CRYSTAL RIVER UNIT 3

SAFETY EVALUATION REPORT

APPENDIX R TO 10 CFR 50

INTRODUCTION

On February 19, 1981, the fire protection rule for nuclear power plants, 10 CFR 50.48 and Appendix R to 10 CFR 50 became effective. The rule required all licensees of plants licensed prior to January 1, 1979, to submit by March 19, 1981: (1) plans and schedules for meeting the applicable requirements of Appendix R, (2) a design description of any modification proposed to provide alternative safe shutdown capability pursuant to Section III.G.3 of Appendix R, and (3) exemption requests for which the tolling provisions of Section 50.48(c)(6) was to be invoked. Section III.G of Appendix R, "Fire Protection of Safe Shutdown Capability" was retrofitted to all pre-1979 plants regardless of previous SER positions and resolutions.

By submittal dated October 29, 1982, the licensee provided the description of the proposed modifications to the Crystal River plant to meet the requirements of Appendix R to 10 CFR 50, Section III.G. The proposed modification will also resolve the open items concerning alternative shutdown from our previous

SER. Additional information and clarification was provided by submittals dated June 30, 1982, December 9, 1982, and December 17, 1982.

Our previous fire protection Safety Evaluation Report (SER) dated July 27, 1979 concerning Branch Technical Position APCB 9.5-1 indicated that in certain plant areas redundant systems could be damaged by a single fire which would affect safe shutdown. The licensee was requested to provide alternative shutdown capability for areas which could not be protected by fire barriers, fire detection and fire suppression systems.

Our evaluation of the licensee's submittals follows:

SYSTEMS USED FOR POST-FIRE SAFE SHUTDOWN

A. Systems Required for Safe Shutdown

Safe shutdown is initiated from the control room by a manual scram of the control rods. Reactor coolant inventory and reactivity control are maintained by one of the three makeup and purification pumps taking suction from the borated water storage tanks (BWST). Primary system pressure is maintained by the pressurizer heaters, the makeup pumps taking suction from the BWST combined with letdown flow, and the pressurizer spray (cold shutdown only).

For hot shutdown, decay heat removal is accomplished by the emergency feedwater pumps supplying water to the steam generators from the condensate storage tank. The atmospheric dump valves are used to remove heat from the steam generators. For cold shutdown, decay heat removal is accomplished by the decay heat removal system in conjunction with the decay heat closed cycle cooling system and the decay heat seawater cooling system.

Support for the above systems is provided by the reactor building cooling system, the nuclear service closed cycle cooling system, the nuclear service seawater cooling system, essential area HVAC systems and the 125 volt DC power system. In the event of a loss of offsite power, the diesel generators will be utilized to power the safe shutdown systems. The shutdown system will be monitored and controlled from the control room or the dedicated shutdown panel, local control stations, switchgear, and motor control centers.

B. Areas Where Alternative Safe Shutdown is Proposed

The licensee's proposed modification provides alternative shutdown capability for the control room, cable spreading room and control complex HVAC equipment room.

C. Remaining Plant Areas

By letter dated October 29, 1982, the licensee stated that the Crystal River Unit 3 plant would be modified to comply with Section III.G.2 of Appendix R except as noted above. Plant modifications are needed to comply with Section III.G.2. The proposed plant modifications include: (1) the addition of three-hour barriers to separate redundant equipment, (2) relocation of cabling, (3) locking out power to valves to prevent fire induced spurious operation and (4) providing one-hour rated barriers enclosing cable trays and conduit.

D. Alternative Safe Shutdown System

The alternative shutdown capability will consist of a dedicated shutdown panel, redundant dedicated shutdown auxiliary equipment cabinets, redundant dedicated shutdown relay cabinets, local control stations, and motor control centers. The design of the alternative shutdown capability provides the capability of operating at least one train of the systems needed for safe shutdown listed in Section A above. In addition, the design provides for redundancy for most systems used for safe shutdown. The dedicated shutdown panel (DSP) will be located in a fire area designated as the dedicated shutdown room. One set of cabinets, a dedicated shutdown auxiliary equipment cabinet and a relay cabinet, is located in the switchgear room "A" and the other set of cabinets is located in switchgear room "B". The design of the dedicated shutdown panel provides electrical isolation from the control room by transfer switches located in the dedicated shutdown auxiliary equipment cabinets. Thus, a fire in either the dedicated shutdown room or the control room will not result in loss of control of the systems needed for safe shutdown at the other location. A fire in either of the switchgear rooms would result in loss of only one train of systems needed for safe shutdown.

EVALUATION

A. Performance Goals

For post-fire shutdown, the performance goals of the alternative safe shutdown capability will be met using the systems listed in Section A above. Reactivity control will initially be provided by a manual scram of the control rods from the control room. Continued shutdown reactivity control is provided by the makeup and purification pumps taking suction from the borated water storage tank (BWST). Two makeup pumps are used for safe shutdown and are started at the switchgear. An optional third makeup pump is also available for shutdown. The valves for the makeup and purification system are controlled at the DSP. Reactor coolant inventory and primary system pressure are maintained utilizing the makeup pumps and the letdown line. The valves in the letdown line are controlled at the DSP. Additionally, the option of using a group of pressurizer heaters which are controlled at the DSP, is available to the operator. Some repairs may be necessary to provide control of the pressurizer heaters. For cold shutdown, pressurizer spray through the decay heat removal pump connection to the spray valve, can be made available with some repairs, to provide additional pressure control.

Decay heat removal will initially be provided by the atmospheric dump valves and the turbine-driven emergency feedwater pump. Control of steam to the emergency feedwater pump and the atmospheric dump valves is provided at the DSP. Additionally, the motor driven emergency feedwater pump can be started at the switchgear. Flow control for the emergency feedwater system is provided at the DSP. For cold shutdown, the decay heat removal system, the decay heat closed cycle cooling system and the decay heat seawater cooling system are utilized for decay heat removal. The pumps for these systems can be started at the switchgear utilizing repairs to the control power circuit. Flow control for the decay heat removal system is provided at the DSP. The cooling water systems will be controlled locally.

Processing monitoring for safe shutdown will be provided by the instrumentation at the dedicated shutdown panel. The following variables are monitored at the DSP: pressurizer level, pressurizer temperature, reactor coolant pressure, reactor coolant hot leg temperature, reactor coolant cold leg temperature, steam generator pressure and steam generator level. The DSP also includes monitoring of emergency feedwater flow, makeup flow, condensate storage tank level and BWST level. However, the DSP does not include a source range neutron flux monitor. We require that the licensee provide a source range neutron flux monitor electrically independent of the control room and cable spreading room. (It should be noted that this instrumentation does not have to be safety grade, but only meet the requirements of Section III.L.6 of Appendix R).

Support systems required for safe shutdown include the nuclear service closed cycle cooling system (NSCCC), the nuclear service seawater cooling system (NSSC), the reactor building cooling system, essential area HVAC systems, the 125 volt DC power system and the diesel generators. The NSCCC pumps and valves can be controlled at the DSP. The NSCCC and the reactor building cooling system will be operated from the switchgear and motor control centers. The diesel generator will be provided with the capability to automatically initiate on loss of offsite power, and to be electrically independent of the control room and cable spreading room. A dedicated HVAC system will be provided for ventilation and cooling of the dedicated shutdown panel, power supply and switchgear. The licensee has not completed the design of the dedicated HVAC system; and thus, the HVAC system review is not included in this report.

B. <u>72-Hour Requirement</u>

The alternative shutdown systems have the capability of achieving cold shutdown within 72 hours. The alternative shutdown systems can accomplish cold shutdown using only onsite power sources.

C. <u>Repairs</u>

The licensee intends to utilize repairs to restore control of some optional equipment for usage during hot shutdown such as the pressurizer heaters. Additionally, the licensee will utilize repairs to restore control of the decay heat removal system and other components used for cold shutdown. The repairs generally include wire removal, installation of temporary circuits or wiring at the motor control center or switchgear, in order to provide local control of equipment. The licensee has developed procedures for these repairs and all material needed for the repairs will be stored onsite.

D. Associated Circuits

The licensee provided the results of their associated circuits review for the control room and the cable spreading room. The results identified the associated circuits of concern in these areas and the proposed methods for protecting the safe shutdown capability from fire-induced failures of these circuits. The proposed methods for protecting the safe shutdown capability are consistent with the guidelines provided by us.

1. Power Source Case - The licensee's analysis concluded that power circuits which share a common power bus with the power circuits of the dedicated shutdown panel are provided with coordinated fuses and breakers or are isolated from the power source via transfer switches.

2. Spurious Signal Case - The licensee's analysis identified a number of circuits whose fire-induced failures may adversely affect the safe shutdown capability. The licensee has proposed methods for protecting the safe shutdown capability. Over 80 valves will be electrically isolated from the control room and will be controllable from the DSP. Valves for cold shutdown systems may utilize repair to provide local control as stated above. Additionally, a number of circuits will be re-routed independent of the control room and cable spreading room. For instrumentation circuits, voltage to current converters will be installed. The alternative shutdown capability relies on automatic start of the diesel generator on loss of offsite power. Thus, for each diesel generator, the control room controls for the governor, one of the redundant start circuits, and stop circuits will be isolated from the control room and cable spreading room. Further, for prevention of a possible fire-induced LOCA, the power for one of the redundant electrically controlled valves at the high/low pressure interface of the reactor

coolant loop and decay heat drop line, will be locked closed by locking out the breaker at the Motor Control Center.

3. Common Enclosure Case - The licensee's analysis identified the associated circuits which share a common enclosure with the alternative shutdown circuits. These circuits are isolated by transfer switches at either the dedicated shutdown auxiliary panels or at the dedicated shutdown panel.

E. Safe Shutdown Procedures and Manpower

The licensee will revise existing procedures EM-101, "Fire Protection Plan" and EP-113, "Plant Shutdown from Outside Control Center" prior to operation of the dedicated shutdown panel. The manpower necessary for safe shutdown using the dedicated shutdown panel will be available. No fire brigade members are included in the shutdown manpower requirements.

The licensee will submit Technical Specifications for the dedicated shutdown panel prior to operation of the panel.

CONCLUSION

Based on our review, we conclude that the performance goals for accomplishing safe shutdown in the event of a fire, i.e., reactivity control, inventory control, decay heat removal, pressure control, process monitoring and support function are met by the proposed alternative shutdown capability with the exception of the capability to monitor neutron flux. We require that the licensee provide a source range neutron flux monitor electrically independent of the control room and cable spreading room. This instrumentation does not have to be safety-grade, but only meet the requirements of Section III.L.6 of Appendix R. The justification for our requirement is provided below. Additionally, the licensee has committed to provide a dedicated HVAC system that meets the requirements of Section III.G of Appendix R. However, the licensee has not completed the design of the HVAC system. We will provide a separate evaluation for the HVAC system. Therefore, we conclude that the licensee's alternative shutdown capability for the control room, the cable spreading room and the control complex HVAC equipment room complies with the requirements of Section III.G.3 and III.L of Appendix R pending the licensee's commitment to provide a source range neutron flux monitor.

SOURCE RANGE NEUTRON FLUX MONITOR

STAFF POSITION

Section III.L.2 of Appendix R to 10 CFR 50 requires provision for direct readings of the process variables necessary to perform and control the reactor shutdown function. The staff considers neutron flux as a process variable. Monitoring of core flux provides the only direct indication of the reactor shutdown condition. The monitoring of any other process variable will provide an inferred answer only. With regard to the fission process, changes in neutron flux provides the quickest and only direct means of assessing reactor criticality conditions. Dilution events caused by the postulated spurious operation of valves could result in power ascension condition which would not be readily detected by interpreting the changes in other process variables (such as reactor coolant temperature or pressure). Periodic sampling of the reactor coolant for boron concentration is considered inadequate for determining "real-time" boron requirements. Additionally, should the operators fail to detect a loss of negative reactivity in a timely manner, the capability to prevent a criticality is indeterminate since components needed for such actions may be unavailable due to fire. Thus, provisions for post fire source range flux monitoring are required.