support ASD were analyzed for fire induced faults that could defeat operation from the MCR or the ASP. The team reviewed the electrical isolation and protective fusing in the transfer circuits of components (e.g., motor operated valves) required for post-fire SSD at the ASP to verify that the SSD components were physically and electrically separated from the fire area. The team also examined the electrical circuits for a sampling of components operable at the ASP to ensure that a fire in the ESGRs would not adversely affect SSD capability from the MCR.

b. Findings

No findings of significance were identified.

.05 Operational Implementation of Alternative Shutdown Capability

a. Inspection Scope

The team reviewed and walked down the following fire procedures to evaluate consistency, adequacy, training and operator familiarity as these procedures would be implemented during the performance of fire area specific ASD procedures for the MCR and ESGR No. 2.

1. 0-FCA-0,Fire Protection - Operations Response, Revision XX
2. 0-FCA-1, Control Room Fire, Revision 26
3. 2-FCA-2, Emergency Switchgear Room Fire, Revision 17
4. 2-ECA-0.0, Loss of All ACI Power, Revision xx

The team reviewed the operational implementation of the ASD capability for a fire in the MCR and ESGR No. 2 to determine if: (1) the procedures used for ASD were consistent with the safe shutdown analysis (SSA) methodology and assumptions; (2) the procedures were written so that the operator actions could be correctly performed within the times assumed in the SSA; (3) the training program for operators included ASD capability; and (4) personnel required to achieve and maintain the plant in hot standby from ASP could be provided from normal onsite staff, exclusive of the fire brigade. The team walked down procedures Fire Contingency Action (FCA) 0-FCA-1.00, Limiting MCR Fire, Revision xx, and 2-FCA-2.00, Limiting ESGR Number 2 Fire, Revision xx, in combination with the common fire procedures listed above, to evaluate whether these procedures could be performed within the required times given the minimum required operator staffing level, with or without offsite power. Operator and fire brigade staffing was reviewed to establish compliance with TS and conformance with the FPP. The team discussed the training with operators to ascertain if they were familiar with the actions and the location of significant equipment.

b. Findings

The licensee's Appendix R analysis described the means by which SSD could be achieved in the event of fire on Unit 1 or Unit 2 to meet the requirements of Appendix R to 10 CFR 50, Sections III.G.3 and III.L. Alternative shutdown capability independent of the existing cabling and equipment was provided for plant locations which did not meet the requirements of Section III.G.2 of Appendix R. The licensee's analysis identified a minimum set of plant systems and components necessary for achieving the safe shutdown performance goals of 10 CFR 50, Appendix R. One of the minimum required systems was the CVCS which would be used to provide makeup water to the RCS. This would be accomplished using two separate and independent flow paths: the seal injection lines to the RCP seals, and the normal charging line to the loop 2 cold leg. The North Anna charging pump discharge headers are cross-connected between units through a normally isolated line. Per the licensee's analysis and procedures, in the event that one unit's charging pumps were incapacitated due to fire, the opposite unit's charging pumps could be used to provide charging to the fire-affected unit's RCS through the charging pump cross-connect. Local manual operator action would be required to make this alignment. The team noted from the licensee's analysis that "the

Appendix R analysis is based on reestablishing charging flow via the cross-connect within 60 minutes." The team determined that in certain fire scenarios, charging pump flow could be temporarily lost, hence RCP seal injection to the fire-affected unit would be temporarily lost as well. The team identified that the licensee's Appendix R analysis failed to evaluate the potential adverse effect on the RCP seal packages from restoring seal injection flow following a prolonged loss of seal injection. This contributed to the findings and unresolved items (URIs) described below.

DOCUMENTATION

Drawings

12050-DAR-095C, Appendix R Flowpath - Chemical & Volume Control System, sh. 1, Rev. 5
12050-DAR-096A, Appendix R Flowpath - Chemical & Volume Control System, sh. 3, Rev. 0
12050-DAR-095B, Appendix R Flowpath - Chemical & Volume Control System, sh. 2, Rev. 3
12050-DAR-095C, Appendix R Flowpath - Chemical & Volume Control System, sh. 2, Rev. 4
12050-DAR-095B, Appendix R Flowpath - Chemical & Volume Control System, sh. 1, Rev. 7
12050-DAR-074A, Appendix R Flowpath - Feedwater System, sh. 3, Rev. 1
12050-DAR-074A, Appendix R Flowpath - Feedwater System, sh. 1, Rev. 7
12050-FE-90BA-2, Appendix R Block Diagram - Charging Pump System, sh. 1, Rev. 2
12050-FE-90BB-2, Appendix R Block Diagram - Charging Pump System, sh. 2, Rev. 2
12050-FE-90BC-3, Appendix R Block Diagram - Charging Pump System, sh. 3, Rev. 2
12050-FE-90BD-3, Appendix R Block Diagram - Charging Pump System, sh. 4, Rev. 3
12050-FE-90CA-2, Appendix R Block Diagram - Auxiliary Feedwater System, sh. 1, Rev. 3
12050-FE-90CB-2, Appendix R Block Diagram - Auxiliary Feedwater System, sh. 2, Rev. 2
12050-FE-90HB-2, Appendix R Block Diagram - Emergency Diesel Control Isol., sh. 1, Rev. 2
12050-FE-90HC-2, Appendix R Block Diagram - Emergency Diesel Control Isol., sh. 2, Rev. 2
12050-FE-90GA-3, Appendix R Block Diagram - High/Lo Boundary Valves, sh. 1, Rev. 3
12050-FE-90GB-3, Appendix R Block Diagram - High/Lo Boundary Valves, sh. 2, Rev. 3
12050-FE-3MN, Wiring Diagram- Appendix "R" Isolation Switch Panel, Rev. 0
12050-ESK-6DP, Elementary Diagram 480 V Circuits, MOV (2536), sh. 38, Rev. 18
12050-ESK-6NR, Elementary Diagram, Solenoid Oper. Valves (2456 & 2455C), sh. 1, Rev. 20
11715-ESK-5AN, Elementary Diagram 4160 V Charging Pump 1-CH-P-1C, sh. 1, Rev. 15
12050-ESK-6PR, Elementary Diagram),Solenoid Oper. Valves (MS211A & B) sh. 40, Rev. 19
12050-ESK-6EA, Elementary Diagram 480 V Circuits, MOV (2370), sh. 49, Rev. 10
12050-ESK-6DN, Elementary Diagram 480 V Circuits, MOV (2289A & 2373), sh. 37, Rev. 16
12050-ESK-6DV, Elementary Diagram 480 V Circuits, MOV (2867A), sh. 44, Rev. 18
12050-ESK-6DW, Elementary Diagram 480 V Circuits, MOV (2867C), sh. 45, Rev. 14
12050-FE-9EV, Wiring Diagram 480 V Emer., MCC 2H1-2S (Sect. A, B, C), Rev. 17
12050-FE-9EQ, Wiring Diagram 480 V Emer., MCC 2H1-2N (Sect. G, H, J), Rev. 17
12050-FE-9FG, Wiring Diagram 480 V Emer., MCC 2H1-2N (Sect. G, H), Rev. 10
12050-FE-9EN, Wiring Diagram 480 V Emer., MCC 2H1-2N (Sect. C, D), Rev. 17
12050-FE-9EP, Wiring Diagram 480 V Emer., MCC 2H1-2N (Sect. E, F), Rev. 13
12050-FE-91N, 480 V One Line Emergency , MCC 2H1-2N & 2S, Rev. 28
12050-FE-91P, 480 V One Line Emergency , MCC 2J1-2, Rev. 28
12050-FE-34Z-6, Cable Tray Plan - Emergency Switchgear Room, Rev. 6
12050-FE-34BF-6, Cable Tray Plan - Emergency Switchgear Room, Rev. 6
12050-FE-34BH-7, Cable Tray Plan - CV & T, Orange Trays , sh. 1, Rev. 7
12050-FE-34BJ-5, Cable Tray Plan - CV & T, Orange Trays , sh. 2, Rev. 5
12050-FE-34BK-9, Cable Tray Plan - CV & T, Purple Trays , Rev. 9
12050-FE-42M-15, Sleeve Identification MCC Cable Entry, sh. 2, Rev. 15
12050-FE-3CD, Wiring Diagram, Auxiliary Shutdown Panel Train A, sh. 1, Rev. 15
12050-FE-3CE, Wiring Diagram, Auxiliary Shutdown Panel Train B, sh. 1, Rev. 15
12050-FE-3GC, Wiring Diagram, Auxiliary Shutdown Panel Train A, sh. 2, Rev. 11
12050-FE-3GD, Wiring Diagram, Auxiliary Shutdown Panel Train B, sh. 2, Rev. 14
11715-FE-3QA, Wiring Diagram, Auxiliary Monitoring Panel 1-EI-CB-203, sh. 1, Rev. 0
11715-FE-3QH, Wiring Diagram, Auxiliary Monitoring Panel 1-EI-CB-203, sh. 2, Rev. 0

Procedures

2-FCA-2, Emergency Switchgear Room Fire, Rev. 17
0-FCA-1, Control Room Fire, Rev. 26
2-ECA-0.0, Loss of All AC Power, Rev. xx

Calculations & Evaluations

Technical Report EP-0017, Combustible Loading Analysis: NAPS Units 1 & 2, Rev. 2
Calculation EE-0027, Emergency Diesel Generator Loading Sequencing, Rev. 1
ET CEP 00-0043, Availability of MOVs for Local Operation NAPS, Rev. 0
ET CEE 95-032, Plenum Cable Fire Protection Acceptability NAPS, Rev. 0
Electrical Engineering Standard STD-EEN-002, Design Standard for Cable, Rev. 5
NAPS Response to Request for Additional Information- IPEEE, Attachment 1, dated 8/6/99
NAPS Appendix R Report, Rev. 21
S-012-1, High Temperature O-Rings to Survive Loss of All Seal Cooling, dated 11/91

License Basis Documents

NAPS UFSAR , Section 8.3, Onsite Power Systems, Rev. 38
SER Re Sections III.G.3 & III.L of Appendix R to 10CFR50 Concerning Alternate Safe Shutdown Capability In Event of Fire. Facilities In Compliance With Requirements, dated 11/82
SER Re Appendix R to 10CFR50 Items III.G.3 & III.L Supporting Utility Proposal for Alternate Safe Shutdown Capability In Event of Fire, dated 11/82
NAPS Post Fire Safe Shutdown SE Submittal, dated 6/82

Work Orders / Work Request

W.O. 422576-01, High Temperature O-Ring Installation for "B" RCP Seal, dated 4/3/01

Standards & Codes

UL 910, Test for Flame Propagation and Smoke Density Values for Electrical and Optical Fiber Cables Used in Spaces Transporting Environmental Air, dated 2/95
IEEE 383, Standard for Type Test of Class 1E Electrical Cables, Field Splices and Connections for Nuclear Power Generating Stations, dated 1974