UNITED STATES
NUCLEAR REGULATORY COMMISSION
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SAFETY EVALUATION BY THE OFFICE OF NUCLEAR REACTOR REGULATION

MAINE YANKEE ATOMIC POWER COMPANY

MAINE YANKEE ATOMIC POWER STATION

DOCKET NO. 50-309

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.3 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 November 24, 1982, the licensee provided a description of the proposed modifications to the Maine Yankee Plant to meet the requirements of Appendix R to 10 CFR 50, Section III.G. The proposed modifications will also resolve the alternative shutdown open items for our previous fire protection Safety Evaluation dated June 22, 1979 concerning Branch Technical Position APCB 9.5-1.

Additional information and clarification was provided through telephone conferences of December 10, 1982 and December 13, 1982, through a meeting held on December 16, 1982, and by a submittal dated December 22, 1982. 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. Additionally, a scram can be initiated by opening the scram breakers in the switchgear room. Reactor coolant inventory is maintained by one of three charging pumps taking suction from the refueling water storage tank. An auxiliary charging pump is also available for inventory makeup. Reactivity control is provided by one of three boric acid transfer pumps taking suction from the concentrated boric acid tank, in conjunction with the charging system. If the boric acid transfer pumps are not available, boration is available by a gravity feed from the concentrated boric acid tank to the auxiliary charging pump suction. Primary system pressure is maintained by the charging system combined with letdown.

For hot shutdown, decay heat removal is accomplished by the auxiliary feedwater pumps, supplying water to the steam generators from the demineralized water storage tank. The decay heat release valve (atmospheric dump valve) is used to remove heat from the steam generators. For cold shutdown, decay heat removal is accomplished by the residual heat removal system.

Support for the above systems is provided by the service water system and the component cooling water system. In the event of a loss of offsite power, the diesel generators will be utilized to power the safe shutdown systems. The shutdown systems will be monitored and controlled from the control room or the alternate shutdown panel.

B. Areas Where Alternative Safe Shutdown is Proposed

The licensee's proposed modification provides alternative shutdown capability for the control room and cable chase, the protected cable vault, the cable tray rooms, the turbine building, the circulating water pumphouse, and the switchgear room (protected).

C. Remaining Plant Areas

By letter dated December 22, 1982, the licensee indicated that the Maine Yankee Plant would meet the requirements of Section III.G.2 of Appendix R except as noted above. The licensee provided a list of the plant areas which would comply with Section III.G.2 of Appendix R.

D. Alternative Safe Shutdown System

The alternative shutdown capability utilizes the auxiliary charging pump, the turbine-driven auxiliary feedwater pump and the diesel driven fire pump for safe shutdown. The alternative shutdown capability consists of an alternate shutdown panel (ASP), a new diesel generator, a new 125V DC battery and battery charger, a new 120V inverter and a cooling unit for the auxiliary charging pump. The alternate shutdown panel will be located in the auxiliary feedwater pump room. The new electrical components will be provided with a new enclosure adjacent to the auxiliary feedwater pump room. The diesel generator will be located in the plant yard separate from the plant's present diesel generators.

The new diesel generator will supply power to the new electrical bus to power the auxiliary charging pump, two air compressors, a number of motor-operated valves, the new battery charger and the auxiliary charging pump cooler motor. The new electrical bus will be normally powered from the plant's essential electrical distribution system. The new electrical bus will be isolated from the plant's electrical distribution system by mechanical and electrical interlocked breakers.

The alternate shutdown panel (ASP) provides control and isolation for the auxiliary charging pump and its cooler, the turbine driven auxiliary feedwater pump steam supply and flow control valves, the excess flow check valves (main steam line isolation valves), the decay heat release valve, two air compressors, the letdown isolation valve, and the seal water return valves. The isolation/transfer switches for these components are located on the ASP. In the event of a fire at the ASP (auxiliary feedwater pump room), control of these components and the motor-driven auxiliary feedwater pumps could potentially be damaged. However, safe shutdown could be achieved utilizing the normal charging pumps which would be controllable from the control room and the turbine-driven

auxiliary feedwater pump which would be manually controlled. The turbine-driven auxiliary feedwater pump is located in the steam and feedwater valve area which is separate from the auxiliary feedwater pump room.

EVALUATION

A. Performance Goals

For post-fire shutdown, the performance goals of the alternative safe shutdown capability will be met using the auxiliary charging pump, the turbine-driven auxiliary feedwater pump and the diesel-driven fire pump. Reactivity control will initially be provided by a manual scram of the control rods from the control room or by opening the scram breakers in the switchgear room. Continued shutdown reactivity control will be provided by the auxiliary charging pump utilizing a manually controlled gravity feed from the concentrated boric acid tank to the pump suction. Reactor coolant inventory and primary system pressure will be maintained by the auxiliary charging pump in conjunction with letdown (manually aligned).

Decay heat removal will initially be provided by the turbine-driven auxiliary feedwater pump (AFP) and decay heat release valve. The turbine-driven AFP would be used until reactor coolant temperature is reduced to approximately 300°F. The diesel-driven fire pump would then be manually aligned to feed the steam generators. As reactor coolant temperature is reduced, the fire pump would be used to fill the steam generator(s). The steam generator(s) would be used in a water solid mode for residual heat removal. For this event (water solid mode) the residual heat removal system is assumed to have been damaged by the fire.

An analysis demonstrating the acceptability of using a water solid mode of steam generator operation has not been completed by the licensee. The licensee's analysis will address the adequacy of the steam piping to support the added water, the radiological effects considering steam generator tube leakage, and the time required to achieve cold shutdown.

Process monitoring for safe shutdown will be provided by the instrumentation at the alternate shutdown panel (ASP). The following variables are monitored at the ASP: pressurizer level, pressurizer pressure, reactor coolant hot leg temperature, reactor coolant cold leg temperature, steam generator level, main steam pressure and neutron flux (source range). The ASP also includes monitoring of the auxiliary charging pump and the diesel generator.

Support systems required for safe shutdown include the diesel generator, a cooling unit for the auxiliary charging pump and temporary fans for ventilation of shutdown equipment.

B. 72-Hour Requirement

By letter dated December 22, 1982, the licensee requested an exemption from the requirement of achieving cold shutdown within 72 hours. The licensee proposes a method of achieving cold shutdown utilizing a water solid mode of steam generator operation for the situation wherein the residual heat removal system is lost due to the fire. This method will require about 130 hours to reach a cold shutdown condition. Adequate water supply is available for the extended shutdown. Additionally, the alternative shutdown systems can accomplish cold shutdown using only onsite power sources. Since the alternative shutdown system uses only onsite power, we conclude that the licensee's exemption request is acceptable. With the residual heat removal system operable the 72 hour requirement can be met.

C. Repairs

The alternative shutdown capability utilizes repairs to align the diesel driven fire pump to the steam generators. A transfer hose will be connected to an existing yard fire hydrant and a flanged connection in the discharge line of the feedwater pump. The transfer hose will permit the diesel-driven fire pump to feed the steam generators. Additionally, the main

steam linesmay need to be cradled or pinned to support the weight of the water. The extent of supports will be identified in the licensee's analysis as discussed above. A transfer hose will also be used to provide makeup to the demineralized water storage tank (water source for auxiliary feedwater system). The licensee will develop 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. The results identified the associated circuits of concern 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 alternative shutdown capability utilizes a dedicated diesel generator and electrical bus. The power circuits which share a common power bus with the power circuits of the alternative shutdown equipment are protected by coordinated fuses and breakers. The dedicated electrical bus is protected from the normal electrical buses by fuses, breakers and 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. For prevention of a possible fire-induced LOCA, the power for one of the redundant electrically controlled valves at a high/low pressure interface will be removed during normal plant operation. These interfaces include the RHR isolation line, reactor vent line, pressurizer vent line and the loop drain line. For the PORVs and block valves, the licensee will provide procedures for areas that contain control circuits for the PORV. The procedures will require that the operator remove power to the PORV (fail close on loss of power) upon notification of a fire in these areas. Additionally, the alternate shutdown panel (ASP) contains controls to isolate a number of valves whose fire-induced failures may adversely affect safe shutdown. These include: the letdown isolation valve, the reactor coolant pump seal return valves and the main steam excess flow check valves. The licensee will also provide procedures to verify valve position and manually isolate if necessary, valves which may fail as a result of the fire, but do not directly affect safe shutdown.

3. Common Enclosure Case - The licensee's analysis identified no instances where associated circuits share a common enclosure with the alternative shutdown circuits and are not electrically protected by circuit breakers, fuses or similar devices.

E. Safe Shutdown Procedures and Manpower

The licensee will develop and implement written procedures for obtaining safe shutdown conditions given a fire event. The manpower necessary for safe shutdown using the alternate shutdown panel will be available. No fire brigade members are included in the shutdown manpower requirements.

The licensee will submit Technical Specifications for the alternative shutdown capability upon completion of the plant modifications. The Technical Specification will require surveillance testing of the new diesel generator and electrical system similar to the requirements for the plant's present diesel generators and electrical systems. The Technical Specifications will also limit the out of service time of the new power system to 24 hours. After 24 hours, the licensee will provide a fire patrol for the fire zones for which the alternative shutdown capability was provided. Within seven days, the licensee will restore the equipment to an operable status or install temporary equipment.



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 pending the licensee's analysis concerning acceptable solid steam generator operation. We conclude that the licensee's exemption request concerning the time to achieve cold shutdown is acceptable. Therefore, we conclude that the licensee's alternative shutdown capability for the control room, the cable chase, the protected cable vault, the cable tray rooms, the switchgear room, the turbine building and the circulating water pumphouse complies with the requirements of Sections III.G.3 and III.L of Appendix R pending receipt of the licensee's analysis for the secondary side solid steam generator operation. As previously stated, this SE also resolves the alternative shutdown open items in our SE dated June 22, 1979.

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