UNITED STATES
NUCLEAR REGULATORY COMMISSION
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Enclosure 2

SAFETY EVALUATION BY THE OFFICE OF NUCLEAR REACTOR REGULATION
RELATED TO ALTERNATE SHUTDOWN CAPABILITY
PURSUANT TO 10 CFR 50, APPENDIX R

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PENNSYLVANIA ELECTRIC COMPANY
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THREE MILE ISLAND NUCLEAR STATION, UNIT NO. 1

DOCKET NO. 50-289

1.0 INTRODUCTION

On February 17, 1981, the fire protection rule for nuclear power plants, 10 CFR 50.48 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 19, 1981: (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. Section III.G of Appendix R is a retrofit item 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 where licensees are incorporating alternate or dedicated shutdown capability.

The NRC staff's previous fire protection Safety Evaluation Report (SER) dated September 1978, noted that increased capability for safe shutdown from outside the control room for fires in the control room and relay room was required. The SER further noted that the licensee had committed to provide necessary modifications to attain this capability. This SE addresses these modifications.

By submittals dated July 1, 1982, October 1, 1982, November 15, 1982, and December 2, 1982, the licensee described proposed modifications to Three Mile Island, Unit 1 to meet the requirements of Appendix R to 10 CFR Part 50, Items III.G.3 and III.L. The licensee also responded to an earlier staff request for additional information transmitted to the licensee by letter dated May 10, 1982. Additional information and clarification was obtained during a meeting held on November 5, 1982. The licensee's report entitled "Three Mile Island, Unit 1 Fire Hazards Analysis Report and Appendix R Section III.G Safe Shutdown Evaluation" enclosed with the July 1, 1982 letter contained the majority of the information on the safe shutdown capability.

The licensee has provided a safe shutdown analysis for a fire event and has demonstrated that adequate redundancy exists and/or alternative safe shutdown capability is available. Our evaluation of this follows.

2.0 POST-FIRE SAFE SHUTDOWN CAPABILITY

2.1 Systems Required for Safe Shutdown

Shutdown of the reactor and reactivity control is initially performed by rod insertion from the control room. Reactor coolant inventory and long term reactivity control is maintained by one of the makeup pumps. Primary system pressure control is maintained by the pressurizer heaters, letdown flow, makeup pump, and pressurizer spray (cold shutdown only). Decay heat removal during hot shutdown is accomplished by the emergency feedwater system and atmospheric dump valves or main steam safety valves. Decay heat removal during cold shutdown is accomplished by the decay heat removal system, decay heat closed cooling water system, and decay heat river water system.

2.2 Areas Where Alternate Safe Shutdown is Required

The NRC staff, in its fire protection SER, requested that the licensee install alternative shutdown capability independent of the cabling and equipment in the control room and relay room (cable spreading room) where redundant cabling/equipment required for safe shutdown cannot meet the requirements of Appendix R, Section III.G.2. The licensee has provided alternative safe shutdown capability for the above areas.

2.3 Section III.G.2 of Appendix R

The licensee also stated that all other 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, unless an exemption request has been approved by the staff.

2.4 Alternate Safe Shutdown System

The alternate safe shutdown system required for the control room and relay room utilizes existing plant systems and equipment as identified in Section 2.1, and a remote shutdown station. The remote shutdown station consists of the two existing electrically

independent remote shutdown panels plus new electrically isolated panels in the same area which will provide additional equipment control capability independent of the control and relay room. Transfer switches provide the electrical isolation capability for these controls. Existing controls are provided at the remote shutdown panels for the atmospheric dump valves and emergency feedwater flow control valves. Safe shutdown instrumentation is also provided at the existing remote shutdown panels, and at local locations. The instrumentation is provided with separate power cables independent of those for control room indication. Modifications are required, however, to provide electrical isolation for the source range neutron flux monitor at the remote shutdown panels. Additional controls will be provided at the new panels for one train of various safe shutdown and support system equipment including makeup system pump and valves, decay heat closed cooling water pump, decay heat river water pump, intermediate closed cycle cooling water pump, nuclear services closed cycle cooling water pump, and letdown line valves. Electrically isolated local control stations at the associated switchgears are or will be provided for a diesel generator, emergency feedwater pump, pressurizer heaters, decay heat removal pump, instrument air compressor, nuclear river water pump, reactor river water pump, and reactor building fan.

Some valves in the above systems will be manually operated at the valve as necessary. The isolation design for the remote shutdown station is such that a fire at the panels will not result in loss of necessary control and indication within the control room. "Cut and jumper" repairs are also required for certain automatic signal bypassing and to provide control of other equipment not immediately required for hot shutdown and required for cold shutdown. This is discussed further in Section 3.3. The existing plant design and modifications assure availability of equipment essential for achieving safe shutdown assuming loss of offsite power in the event of a control room or relay room fire.

3.0 EVALUATION

3.1 Performance Goals

The alternate shutdown system described in Section 2.4 will enable the achievement of the performance goals outlined in Section III.L of Appendix R as follows:

3.1.1 Reactivity Control

Safe shutdown of the reactor is performed by manual

scram of the control rods from the control room. Power can also be removed at the breaker location to achieve scram. The makeup pumps provide boron injection for subsequent reactivity control during cooldown and cold shutdown by taking suction from the makeup tank or borated water storage tank.

3.1.2 Reactor Coolant Inventory

Reactor coolant makeup is also provided by the makeup pumps which inject borated water from the makeup tank or borated water storage tank. Control of the makeup pumps and valves is available at the new remote shutdown station panels. Cooling water to the makeup pumps is provided from the decay heat closed cycle cooling water system and decay heat river water system.

3.1.3 Reactor Coolant Pressure Control

Reactor coolant pressure control is provided by the makeup pumps, pressurizer heaters, letdown line, and pressurizer spray (cold shutdown only). Normal primary depressurization utilizing the pressurizer spray is not available as it requires operation of a reactor coolant pump which is not possible with loss of offsite power. Pressurizer spray is available

after decay heat removal cut-in through the decay heat removal pump connection to the spray valve.

3.1.4 Reactor Decay Heat Removal

Decay heat removal in hot shutdown is accomplished by natural circulation through the use of the emergency feedwater pumps supplying water to the steam generators from the condensate storage tanks and rejecting heat from the steam generators to the atmosphere through the atmospheric dump valves or main steam safety valves as a backup. Long term emergency feedwater supply is provided by the river water system. The emergency feedwater flow control valves and atmospheric dump valves are controllable from the remote shutdown panels. The emergency feedwater pump is controlled at a local panel.

Decay heat removal in cold shutdown is provided by the decay heat removal system through the decay heat cooler. The decay heat closed cycle cooling water system provides cooling to the decay heat cooler, and is in turn cooled by the decay heat river water system. Pumps in these systems are controlled at the new remote shutdown station.

3.1.5 Process Monitoring

Direct indication of process variables including reactor coolant temperature (T_H and Tc), reactor coolant pressure, pressurizer level, steam generator level, steam generator pressure, makeup tank level, borated water storage tank level, source range neutron flux, and decay heat removal system flow and temperature are provided at the remote shutdown panels. Condensate storage tank level indication is available at the local tank indicators. Diagnostic indications available at local locations include makeup system pressure, emergency feedwater system pressure, decay heat, nuclear services and intermediate closed cycle cooling systems' pressure, and decay heat and nuclear services river water system pressure.

3.1.6 Support Functions

The diesel generators, decay heat closed cycle cooling water system, nuclear services closed cycle cooling water system, intermediate closed cycle cooling water system, decay heat river water system, nuclear services river water system, reactor river water system, essential ventilation systems, instrument air system

and plant communication system are available to provide necessary support functions for the alternate shutdown system. Control and monitoring capability for these support systems is provided at the new remote shutdown station or local locations.

3.2 72-Hour Requirement

The licensee has stated that the capability exists to achieve cold shutdown within 72 hours after a fire event assuming no offsite power is available.

3.3 Repairs

The licensee has identified the need for certain repairs in order to achieve cold shutdown within 72 hours. A "cut and jumper" of various circuits is required in order to prevent inadvertent signals and equipment operation and provide other equipment control. These actions are not required for a number of hours after shutdown begins and are not required for achieving hot shutdown. These specific "cut and jumper" actions are required to start the control building emergency recirculation ventilation fans, and intermediate building fan and to bypass the automatic high

pressure injection signal on low reactor coolant pressure and the automatic low pressure injection signal, and to isolate the core flood tanks. In addition, "cut and jumper" repairs are necessary for achieving cold shutdown. This action is required specifically in order to open the decay heat removal pressurizer spray valve. The licensee stated that the necessary repair procedures for the above actions will be developed and that the required materials will be stored on site.

3.4 Associated Circuits and Isolation

The licensee conducted a review of the present electrical systems to determine the plant's capability to meet the associated circuit criteria as stated in Appendix R relating to safe shutdown and concluded that the existing electrical installation with some additional equipment modifications would satisfy these criteria. Modifications including isolation devices are necessary to the circuitry for a diesel generator, pumps and valves as previously discussed in order to assure their operability in case of fire in the control room or relay room. The licensee has addressed associated circuits of concern as discussed below.

3.4.1 Common Power Source

The licensee stated that all instrumentation and power circuits are protected or will be provided with coordinated protection by either circuit breakers or fuses.

3.4.2 Common Enclosure

As in the common power source case, the licensee stated that associated circuits that share a common enclosure with those required for safe shutdown are provided with isolation devices.

3.4.3 Spurious Signals

The licensee stated that fires in the control room or relay room can cause spurious signals which could impair safe shutdown. Therefore, the isolated remote shutdown station and local control stations for safe shutdown equipment will be provided as previously discussed to assure proper equipment operation. Circuits to equipment whose spurious operation can cause an unacceptable condition will be de-energized at the new remote shutdown station panels, local switchgear or motor control centers. Further, in

order to prevent spurious opening of the high/low pressure interface valves between the reactor coolant system and decay heat removal system, one of the motor operated valves will have its power supply breaker normally open at all times when the system is not in operation.

3.5 Safe Shutdown Procedures and Manpower

The licensee will revise existing safe shutdown procedures to incorporate the above described alternate shutdown method. The licensee further states that the revisions will be made to assure that the necessary shutdown functions can be performed at all times by manpower available.

4.0 CONCLUSION

We have reviewed the licensee's proposed alternate shutdown capability for Three Mile Island Unit 1 in accordance with Appendix R criteria. Based on that 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 functions are met by the proposed alternate. Therefore, we conclude that the requirements of Appendix R, Sections III.G.3 and III.L are satisfied for fires in the control room and relay room (2.2).