UNITED STATES
NUCLEAR REGULATORY COMMISSION
WASHINGTON, D. C. 20555

SAFETY EVALUATION BY THE OFFICE OF NUCLEAR REACTOR REGULATION
APPENDIX R TO 10 CFR PART 50, ITEMS III.G.3 AND III.L
VIRGINIA ELECTRIC AND POWER COMPANY
NORTH ANNA POWER STATION UNITS 1 AND 2
DOCKET NOS. 50-338 AND 50-339

1.0 INTRODUCTION

On February 19, 1981, the fire protection rule for nuclear power plants, 10 CFR 50 and Appendix R to 10 CFR Part 50, became effective. This rule required all licensees of plants licensed prior to January 1, 1979, to submit by March, 1980: (1) plans and schedules for meeting the applicable requirements of Appendix R, (2) a design description of any modifications proposed to provide alternative safe shutdown capability pursuant to Paragraph III.G.3 of Appendix R, and (3) exemption requests for which the tolling provision of Section 50.48(c)(6) was to be invoked. Sections III.G and III.L of Appendix R are retrofit items to all pre-1979 plants regardless of previous SER positions and resolutions. The criteria contained in Section III.L of Appendix R is used for those cases whose licensees are incorporating alternate or dedicated shutdown capability.

By submittal dated June 22, 1982, the licensee described the means by which safe shutdown can be achieved in the event of fire and proposed modifications to the North Anna Power Station Units 1 and 2 to meet the requirements of Appendix R to 10 CFR Part 50, Items III.G.3 and III.L. This submittal summarizes all of the work contained in the previous submittals and provides answers to the questions contained in our Generic Letter 81-12. While this document and the preceding correspondence is

extensive and fairly complete, several questions in the areas of systems and associated circuits were clarified in a meeting with the licensee on August 5, 1982.

The licensee has provided a safe shutdown analysis for a fire event and has demonstrated that adequate redundancy and/or an alternative safe shutdown method exists for those systems required to assure safe shutdown. Our analysis and evaluation of this follows:

SYSTEMS USED FOR POST-FIRE SAFE SHUTDOWN

A. Systems Required for Safe Shutdown

Safe shutdown of the reactor is initially accomplished by control rod insertion either manually upon discovery of fire or automatically on the loss of offsite power.

Reactor coolant inventory and subsequent reactivity control is maintained by one or both sets of charging pumps, injecting borated water using either the CVCS system or the refueling water storage tank as a source of borated water. A cross connection between the manifolds of Unit 1 and Unit 2 charging pumps, which can be operated manually, enables either set of pumps to feed both units in case of fire affecting the charging pumps of either unit.

Decay heat removal is accomplished by natural circulation flow in the core and heat transfer to the steam generators, only one of which is required for this function. The heat is transmitted via steam dump directly to the atmosphere using the atmospheric steam dump valves. Feedwater is provided either by the steam driven or motor driven auxiliary feedwater pumps which, for each unit, are located in separate fire areast The water source for each unit is a 110,000 gallon emergency condensate tank with three backup sources including a 300,000 gallon main condensate storage tank, the fire main and the service water system.

Primary system pressure is maintained by the charging pumps. The pressurizer heaters are not used during shutdown.

The RHR system is used for decay heat removal for maintaining cold shutdown conditions. This requires both the component cooling and the service water system to be operational. The service water system is also required for hot shutdown and has two redundant pumps in separate fire areas. Electrical systems used for safe shutdown are the 4160 VAC, 480 VAC, 240 VAC, 120 VAC and 125 VDC distribution systems.

B. Areas Where Alternate Safe Shutdown is Required

The licensee stated in a June 22, 1982 submittal, that a study of the post-fire safe shutdown capability has been made for all fire areas. As a result of this study, the licensee concluded that the areas in the plant that do not meet the requirements of Section III.G.2 of Appendix R are as follows:

- Unit 1 and 2, Control Room
- Unit 1, Emergency Switchgear Room
- Unit 2, Emergency Switchgear Room
- Unit 1, Cable Vault and Tunnel
- Unit 2, Cable Vault and Tunnel
- Unit 1, Auxiliary Building
- Unit 2, Auxiliary Building

The licensee has provided the alternate shutdown capability independent of the cabling and equipment in these areas. An alternate shutdown panel, located in each of the respective units emergency switchgear room, contains the necessary controls for safe shutdown and is electrically isolated from the control room to the extent that a fire in the control room will not affect its function. However, a fire in the emergency switchgear room which affects the alternate shutdown panel could impair the operability of controls and instrumentation in the control room. Thus, an electrically isolated remote panel

will be installed in the fuel building to provide instrumentation needed for process monitoring. This panel will include displays for both units for the following parameters:

- Pressurizer level
- Pressurizer pressure
- Reactor coolant hot leg temperature
- Reactor coolant cold leg temperature
- Steam generator level
- Steam generator pressure
- Source range neutron flux

These are all in addition to the instrumentation available for each unit at the auxiliary shutdown panels located in the individual emergency switchgear rooms. The auxiliary shutdown panel and new remote primary instrumentation panel are electrically isolated from the control room by isolation switches. The isolation switches are not keylocked but are alarmed in the control room when in the local position.

The system/component which could be affected by a fire, common to all of the above identified areas, are the CVCS charging pumps. A fire in any of these areas could render the unit's CVCS charging pumps inoperable from the control room. As such, the licensee has provided a "cross-tie" capability which allows the component(s) of the opposite unit to fulfill the shutdown requirements of the affected unit in the event such a configuration is needed. Power, instrument and controls associated with the charging pumps would be from the unaffected unit's power sources and routed completely outside the cable vault and tunnel of the fire affected unit. No other components or instrumentation need to be cross-tied to achieve safe shutdown conditions since other plant functions will be controlled or monitored by the normal equipment or the "new" remote panel.

C. Section III.G.2 of Appendix R

The licensee has stated that all fire areas of the plant not required to have an alternate safe shutdown system will comply with the requirements of Section III.G.2 of Appendix R; therefore, no technical exemptions were requested.

EVALUATION

A. Performance Goals

The performance goals for post fire safe shutdown can be met using the existing mechanical systems and equipment listed in Section A above. The control of these functions can be accomplished using the existing alternate shutdown methods or the control room depending on the location of the fire.

The process monitoring instruments to be used for a post fire shutdown are available at each units' auxiliary shutdown panel in addition to the new instrumentation to be provided in the fuel building (Section B). The instrumentation at each auxiliary shutdown panel includes pressurizer pressure and level, T_{avg} indication, steam generator level, main steam line pressure, auxiliary feedwater pump discharge pressure, condensate storage tank level, charging flow and status of the control and relay room emergency vent.

The licensee provided alternate shutdown capability via the auxiliary control panel and by adding capability to operate the diesel generators from outside the control room.

The support systems for the post fire safe shutdown are the redundant diesel generator system, the emergency bus distribution system and the service water system. Adequate separation exists between redundant trains of these systems to assure safe shutdown capability following a fire in any fire area.

B. 72 Hour Requirement

The licensee is capable of bringing either unit to cold shutdown within 72 hours after a fire event in that unit.

C. Repairs

The only repairs contemplated which may be necessary to reach cold shutdown following a fire are rerouting power cables to RHR pumps. The licensee has noted that a procedure for such repairs has been developed and the materials required will be maintained on site.

D. Associated Circuits and Isolation

The licensee satisfactorily addressed associated circuits of concern utilizing the fire area approach as described in the clarification of Generic Letter 81-12. As the result of the licensee's associated circuit study, several modifications were made which rerouted alternate shutdown instrument cables to prevent them from passing through fire areas containing normal* safe shutdown equipment. The licensee has addressed all three types of associated circuits as discussed below:

1. Common Power Source

Associated circuits that are powered from the vital bus and are associated with the safe shutdown circuits by a common power supply are protected by coordinated circuit breakers and fuses. This includes control power for instrumentation loops.

2. Spurious Signal

The devices whose inadvertent operation by spurious signals could affect safe shutdown have been identified as shutdown circuits and are included in the licensee's submittal. The licensee has considered shorts to

* The licensee denotes all shutdown equipment which is not alternate or dedicated as normal shutdown equipment.

ground, open circuits and hot shorts in the analysis. We find the analysis and the isolation devices proposed satisfactory, since adequate electrical isolation is provided.

3. Common Enclosures

The licensee stated that there are no circuits of concern that share a common enclosure with circuits of the alternative shutdown systems since all cables are protected by circuit breakers or fuses. This satisfactorily resolves this concern.

E. Emergency Diesel Generators

During the associated circuits study, the licensee found that a control room fire might impair control of the diesel generators since the only control location for the diesel generators was the control room. The licensee has committed to provide the capability for control of the emergency diesel generators from the remote panels located in the diesel generator rooms. The diesel generator control circuit to the remote panel will be electrically isolated, so that a fire in any other area of the plant will not affect its operation.

F. High/Low Pressure Interface

The licensee has identified two high/low pressure interfaces: (1) RHR Interlock Valves and (2) Pressurizer Power Operated Relief Valves.

The RHR interlock valves protect the high-low pressure interface between the RHR system and the reactor coolant system. Each unit has two valves in series, both of which must be opened to break the interface. Circuit breakers feeding power to each valve are located in the cable vault, remote from the valves themselves. To assure that the interface will be protected, the licensee's procedures call for the breakers for one of the series MOVs to be open at all times when the primary system pressure is above the RHR system operating pressure. We have reviewed this feature and found it acceptable.

The licensee stated that the pressurizer power operated relief valves control circuit could be damaged by a fire in the emergency switchroom or the control room such that the power operated pressurizer relief valves could stick open. The licensee has committed to develop procedures which will require opening the control power breaker when status indication of either PORV is lost or in the event control room evacuation is required.

The control loop is powered from a 120V breaker and opening the breaker will close the valve. The breaker can be opened in less than four minutes while greater than 20 minutes is available before the beginning of core uncovery. We therefore find the licensee's consideration of high/low pressure interfaces to be acceptable.

G. Safe Shutdown Procedures and Manpower

The licensee has committed to develop and implement detailed written procedures for obtaining a safe shutdown condition given a fire event. These procedures will be approved and made operational by the licensee. The licensee's fire brigade technical specifications require five members in accordance with Appendix R. The licensee stated in a May 19, 1981 letter that sufficient manpower will be available for accomplishing manual operations required for safe shutdown of the plant. Based on the licensee's commitment to provide adequate manpower, we find the licensee's response to be acceptable.

CONCLUSION

The goals of reactivity control, inventory control, decay heat removal and pressure control, process monitoring and adequate support systems have been met. Based on our review, we conclude that the North Anna Station Units 1 and 2 meet the requirements of Appendix R to 10 CFR Part 50, Items III.G.3 and III.L, with respect to safe shutdown in the event of a fire.