June 02, 2003

INSPECTION SUMMARY - TRIENNIAL FIRE PROTECTION INSPECTION NORTH ANNA POWER STATION

Report Number: 50-338,339/2003-06

Onsite Inspection Dates: Week 1 of onsite inspection - May 5 - 9, 2003
Week 2 of onsite inspection - May 19 - 23, 2003

Inspection Team: Gerry Wiseman ((team lead, fire protection); Shakur Walker (electrical); M. Villaran, Contractor, BNL (Mechanical Systems/Operations).

Accompanying Personnel: N. Staples, Nuclear Reactor Safety Intern, was in training and supported the review of post-fire safe shutdown electrical circuit analysis and fire protection program problems/issues. **Mr. Staples conducted the exit interview for inspector qualification purposes.**

Scope: Routine Triennial Fire Protection Inspection, per IP 71111.05, focusing on selected fire areas/zones listed below. Due to the plant design, the licensee uses an alternative shutdown strategy in order to achieve safe shutdown (SSD). Selected fire areas included:

1. **Fire Area 2 , Main Control Room Complex; Service Building +276'-9" ft. level.**
This fire area is common to both units and consists of the Control Board areas, Computer Rooms, Logic Rooms, and Air Conditioning Rooms. Fire barriers in this area consist of 3-hour rated fire walls, floor and ceiling. The Control Room Complex is protected by a smoke detection system and by an automatic Halon 1301 fire suppression system in the underfloor area. A fire in this area would involve operators of both units to abandon the main control room and accomplish post-fire shutdown activities at the Alternate Shutdown Panels in the ESGR rooms supplemented with indicator readings provided by an operator at the is located on the fuel building monitoring panel. (See attached SRA comments)

2. **Fire Area 5-2, Unit 2 Normal Switchgear Room; Service Building +307'-3" ft. level, including normal power to D, E and F busses.**
Fire barriers in this area consist of 3-hour rated fire walls, floor and ceiling. The ceiling of this fire area is also the Service Building roof. Fire detection includes ionization smoke detectors and thermal detectors. Automatic suppression is provided a low pressure CO_2 system. A fire in this area would involve a shutdown from the main control room. (See attached SRA comments)

3. **Fire Area 6-2, Unit 2 Emergency Switchgear and Relay (ESGR) Room; Service Building +252'-0' and 254'-0' ft. levels.**
The fire area is composed of two emergency switchgear rooms and a relay room. The rooms within each fire area adjoin each other with open passageways between them. The auxiliary shutdown panel for each unit is located in this area. Unit 2 station 125V dc batteries are also located in the area in separate rooms within the switchgear room. Fire

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barriers in this area consist of 3-hour rated fire walls, the floor and the ceiling. Fire detection includes ionization smoke detectors. Suppression is provided with a manually actuated Halon suppression system. A fire in this area would involve shutdown from the main control room including use of Unit 1 equipment and crossties if Unit 2 equipment is not available.

Findings include:

There are four URI's identified during the inspection, pending completion of the Significance Determination Process. These issues are preliminary and subject to management review. Two of these items were identified during the Surry Nuclear Power TFPI and are applicable to North Anna.

1] For certain fire scenarios in the Unit 2 Emergency Switchgear Room, RCP seal injection will be interrupted for a significant period of time (30 minutes). The fire contingency action procedure directs the operator to initially isolate the RCP seal injection. After charging flow to Unit 2 has been reestablished via the charging cross-tie connection from Unit 1, the procedure directs the operator to either verify or reestablish RCP seal injection flow by throttling open the RCP seal injection inlet header isolation valves. Loss of seal injection may result in damage to RCP seal integrity and subsequently to a seal loss-of-coolant condition when seal injection flow is reestablished. Loss of RCP seal injection and recovery thermal shock issues have not been fully bounded by vendor analyses.

NA initiated plant issue (PI) PI-N- 2003-2005 to evaluate the condition. This is a URI pending completion of the SDP, which was also identified at Surry Nuclear Power Station. (Apparent VIO of App. R, III.L, TBD)

The NRC inspectors contend that the building FA would present a worst case time for reestablishing seal injection (60 minutes per SSD analysis)

NA's position for ESGR fire:

- **Will establish RCP seal injection within 30 minutes.**
- **Utilize better procedural control, contrary to Surry, by throttling the seal return valve.**
- **Consistent with Westinghouse guidance (MUHP-1063) and the NA SER.**

2] For a fire in the Unit 2 ESGR, all Unit 2 SSD equipment and associated controls are routed through this area and are potentially lost. The licensee relies upon an alternative shutdown strategy for assuring SSD of the plant for a fire in U2 ESGR (FA 6-2). This strategy includes using crossties with the unaffected unit to provide RCS charging flow. The procedure (2-FCA-2) for aligning the charging system for assured RCS flow requires an operator to enter the Cable Vault/Cable Tunnel to open breakers (16 breakers of valves in the SSD charging system) to remove power from fire affected MOV's to prevent spurious operation. The carbon dioxide (CO_2) gaseous FP system actuation relay devices and circuits are located in the U2 ESGR (FA 6-2). Inadvertent operation of the cable vault and tunnel (CV&T) CO_2 gaseous FP system due to fire in U2 ESGR (FA 6-2) has not been fully evaluated for adverse environmental effects on manual operator actions within cable vault and tunnel identified in the SSD procedures as required to achieved SSD. Licensee UFSAR states that SCBAs are available for operators' use, however,

neither their availability nor instructions to don were identified in the FCA procedure. Operators may be inhibited from performing their assigned manual actions in CV&T.

NA initiated plant issue (PI) PI-N- 2003-2081 to evaluate the condition.
This is a URI pending completion of the SDP, which was not identified at Surry.

NA's position regarding procedures involving Manual actions in CV&T:

- **Procedure deficiency only.**
- **(with SCBA) Still can perform actions as written with delay.**
- **Must take hot short to actuate CO_2 (smart fire) fire suppression system and this would not occur on a Loss of Power.**

3] For a fire in the main control room, the operators abandon the MCR and utilize the Unit 1 and Unit 2 Alternate Shutdown Panels (ASP) in the Unit 1 and Unit 2 ESGRs, respectively, to achieve safe shutdown of the units. The ESGRs share a common ventilation system with the MCR which is not mechanically separated during a MCR fire. A large fire in the MCR areas could generate large amounts of heavy black smoke and toxic gases. While there are smoke dampers in the ventilation system, there are no positive smoke/detection activation devices to signal them to shut. (However, actuation of the Halon system for a fire in the ESGR would signal the dampers to shut.) The open dampers could permit the spread of smoke and toxic gases from the MCR to the ESGR. As a result, smoke could migrate from the MCR to the ESGR . This situation could present a habitability concern for the operators at the Unit 1 and Unit 2 ASPs, while they attempted safe shutdown of their respective units. The MCR abandonment procedure does not require the operators to bring SCBA gear to the ESGR and none is readily available in the area. Also, the Licensee's Analysis of the condition did not include an evaluation of potential maloperation of the ventilation system, or its components, and its effect on habitability at the ASP.

NA initiated plant issue (PI) PI-N- 2003-1585 to evaluate the condition. This is a URI pending completion of the SDP, which was also identified at Surry Nuclear Power Station. (Apparent VIO of App. R, III.L, TBD)

NA's position regarding MCR/ESGR ventilation:

- **Credit should be taken for Fire Brigade ventilation to reduce the fire induced delta in pressure between MCR and ESGR.**
- **Procedural concern (operators at ASP in ESGR).**
- **Multiple and serious failures of exhaust and intake dampers will have to occur before the smoke and toxic gases accumulate significantly.**

4] Fire rated wrap for MCR HVAC exhaust duct in the Unit 2 Normal Switchgear Room is not qualified for the 3-hour test. The licensee did not have an acceptable evaluation for the rating of the fire wrap. The duct is wrapped with 4" thick mineral wool batts. This installation design is based on UL design No. X306 test which qualified the fire resistance rated protection of a minimum size W10X49 steel building column with the mineral wool batts. A steel building column of this size has a mass/unit length of about 49 lb/ft. A standard 18"D 22 gauge duct has a mass/unit length of about 15 lb/ft. The design qualification test did not address the acceptance of using this design on the 18"X18" and 21'X21" 22 gauge duct. The design qualification does not bound installed configuration of 22 gauge duct mass.

NA initiated plant issue (PI) PI-N- 2003-2094 to evaluate the condition. This is a URI pending completion of the SDP. (Apparent VIO of Operating License Conditions 2.D, TBD)

NA's position regarding qualification of the fire retardant wrap:

- **NA will create an evaluation as indicated by PI.**

Other issues:

Additionally two issues are pending receipt of additional guidance and information from the Regional Management and NRR to allow a determination as to whether there is a Generic Issue and whether there are potential findings or not.

UFSAR Items:

1)The team identified UFSAR discrepancies related to the FHA. The team found that the North Anna fire hazards analysis failed to consider and evaluate the combustibility of in-situ plant combustible hazards associated with combustible material and cabling internal to Switchgear (SWGR) and motor control center (MCC) cabinets located in the Emergency Switchgear Room FA 6-2. As a result, the SWGR and MCCs' contribution to fire fuel loading and their effects on safe shutdown capability had not been assessed as specifically described in UFSAR Section 9.5.1.4. The current description of 9.5.4.1.1, Starting Conditions and Assumptions, is unclear in identifying the combustibles considered in the evaluation (9.5.1.4 Evaluation of Postulated Fires).

The UFSAR Section states that the following are combinations of combustible material and ignition sources most likely to start a fire:
1. Spilled oil on hot pipes.
2. Electrical insulation and malfunctioning overload protective devices.
3. Packing materials of wood and paper and carelessly discarded smoking materials.
4. Any Combustible materials and unidentified sources of ignition.

The NRC inspectors interpreted No. 2 above, Electrical insulation and malfunctioning overload protective devices to include combustible material and cabling internal to Switchgear (SWGR) and motor control center (MCC) cabinets. The licensee disagrees with the inspectors and consider only cables in trays within the rooms.

The issue **has not been fully evaluated by the inspection staff.** The licensee states that the impact is very low safety because the higher fuel loading in the associated fire areas/zones (by fire hazards of SWGR and MCCs') was offset buy the licensee's conservative FHA fire load assumptions and calculations and would not increase the duration and severity of postulated fires in those areas beyond that previously analyzed. **This discrepancy may however, have GENERIC implications for which the inspectors will discuss with Regional Management following the inspection.**

NOTE: ---- IPEEE for FA 6-2 assumes 1200 kW maximum HRR fire severity in SWGR + MCCs to develop the area CDF. The licensee has not evaluated the actual fire loading v.s. their

assumed 1200 kw, therefore their calculated risk may be greater and is not plant specific for NAPS.

NA initiated plant issue (PI) PI-N- 2003-2079 to clarify the NAPS UFSAR.

2) UFSAR section 9.5.1.13 incorrectly references the Turbine Driven AFW Pump Rooms are 10 CFR 50 Appendix R, III.G.3 areas as requiring fixed suppression systems, and should have referred to the Motor Driven AFW pump houses.

NA initiated plant issue (PI) PI-N- 2003-2050 to modify the NAPS UFSAR.

3) UFSAR section 8.3.1.1.2.6 states " All cables installed have been specified to meet ... the fire propagation test outlined in IEEE 383". Contrary to this statement, cable tested to UL 910 has been installed at the site. UL 910 does not fully satisfy the requirements of IEEE 383. Furthermore, the licensee does not consider using UL 910 (plenum) cable for different factors including safety-related applications and Appendix R functions (per ET No. CEE 95-032). The FSAR should reflect this and revise the statement to specify that only safety-related and Appendix R cables meet the flame propagation test of IEEE 383.

NA initiated plant issue (PI) PI-N- 2003-2096 to evaluate the condition.

Other Observations:

1. A fire occurring in the NSR or the Service building roof of a less intensity and duration than that for a flashover condition may cause the failure of I unprotected support steel beams and/or columns and collapse of Service building roof onto all stations service transformers. Concern that this is precursor to initiating event (LOOP).

2. NAPS Unit 1 and Unit 2 Fire Protection Operating License Condition (OLC) Condition 2.D does not fully reference NRC approved Fire Protection Plan as reflected in Appdx R SER's as expected in GL 86-10. NAPS LC is not consistent with GL 86-10 Standard and Surry....

Inspection Successes:

- Good synergistic working relationship between inspectors. Prior to inspection (perhaps after info gathering trip), coordination between the various roles (electrical, operations, fire protection) should be established providing each inspector a broad overview of what support they may need to provide to other team members.

- Nuclear Safety Intern (Necota Staples) provided good involvement and support on the review of post-fire safe shutdown electrical circuit analysis and documenting fire protection program issues. He conducted the exit in an excellent manner. There was good, direct, and very forthright exchange during both the Pre-exit and the Exit Meeting concerning the inspection issues which were complex relative to the fire protection regulatory basis. There

was some disagreement with the "tone" of a couple of the potential findings.

- The TFPI team provided site coverage during the first week of inspection while the resident inspectors were unavailable because they were attending the Resident Inspectors Counterpart Meeting in the Regional Office.

- There was good use of the Fire Area Matrix to aid the inspection team to identify the fire areas adjacent to the areas selected for inspection to identify components affected by fire in the selected fire areas and to look at potential component vulnerabilities in the six adjacent fire areas. This is to supplement the triennial fire protection inspection plan to aid the inspectors in their review of (1) normal redundant safe-shutdown train cable separation criteria and (2) Normal redundant train (MCR) and/or alternative safe-shutdown operator actions.

Inspection Challenges:

- The number of assigned inspection hours precludes proper evaluation of many lines of inquiry including tracing cables or walking down local manual operator actions needed to support SDP analysis unless the inspection scope is reduced.

- Each inspector could use training on the basic principles of the other's job. For example, the electrical inspectors asked for more thorough detailed knowledge of DDFP to evaluate the licensee's strategy and/or significance of spurious operation of valves.

- The licensee routinely attempted to use the need for flexibility in plant operations, presence of multiple flow paths and general operator knowledge/common sense (tribal knowledge) as a basis for not needing well defined and thorough procedures.

- The licensee routinely lacked analyses or documentation to support the basis for acceptability of their alternate shutdown approach. Much that was available was anecdotal and was not plant specific. Often the analyses being provided were only recently developed (during the inspection).

- Much of the pre-inspection material (UFSAR and Procedures) was provided by the licensee on CD. However, there was insufficient time and resources available prior to the preparation weeks to properly make enough hard copies of the procedures and documents for each inspector. Therefore, this printing time was spent during the preparation weeks rather than reviews and evaluation of the documents in preparation to inspect. The teams should consider preparing an inspector's notebook to aid each inspectors' review of relevant information more efficiently during the Team Preparation Week.

Suggested areas of routine Inspection focus:

- Evaluate the likelihood of uncontrolled cooldown due to S/G safety valve or PORV stuck open and ability of SSD equipment to survive this transient.

- Pressurizer PORVs and the corresponding block valves should be routinely included as part of the Hi-Lo pressure interface review. Circuits should be analyzed for any

spurious operation. Should include an analysis of whether, if applicable, the isolation switches for the PORVs can be bypassed by a short in the circuit.

- Process monitoring per 10CFR 50, App. R, III.L requires close attention. The necessary instrumentation required for SSD should be outlined in the beginning of the inspection, and each logic diagram should be analyzed and cables traced. Significance increases for III.G.3 fire areas (Alt. S/D).

- If the site being reviewed relies upon a "cross-connect" method between units for SSD, the inspection should postulate the worse case scenario - the minimum power sources available. Review of the breaker coordination should demonstrate what buses may be lost due to a fire in a specific fire area. Once the minimum power source(s) are recognized, it should be evaluated whether the power source(s) are sufficient to power the necessary equipment to shutdown both units [i.e. adequate charging for the units, portable air bottles for air operated valves (AOVs) on a loss of instrument air (LOIA)]. In addition, these alternate components should be free of any damage as a result of the fire in the affected unit.

- As a general input to the Fire Protection Inspector, inspectors conducting the electrical segment of the TFPI should attempt to determine the following while evaluating cables:

  * type of cables used at site (safety, non-safety)
  * mass loading for cable trays (mass/linear ft.) - affects duration of fire
  * width/height (above combustible/ignition source)

- For plant areas with exposed or protected structural steel supporting floors or roofs the inspectors should review structural integrity and fire resistance of the room's roof and floor structural steel members to evaluate adverse consequences due to fire exposure from fires originating on the roof or within the room.

- The use of the Fire Area Matrix to aid the inspection team to identify the fire areas adjacent to the areas selected for inspection to identify components affected by fire in the selected fire areas and to look at potential component vulnerabilities in the six adjacent fire areas should be a recommended practice in all future inspections.